The Dissemination and Adoption of Knowledge Management Practices Behavioural Model

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Abstract: Moving a global consulting organisation from an attitude based on individuals’ “knowledge is power” to the advocated principles of knowledge sharing is a challenge that requires facilitation. This paper studies a real global consulting organisation that recognised that important firm resources like processes, technology and capital were not enough in order to drive the required attitudinal change. Details are presented about the lessons learned from a couple of unsuccessful past knowledge management programs and from a successful implementation of a knowledge enablement program involving agents as facilitators of attitudinal change. Some of the lessons learned were that (i) action research components were of help harvesting knowledge assets from tacit knowledge, (ii) perceived value moderates the motivation of associates to participate in the knowledge enablement program, and (iii) knowledge practice owners should perform their agentic task as consultants. A topic for discussion is if the prior knowledge of knowledge practice owners on a given knowledge domain is a requirement to facilitate an attitudinal change.

Keywords: driving attitudinal change, knowledge practice owners, ethnography, knowledge enablement, global consulting organisation, action research

1. Introduction

This paper addresses a subject of business and academic relevance: How to implement a behavioural change in a professional services organisation that is perceived as having an excellent performance delivering projects? The question has embedded a subtle distinction between behaviour and performance. If it is performing, why we should touch it? The counterargument is that it is better to focus firm scarce resources in changing behaviour in areas that are not performing as expected. The compelling business reason for implementing behavioural change in a professional services organisation that is perceived as performing well it is essentially of competitive nature (e.g. sustainability of a leadership position).

Past experiences and the lessons learned implementing knowledge management practices are presented with a narrative style. All the field observations were made using a combination of case study research and action research (Remenyi, Williams, Money, and Swartz 1998). A number of working hypotheses are articulated driving behavioural change towards the adoption of knowledge management practices. A research model is suggested for discussion that explains the hypothesized relationships among the drivers for behavioural change and adoption of knowledge management practices as the dependent variable. Knowledge Management Antecedents

1.1 The organisation

DataCon is the fictitious name of a real business unit of a big IT firm. DataCon has a global presence (i.e. over 100 countries), a world-class customer list with more than 800 customers in industries like banking, telecommunications, retail. DataCon customer base includes firms in the top ten ranking in Fortune 500 (e.g. 90% of top global communication service providers, 50% of top global retailers). DataCon’s technological solutions are delivered by 2,500 professional service consultants and produced revenue of $1,500M in 2005. Market analysts consider DataCon as the dominant leader of decision-making solutions (e.g. customer management, financial management, profitability analytics, supply chain management, demand chain management), which includes professional services.

The professional services are organised on territorial bases. Professional services managers report to a sales vice-president. Consultants in the professional services organisation have strong billable time objectives and their delivery approach is the traditional consulting project team applying project management techniques (e.g. Project Management Institute 2000). Deliverables are produced in most of the cases in local language with some remarkable exceptions. For example, in Scandinavia and Middle East it is common to deliver in English. In terms of language, Europe, Middle East and Africa professional services organisations demand that best-in-class assets are translated to English. However, Asia-Pacific and Japan professional
services organisations demand that best-in-class assets are translated to their country languages. The territory is clustered by location and demand. So, in areas like Middle East, a professional organisation covers more than one country and for all industries. However, in US, professional organisation are segmented by industry covering a number of estates (e.g. South East states and for retail industry).

Project teams are the organisational links among the professional consultants. Consultants on "the bench" (i.e. not assigned to a project) use to have a virtual office. Most of the projects are done at the customer site. This means that project team members travel to the locations where the customer premises are located and they keep communication links with the rest of DataCon using phone and e-mail when possible. The implementation phase of a project might last anything between a few weeks for a basic business intelligence reporting to several months for a full data warehouse implementation. Consultants enter and leave the project as dictated in the project plan. It is not uncommon to have a consultant at the customer site for six to twelve weeks. The exception is the project manager who usually has on site presence during the entire project. Contact access is easy through mobile telephony. However, e-mail access and internet access is not a standard even in areas like US. It is not uncommon to find customers that do not allow the consultants to gain external access to internet. This means that these consultants only have access to corporate work environments when they are in their hotel rooms after their long working hours. Furthermore, being at the customer site, their traditional way of sharing assets is via memory sticks and the assets are dispersed among the laptops of the consultants.

1.2 Knowledge management antecedents

Knowledge management practices (e.g. Edvinsson, Buzan, and Truch 2004) had been in place in a few local organisations. In this environment, knowledge did not flow cross local organisations in a smooth way. In fact knowledge was located in organisational local silos. DataCon recognised that knowledge was a firm resource (e.g. Barney 1991, Huang, Lee, and Wang 1998) and define a corporate vision towards knowledge management characterised by the following constructs:

- A generic definition of knowledge management based in reference material (i.e. “Knowledge Management is the discipline that promotes an integrated approach to identifying, managing, and sharing all of an enterprise’s information objects”
- A number of generic objectives (e.g. improve margin and profit, improve use of practitioners, decrease risk)
- Investment in a technology program to develop and deploy an environment that would support this vision. This program was named as Knowledge and Asset Manager (KAM).

KAM was released last quarter 1998 and globally deployed to all the organisations. KAM used a web interface and, optionally a Lotus Notes client interface. KAM web interface provided search and submission capabilities of knowledge assets. The Lotus Notes client interface provided capabilities for manipulating knowledge assets produced in the context of customer facing engagements. In parallel, it was recognised the need for having processes documenting the knowledge asset flow with KAM. Expectation was that the professional organisations delivering projects and the RandD and marketing organisations would make KAM as the single centralised tool and repository of knowledge assets. KAM had limited support resources in the field and they focussed their action to promote the usage of KAM with generic presentations about the value of using KAM. KAM technology received an acceptable level of adoption from the RandD and marketing organisations. This was visible in the form of documentation and sales assets available in KAM. Unfortunately, there was little adoption in the professional services organisations. Acceptance of processes and technology (e.g. Davis 1989) has been frequently studied in the literature in relation behavioural constructs like usage. Frequent complains were: cumbersome access to assets and few or lack or relevancy for the task at hand. KAM was discontinued in October 2002.

By last quarter 2002, a number of intranet sites had been operational for few years and they became the prime mechanism of outbound communication. Each intranet site targeted a function (e.g. sales, support, professional services). There was a clear conviction that knowledge assets had a prime user and it was not needed to grant access to associates in other functional areas. Submissions of assets were under control and not generally available to every associate. Again, this technology received an acceptable level of adoption from the RandD and marketing organisations and a little adoption in the professional services organisations. Furthermore, the volume of assets grew and the need for accessing knowledge assets cross functional areas became an issue. From a technology stand point, this issue was addressed by (i) removing most of the access restrictions that were associated to each role and (ii) with the development of a search engine exploring all the
making the practitioners players they would start management. The hope was that by actively making the practitioners players they would start adopting their dedicated intranet site. This idea was operationalised promoting communities of interests. The management action focussed in communicating the message to the field trying to persuade practitioners to organise themselves into communities covering one specific subject.

These communities of interest were organisational structures characterised in reality by their informal nature (loosely coupled systems (e.g Weick, K.E. 2001), voluntary assignments, and not regular meetings). The hope was that the exchange of knowledge in these communities of interest would drive the usage among the participants of the professional services intranet. Unfortunately, few communities of interest were constituted and they never were really operational. Of course, there were standard advocated processes for conducting projects and, in fact, there was a considerable effort in the organisation developing best in class processes. All this explicit knowledge impacted positively and had business significant impact in terms of risks reduction and quality improvement. However, these artifacts (i.e. processes, tools, templates, KAM) had some holes in terms of detail (e.g. not enough to deliver being a junior consultant), in terms of subject (e.g. released applications by RandD with no explicit knowledge on how to implement them), and in terms of situations (e.g. how to design a logical data model that can be physically populated with the existing data sources versus a theoretical logical data model that might be almost empty in the implementation). Knowledge management needs on the “front line” of customer engagements were addressed by using personal networks of contacts and broadcasting e-mails to discussion forums requesting for help. These discussion groups were very popular among the practitioners and represented a just-in-time access to mostly explicit knowledge in some part of the organisation.

1.3 Lessons learned from the KAM and intranet experiences

The generic objectives (e.g. improve margin and profit, improve use of practitioners, decrease risk) were never formally endorsed by the field professional services management. So, they became more a set of corporate values than a set of operational objectives to be measured for guiding management attention and action. Consultants in the professional organisations are very focussed on their yearly objectives and their behaviour is strongly influenced by such objectives. There were no explicit/implicit knowledge management objectives for professional services and this did not favour their attention for adopting enthusiastically KAM. Knowledge growth was enabled by training courses and mostly by experiential learning (e.g. Kolb 1984). In fact, any average senior consultant (e.g. a logical data modeller, an architect, a project manager) required a considerable learning curve measured in years. It was not unusual to require between three and five years to reach proficiency and once this level was reached it was not uncommon to think that “knowledge is power”. So, as some consultants said “why should I submit my templates and lessons learned?”.

An almost only technologic approach to knowledge management, as the KAM initiative represented, did not enable a significant knowledge management enhancement in DataCon. Professional services organisations did not have the attitudes of a classical consulting company were knowledge is the life-blood of the organisation and where turnaround in the junior levels is measure in months. Another lesson learned was that an appropriate level of human resources is needed to support a technologic approach like KAM. It was clearly not enough to offer presentations talking about the functionalities of KAM and arguing that usage of KAM was synonymous of good corporate citizenship. This few resources acted as tool administrators and in their charter there was not any role in driving change. The intranets sites became technologic environments providing pulling capabilities of knowledge assets. Furthermore, such assets were systematically final versions of released documents. For example, the few knowledge assets that some one could expect to find in the professional services intranet were uploaded when the project was closed (e.g. statements of work, project plans, requirements documents, technical specifications, post-mortem lessons learned). Most of the flow of documents during a normal project implementation among the project team members happened via e-mail. E-mail servers became the critical tool for disperse project teams and the inbox folder of the project manager was the central repository for all the knowledge assets in the project team. From a corporate standpoint, this is an unsatisfactory situation to be corrected. The need for collaborative environment was identified in order to allow that work-in-progress assets are exchanged among the team members.

Furthermore, confusion was identified between access rights and the location of the assets. The implementation of dedicated intranet sites granted
access rights by segregating assets cross-functional areas. DataCon recognised that knowledge is ubiquitous through assets and that segregation of assets in dedicated intranet sites was in fact breaking knowledge that could be formed cross assets just jumping from asset to asset.

The implementation of the communities of interest did not have the desired adoption by the professional services organisations because two factors (i) there was not enough motivation for the consultant to participate in these forums and (ii) consultants already satisfied their individualistic needs for knowledge on just-in-time bases by broadcasting requests for help via e-mails. Of course, a lot of the explicit knowledge (e.g. customer deliverables) was under the control of the delivery local organisation but not under the control of the business unit. Not mentioning that the consultants primarily held the tacit knowledge. Overall, there was not an understanding of the overall knowledge that was out of control. The suspect was that DataCon could be leaking knowledge without being aware of it. Probably, the hardest lesson learned was the frustrating understanding that outstanding management action would be needed in order to enforce the adoption of knowledge management practices by professional services organisations. Interestingly, the knowledge management initiatives were funded at the business unit level and there was a limited authority enforcing such initiatives among the professional services organisations because these organisations were mostly aligned to the sales territorial organisations. Therefore, management communication of the goodness of knowledge management benefits in this organisational context was not enough to get adoption by the professional services organisations. “What do we need to do in order to bring them on board?” this was the question in order to transition to an acceptable level of knowledge capturing, sharing, and reusing.

2. From knowledge management to knowledge enablement

2.1 Enabling knowledge as opposed to managing knowledge

In 2004 a new push to knowledge management was launched in DataCon. The lessons learned from the KAM and intranet experiences were framed in a problem statement (e.g. Dutton, Fahey, and Narayanan 1983, Dutton and Jackson 1987), a theorised conclusion and in a solution approach. The problem statement was enacted as “low adoption of knowledge management practices in the professional services organisation after a number of unsuccessful initiatives” (Abril 2006). The theorised conclusion was that “There are unfavourable attitudes and they influence professional services behaviour which results in low adoption of knowledge management practices in the professional services organisation” (e.g. Davis 1989) (Abril 2006)). If DataCon wanted to achieve a remarkable dissemination (e.g. Schulz 2001) and adoption of knowledge management principles in professional services then significant management action had to be taken changing the attitudes driving such behaviour. This problem statement embedded a holistic approach to knowledge management. It was not enough to formulate a vision, a set of generic objectives and to invest in a technological work environment. It was needed to fundamentally remove all the aspects that were barriers to the dissemination and adoption of knowledge management principles. Another implication of this problem statement was the need for a focus on execution. Change would not happen alone. DataCon would need to assign expensive resources and for a considerable time in order to enforce change. Consequently, a broader solution approach was needed. A contingent solution plan (e.g. Payne, Bettman, and Johnson 1993) was formally defined and approved. This solution plan adopted basically the shape of a change management plan. A subtle change was introduced framing the effort. Instead of targeting “managing” knowledge, DataCon moved to “enabling” knowledge (e.g. Day 1994). This new frame wanted to envelop the objective of providing the appropriate resources for disseminating and adopting knowledge management practices by the entire organisation. This “enabling” construct fully covered the desire of managing knowledge assets (e.g. measure impact) and enriched it with the recognition that dissemination and adoption of knowledge management practice would require facilitation for a considerable period of time.

2.2 Research question and research method. Action research for the formulation of the hypotheses in the change management plan

The following research question was formulated “What are the drivers that will favour positive attitudes that will enable a behavioural change towards the adoption of knowledge management practices (in a professional services organisation that is perceived as having an excellent performance delivering projects)?” Once these drivers would be identified, then the change management plan should be constructed identifying specific actions aligned to such drivers. A research design was decided for addressing the research question. The unit of analysis was the individual member of professional services organisations. The research method was action
research and not, as wrongly presented in (Abril 2006), ethnographic. This aspect deserves explanation. The main criticism characterising as “ethnographic” the conducted research is that the researcher asked questions looking for clarifications. This fact (i.e. asking questions) according to the literature means that the researcher is not a passive neutral observer and therefore, just by the fact of asking clarifications, it might influence the observations because the question might impact the behaviour of the observed individuals. The feedbacks from the experts attending the conference were we presented our findings (see (Abril 2006)) made us to revisit the research method that we used. Furthermore, we consider very difficult to conduct ethnographic research for knowledge management in organisational environments as supported in (Kane, H., Ragsdell, G. and Oppenheim, C. 2006)

In essence, the objective of the action research was to observe the members of the professional organisations and formulate a set of hypotheses addressing the research question. This prior declaration was key in order to identify which findings would count as knowledge acquired (Checkland and Holwell 1998). Data was gathered by asking about the lessons learned of past experiences and by embedding researchers in project teams. This means that researchers were not independent of research as frequently they asked questions. One of the tactics used by researchers was “shadowing” subject matter experts in their daily regular field jobs. Observations were captured in the form of “a day-in-the-life” storyboards (e.g. (Girard and Lambert 2006)) for the main roles in the professional services organisations. Careful attention was dedicated to the knowledge needs of the professional services consultants. The research started in July 2005 and ended in December 2005. As a result of this research a number of drivers were identified. The label “drivers” was used to transmit the sense of the more academic construct “critical success factor”. This means, that such drivers were identified as necessary, all of them, for the successful dissemination and adoption of knowledge management practices among the professional services organisations. Failure in just one of such drivers would imply that attitudinal change would not happen. Furthermore, success implementing all the drivers would not imply success in the dissemination and adoption of knowledge management practices among the professional services organisations because an underidentification issue (e.g. Hair Jr., Black, Babin, Anderson, and Tatham 2006) could have happen with the drives.

The identified drivers for an attitudinal change in DataCon towards the dissemination and adoption of knowledge management practices in the professional organisations were: personalised value, executive sponsorship, effective training, enabling support organisation, and incremental perceived successes.

2.3 The personalised value driver

Individual behaviour is strongly influenced by motivation according to expectancy theory (e.g. Vroom 1964). The benefits of knowledge management practices would be aligned to the business objectives that professional services organisations had. Professional services managers were identified as the key influencers on the dissemination and adoption of knowledge management practices. They fire and hire consultants. They negotiate the yearly objectives with the consultants. The hypothesis was that “consultants’ change of behaviour towards a dissemination and adoption of knowledge management practices would be positively associated with a perception of the value of such adoption by their direct managers”. A knowledge demand-supply approach was deployed were the value was articulated in terms of effectiveness and efficiency filling the knowledge gaps for the project teams. Two types of scenarios were identified: Presales and implementation. In presales situations it is not uncommon the need for tacit knowledge in order to increase credibility and or reduce risks closing deals. This knowledge needs had to be filled in by the project team with the involvement of the professional services manager by broadcasting requests for help via e-mail and with lengthy follow up calls assessing the responses. In this presales scenario the knowledge sources use to be in the form of tacit knowledge. Therefore, the key aspects in this scenario are in the identification and qualification of the sources of the required knowledge and linking such sources with the team looking for knowledge. From the professional services manager perspective, an increase in the availability of tacit knowledge options (i.e. effectiveness) and the reduction in time and effort looking for it (i.e. efficiency) were easily perceived as value.

In implementation scenarios, it is common to find cases that are considered best-in-class implementations. Unfortunately, the explicit knowledge assets produced in such great implementations have a limited reusability power because their specific details in terms of customer references, industry or implementation particularities. Consultants do no use to have time for making re usable their knowledge assets. When they finish a project, they use to move to
another project, or in the few occasions when they go to the “bench” they enroll in training courses. Therefore, in the next project that a similar task has to be performed, consultants use and anchor and adjustment heuristic (Tversky and Kahneman 1974). Consultants search for a past successful knowledge asset (i.e. the anchor) and depending on the specific requirements introduce appropriate adjustments. From the professional services manager perspective, a future increase in the availability of explicit knowledge options (i.e. effectiveness) and the promise of reduction in time and effort looking for it (i.e. efficiency) were easily perceived as an enough expectant value as to agree that it was of worth to invest time in reusability at the time that the assets were produced (i.e. investing now to get the pay off tomorrow).

Overall, reusability of knowledge assets covers both explicit and tacit knowledge assets. Reusability of explicit knowledge assets includes diverse aspects as removing customer references, translation to, for example, English (in Europe) or from English to a local language in Asia Pacific, and cross-industry generalisation (e.g. from financial to retail). Reusability of tacit knowledge, in general, it requires considerable effort and time and includes making it explicit knowledge. Making explicit knowledge from what was just tacit knowledge it was definitively perceived as value by the professional services managers. Lessons learned and white papers are examples of assets with a high perceived value by the professional services managers. It is also remarkable to mention that the value of adoption of knowledge management practices was articulated in terms of instrumental utility with quality improvement initiatives of interest for the professional services organisations. For example, professional services managers understood that knowledge management practices were of value for them as they will help their organisations in achieving Capability Maturity Model level 2 (i.e. repeatable) (e.g. Software Engineering Institute 1980).

The change management plan has been executing initiatives in relation to the personalised value driver for one quarter in 2006 and anecdotic evidence suggests support to the working hypothesis that consultants’ change of behaviour towards the dissemination and adoption of knowledge management practices would be positively associated with a perception of the value of such adoption by their direct managers. This initial evidence has had an unexpected consequence, although reasonable, “management stress” for measuring the impact of the adoption of knowledge management practices by the professional services organisations. The rational goes in the following way “if value has been perceived by the professional services organisations in the adoption of knowledge management practices then a measurable business value contribution should exist and be measured”. Unfortunately, measuring such business contribution has been a difficult exercise that the literature on knowledge management has addressed with very limited consensus on the right approach (e.g. Marr, Schiuma, and Neely 2004). The knowledge management literature has an endless list of papers with suggestions on how to measure the organisational impact of knowledge management. Unfortunately there is no dominant paradigm on how to do it. Nevertheless, there is a considerable stream of research suggesting that perceptions of value are the best proxy to the construct value. This measurement is operationalised through surveys. Theoretically, benchmarking successive measurements it would be possible to measure value contribution (e.g. Moslehi, Mohaghar, Badie and Lucas 2006).

Although in the existing organisational context professional services managers were identified as the key influenceurs on the dissemination and adoption of knowledge management practices, an alternative working hypothesis was formulated as “change of consultants’ behaviour towards the dissemination and adoption of knowledge management practices would be positively associated with recognitions and rewards”. The change management plan defined and executed programs (e.g. “best asset in the month”, regional knowledge champion in the year”) pursuing this alternative working hypothesis. These initiatives have been in place for one year and the evidence gathered so far is that there are applications and nominations. Consultants are interested in getting a personal compensation in terms of value and or recognition but the business impact of these programs is marginal.

2.4 The executive sponsorship driver

The ideal situation would be that knowledge management practices would be institutionalised across all organisations. This means that all levels of management should enforce dissemination and adoption. In the existing organisational management by objectives context (e.g. Drucker 1954) the hypothesis was that “the inclusion of knowledge management objectives at the leadership team levels would be positively associated with the consultants’ change of behaviour towards an adoption of knowledge management practices”.

The rationale for this working hypothesis was that in a hierarchical organisation personal objectives
are aligned across the different levels. Therefore, a contingent effort will be performed by the consultants towards their personal objectives (e.g. Payne, Bettman, and Johnson 1993). Examples of knowledge management objectives at the leadership team level were “searches for existing assets”, “submissions of reusable asset”, and “operational communities of practice”. In December 2005, knowledge management objectives were formally included in the leadership team members and cascaded down to all the levels in the professional services organisations. An unexpected challenge happened framing such objectives (e.g. Dutton et al 1983, Dutton and Jackson 1987). They should lead action towards a change in the behaviour of consultants with respect knowledge management practices indicating a clear adoption. This implied that a set of standard language was recommended in order to keep the essence of the objectives. The two quarter 2006 reviews since the change management plan has been executed in relation to the executive sponsorship driver suggests support to the working hypothesis that “the inclusion of knowledge management objectives at the leadership team levels would be positively associated with the consultants’ change of behaviour towards an adoption of knowledge management practices”. Nevertheless, the next step is the assessment of the intensity of such behavioural change, which potentially will lead to a new set of objectives. Remarkably, the objectives in relation behavioural change with respect the dissemination and adoption of knowledge management practices were not framed in terms of value contribution to the business (e.g. performance improvements). This distinction avoided confusion between behavioural attitudes and business impact.

2.5 The effective training driver

Knowledge management practices involve management disciplines. In general, the components of knowledge management systems involve processes, technology, individuals and assets. There is a difference between adopting knowledge management practices and adopting with proficiency knowledge management practices (e.g. Gist 1989). Learning processes were designed in order to allow a holistic learning on the knowledge management principles in DataCon. The hypothesis was that “the level of trained consultants in the day-in-the-life knowledge management principles would be positively associated with the consultants’ change of behaviour towards an adoption of knowledge management practices”. The rational for this working hypothesis was the aggregation of a number of arguments. Because the learning outcome had to be reflected in a behavioural change, the learning materials had to have a practical utilisation on the daily activities of the consultants. This implied the design of learning courses per each specific role (e.g. project managers, solution architects). Additionally, basic elements of business research had to be included in the learning courses. For example, learning how to perform efficient searches is assessed as a behavioural change with respect broadcasting an e-mail asking for related assets. Another example, filling the appropriate metadata (e.g. context, industry, things did not work well) describing the lessons learned after a project has concluded is assessed as a behavioural change with respect doing nothing or describing just the title of the referred lessons learned. Overall, careful balance had to be considered addressing the different aspects of the knowledge management system in DataCon. Hard lessons from the past, suggested that a focus in just technology did not provide the desired results, therefore, many aspects had to be considered in the learning courses (e.g. the processes, the contact individuals facilitating the dissemination and adoption of knowledge management practices).

Delivery mechanism of the training course was a relevant factor. It was unrealistic to expect presence of all the consultants in class rooms. Flexibility was a critical success factors. Most of the courses were designed to be delivered on demand via internet and via scheduled seminar via telephonic conferences. Tracking the attendance helped in the control of the training plans objectives. Objective of attendance was agreed with the professional services managers. One of the variables considered for measuring the dependent variable behavioural change in the working hypothesis “the level of trained consultants in the day-in-the-life knowledge management principles would be positively associated with the consultants’ change of behaviour towards an adoption of knowledge management practices” was usage of the available technological infrastructure. A basic monthly analysis provided evidence of positive association between the level of training and usage.

2.6 The enabling support organisation driver

DataCon recognised that enabling means (e.g. Day 1994) should be deployed in order to drive change in the professional organisations towards the adoption of knowledge management principles. These resources were funded and owned by a central Knowledge Management Office. As mentioned earlier, professional services organisations did not have a reporting link with...
this Knowledge Management Office. A couple of enabling resources contemplated in the change management plan deserve attention: a collaborative work environment for project teams and the agentic role (Jensen and Meckling 1976) of knowledge practice owners. Enabling knowledge would include providing a collaborative infrastructure that would allow collaborative effort of project teams. This infrastructure would be a mean and not an end towards knowledge management. This collaborative environment was implemented using technology available in the market. The hypothesis was that "the usage of the collaborative environment for all the projects would be positively associated with the consultants' change of behaviour towards an adoption of knowledge management practices". The rational for this working hypothesis was that there was an expectation in that once all the intermediate, work in progress project assets were stored in a project folder in the referred collaborative environment then it would be relatively easy to promote some of them as knowledge assets that should be catalogued as reusable. This environment has been operational for just one quarter and there is not enough evidence to confirm or disconfirm this working hypothesis.

Knowledge practice owners are agents funded by the knowledge management office. Their role consists in facilitating the dissemination and adoption of knowledge management practices by the professional services organisations. This agentic role includes acting on behalf of the professional services organisations as if they were members of such organisations in the context of customer facing projects. The hypothesis was that "the agentic action of knowledge management practitioners would be positively associated with the consultants' change of behaviour towards an adoption of knowledge management practices". The action of knowledge practice owners included facilitation of communities of practice, setting collaboration environments for project teams, ad-hoc support making reusable assets, linking sources and demand of tacit knowledge that were globally disperse, and training. Action research components (Remenyi et al 1998) were of help harvesting knowledge assets from tacit knowledge. Although the academic term "action research" was not used in DataCon, this is what it was done. The terms used were "shadowing a subject matter expert" and "be embedded in the project teams". Each knowledge practice owners shadowed a consultant in his/her regular field job. As a result of these observations a day-in-the-life storyboard was created for the main roles in the professional services organisations. Careful attention was dedicated to the knowledge needs of such consultants. Because consultants perform their job in the context of project teams, "knowledge practice owners" were embedded in such teams while performing the "shadowing" exercise. This experience took all 2006.

Knowledge practice owners were instrumental articulating the personalised value driver mentioned earlier. Framing the value of the dissemination and adoption of knowledge management practices in the terms than professional services organisation use was assessed as fundamental. This meant that knowledge practice owners took the consulting practices of the field for performing their agentic task. For example, a knowledge practice owner approached a new project team as their customers. He had to "sell" the value for the team of adopting knowledge management practices and obtain their acceptance to be embedded in the project team. The project manager was the owner/approver of the action performed by the knowledge practice owner. A knowledge assessment gap analysis had to be conducted in order to identify the knowledge gaps in the project plan before the implementation phase would start.

As a consequence, a knowledge action plan was produced and included as part of the quality assurance project plan. During the project implementation, the assigned knowledge practice owner would support the team executing his/her knowledge action plan until the end of the project. Knowledge assets harvested by the knowledge practice owner would be approved/accepted by the project manager. The rational for the working hypothesis "the agentic action of knowledge management practitioners would be positively associated with the consultants' change of behaviour towards an adoption of knowledge management practices" was that professional services organisations would perceive value in the action of knowledge practice owners and this would provide a vicarious input in their self-efficacy believes (e.g. Bandura 1986) performing knowledge management practices. This agency approach of knowledge practice owners has been operational for just one quarter. The evidence gathered suggests support to the working hypothesis. A limitation of this agency approach in terms of the intensity of its impact it is the number of project teams that can be enabled. There is a limitation of the number of teams than a knowledge practice owner can support concurrently (e.g. three to five).

2.7 The incremental perceived successes driver

DataCon is a public (in US terms) successful organisation that reviews performance quarter by quarter. This introduces a considerable
“management stress” that has considerable beneficial aspects and some undesirable bias towards the time horizon of each program. A basic project management lesson learned says that risk is positively associated with the duration of a project. Unfortunately, behavioural change in a geographically and attitudinally diverse professional services organisation takes some time. Not being able to borrow from the literature a model to predict how much time for a given organisation it is needed for implementing a behavioural change a set of incremental subgoals were established in order to favour a belief of continuous achievements (e.g. Gist and Mitchell 1992) and the hypothesis was that “incremental perceived successes would be positively associated with the consultants’ change of behaviour towards an adoption of knowledge management practices”.

It is very popular the said that “perception is reality”. This means that considerable resources would be needed in order to influence the perception of key stakeholders about the successes increasing the adoption of knowledge management practices by the professional services organisations. If a success is not perceived as such then it is not of worth for the change plan. Another aspect of the language of this hypothesis is that it refers to incremental. This means that the change plan included a roadmap of small successes during a three-year period. An assigned program manager in the knowledge management office monitored this program. The term “success” implies that there is an agreement on the meaning of success. Examples of agreed definitions of behavioural success were usage of explicit knowledge assets by other project teams, meeting the expectations of a knowledge action plan, gathering requirements for new features in the context of a community of practice, availability of explicit knowledge assets for identified critical released products, relevancy of retrieved assets in a search, and intensity of usage of the collaboration environment. Examples of agreed definitions of performance success were revenue increase, margin increase, risk reduction, and project time reduction. The change plan implemented a reporting system to periodically track and communicate metrics about behavioural change. As expected, the difficulties measuring value from a performance perspective makes that the available evidence for reporting is based on anecdotic interpretative assessments of the performance.

The rational for the working hypothesis “incremental perceived successes would be positively associated with the consultants’ change of behaviour towards an adoption of knowledge management practices” was that professional services organisations would be motivated by the results/consequences of their adoption of knowledge management practices. This incremental approach was operational for the last quarter in 2006 and there is not enough evidence to confirm or disconfirm support for the working hypothesis.

3. General discussion

The lessons learned from past experiences deploying knowledge management practices and the evidence gathered executing a change plan towards the dissemination and adoption of knowledge management practices in DataCon suggest support to the dissemination and adoption of knowledge management practices behavioural model (TDAKM) showed in Figure 1 (Abril 2006).

![Figure 1: The dissemination and adoption of knowledge management practices behavioural model (TDAKM)](image-url)
TDAKM hypothesises interdependencies among the independent variables. Obviously, TDAKM requires validation and it is suggested that it is done through empirical positivistic research both case and large-scale surveys. One limitation of this model is that organisational context is not visible as a moderating variable. All the hypotheses in TDAKM consider an organisational context where (i) there is not institutionalised attitudes towards knowledge management practices, (ii) there is a geographically and attitudinally diverse global professional services organisations, (iii) there is not a hierarchical reporting line between the knowledge management office and the professional services organisations, and (iv) professional services organisations are strongly driven with a management by objectives style. TDAKM neglects a debate around the issue of if the prior knowledge of knowledge practice owners on a given knowledge domain moderates the adoption of knowledge management practices. Arguments in favour suggest that trust is an important enabler of good relationship with the project teams and that prior knowledge of the knowledge practice owner (e.g. as a “doer”) will allow him/her to be respected as a value contributor. Arguments against suggest that what matters is the ability persuading the project team members on the value of knowledge management practices. Overall, TDAKM suggest an underpinning ‘quid pro quo’ between the knowledge management office and the professional services organisations where the knowledge management office is an enabler of knowledge management value and the professional services organisations are adopting knowledge management practices.

4. Conclusion

This paper was produced considering the feedback from participants in the 3rd International Conference on Intellectual Capital, Knowledge Management and Organisational Learning to (Abril 2006). Researchers in Knowledge conducting research. We concluded that ethnographic research might not be a suitable research design for knowledge management in an organisational environment. TDAKM was the outcome learning of the conducted action research and this model was tested for one year in 2006. Although evidence is not conclusive, there is no refutation so far to it. The interdependences among the independent variables highlight their nature as critical success factors (i.e. it is postulated that you need all of them) with the caveat that further research is needed in order to check the parsimony in TDAKM (e.g. underinformed model missing relevant variables). From a knowledge management practitioner’s perspective, TDAKM is a reference model that can be used planning a change management plan towards the adoption and dissemination of knowledge management practices in professional service organisations. The possible generalisation of TDAKM to other type of organisations exceeds the scope of this paper.

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Abstract: The paper investigates the theme known as “Knowledge Management” (KM) in three large Brazilian organisations trying to discuss its concepts, constituent elements, managerial approaches and tools, while aiming at leaving behind the purely terminological discussion, which is innocuous and naive. The basic presuppositions were two: (i) most of what is referred to or named KM is actually “Information Management” (IM) and IM is just one of the components of KM. KM is more than simply IM due to the fact that it includes and incorporates other concerns, such as the creation, use and sharing of information and knowledge in the organisational context; (ii) a conceptual model or map can be formulated based on three basic concepts: (a) a strategic concept of information and knowledge, (b) the introduction of such strategy in the tactical and operational levels through the several managerial approaches and information technology tools and (c) the creation of an organisational space for knowledge. The main objective is to investigate and analyse the concepts, motivations, practices and results of KM effectively implemented in three large Brazilian organisations. The qualitative research strategy used was the study of multiple cases with incorporated units of analysis and three criteria were observed for the judgment of the quality of the research project: validity of the construct, external validity and reliability. Multiple sources of evidence were used and data analysis consisted of three flows of activities: data reduction, data displays and conclusion drawing/verification. The results confirmed the presuppositions and the fact that KM means a rethinking of management practices in the information era. Knowledge as such cannot be managed; it is just promoted or stimulated through the creation of a favourable organisational context, namely “Ba”. It was also identified that the main challenges facing organisations committed to KM have its focus on change management, cultural and behavioural issues and the creation of an enabling context that favours the creation, use and sharing of information and knowledge.

Keywords: knowledge management; strategic information management; enabling context or “Ba”; knowledge management conceptual umbrella metaphor; knowledge and information management.
both as an opportunity and an oxymoron, depending on how it is conceived, analysed, practiced and measured for its results concerning the organisations’ core-business and readiness to compete. Alvarenga Neto (2002) and Marchand and Davenport (2004) suggest that most of what it is called “knowledge management” (KM) is actually information management. They also affirm that KM is more than simply information management due to the fact that it includes and incorporates other concerns such as the creation, use and sharing of information and knowledge in the organisational context, not to mention the creation of the so called “enabling context” or “enabling conditions”, among others. Hence, information management is just one of the components of KM and a starting point for other KM initiatives and approaches.

Many researches have risked definitions for KM. Wilson (2002) examined the “Web of Science” databases from 1981 to 2002 and verified the great diversity of concepts attributed to KM, reaffirming all the terminological controversy and polemic. He also confirmed the exponential growing of publications with the expression “knowledge management”, as show in Figure 2.

**Figure 1**: Capital expenditures of American Firms, 1965-1991 (adapted from Stewart, 1998).

**Figure 2**: Publications with the expression “Knowledge Management” – Web of Science – (Wilson, 2002).

The current debate about KM is also and mainly divulged in recent publications of mainstream authors from the librarian and information science field research, such as Davenport and Cronin (2000). They suggest that

*Though considerable academic and professional attention has been focused on this area in the past decade, the concept is not yet stable: the term appears to be used differently across domains with each claiming that its partial understanding represents a definitive articulation of the concept. (Davenport and Cronin, 2000)*

Their inquiry is seminal: “Is it a semantic drift or a conceptual shift?” Davenport and Cronin (2000) explored the concept of KM in the context of three
domains committed to KM, that is to say, (i) librarian and information science (information management or KM by another name), (ii) process engineering (business processes, ontologies, the management of ‘know-how’) and (iii) organisational theory (from knowledge as a resource to knowledge as a capability; tacit and explicit knowledge conversions; the context, “Ba” or organisational space for knowledge). The objective of their proposal - called “KM Triad Framework” - is the proposition of a tool or analysis instrument that it’s suitable for exploring the tensions that might arise in any organisations committed to KM, where different domains have different comprehensions. The “KM Triad” can be used to identify conflicts or territorial struggles and to contribute for a collective understanding of all interactors of the KM space in organisations.

Debates like those, associated with the lack of a conceptual definition and all the controversy surrounding the term KM, motivated a research study concerning how Brazilian organisations understand, define, implement, practice, measure and evaluate KM, what motives led them to those initiatives and what they expect to achieve with it. The basic presuppositions were two, respectively: (i) most of what it’s referred to or named “Knowledge Management” is actually “Information Management” and information management is just one of the components of KM. Consequently, KM is more than simply information management due to the fact that it includes and incorporates other aspects, themes, approaches and concerns such as the creation, use and sharing of information and knowledge in the organisational context, not to mention the creation of the so called “enabling context” or “enabling conditions”, among others; (ii) a conceptual model or map can be formulated based on three basic concepts: (a) a strategic concept of information and knowledge - as proposed by CHOO (1998) - factors of competitiveness for organisations and nations; (ii) the creation of an organisational space (in the tactical level) for knowledge, the enabling context or “Ba”: the favourable conditions that should be provided by organisations in order for them to use the best information and knowledge available - as suggested by Von Krogh, Ichijo and Nonaka (2001); (ii) the introduction of such strategy in the operational level through the several managerial approaches and information technology tools, which are susceptible to communication and orchestration, metaphorically named here as a “KM conceptual umbrella”;

2.1 A strategic concept for information and knowledge in organisations

Choo (1998) asserts that the “knowing organisations” are those that use information strategically in the context of three arenas, namely, (a) sense making, (b) knowledge creation and (c) decision making. Concerning (a) sense making, its immediate goal is to allow the organisations’ members the construction of a mutual and shared understanding of what the organisation is and what it does. Strategic reflections must be done concerning the organisation’s mission, vision, values and culture, allowing its members to bring meaning to their lives and jobs. An ambitious and challenging vision or state of the future reveals the organisation’s intention and it is extremely valuable, contributing to communicate the types of knowledge that are welcomed and will be nurtured. Sense making’s long term goal is the warranty that organisations will adapt and continue to prosper in a dynamic and complex environment through activities of prospect and interpretation of relevant information that allow them to understand changes, trends and scenarios about clients, suppliers, competitors and other external environment actors. Organisations face issues such as the reduction of uncertainty and the management of ambiguity. Competitive, competitor and social intelligences, environmental scanning, marketing research and activities alike are organisational initiatives that aim at constructing meaning about issues for which there are no clear answers. Table 1 presents the organisational sense making process through an information perspective:

2. Knowledge management: models, maps and conceptual trials

A conceptual KM model or map can be formulated based on three basic concepts: (i) a strategic
Table 1: The sense making process (adapted from Choo, 1998).

<table>
<thead>
<tr>
<th>Information Needs</th>
</tr>
</thead>
<tbody>
<tr>
<td>What are the new trends in our industry?</td>
</tr>
<tr>
<td>What are the core competences of our competitors?</td>
</tr>
<tr>
<td>What do our clients value?</td>
</tr>
<tr>
<td>Environmental scanning</td>
</tr>
<tr>
<td>Information Use</td>
</tr>
<tr>
<td>Decision Making</td>
</tr>
</tbody>
</table>

Table 2: Knowledge creation processes (Choo, 1998, p.130).

<table>
<thead>
<tr>
<th>Knowledge Processes (Wikström and Normann 1994)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge Creation Phases (Nonaka and Takeuchi 1995)</td>
</tr>
<tr>
<td>Generative Processes: Generating new knowledge</td>
</tr>
<tr>
<td>Sharing tacit knowledge</td>
</tr>
<tr>
<td>---------------</td>
</tr>
<tr>
<td>Shared problem solving</td>
</tr>
<tr>
<td>Experimenting and prototyping</td>
</tr>
<tr>
<td>Productive Processes: operationalising new knowledge</td>
</tr>
<tr>
<td>Justifying concepts</td>
</tr>
<tr>
<td>Building an archetype</td>
</tr>
<tr>
<td>Implementing and integrating new processes and tools</td>
</tr>
<tr>
<td>Representative Processes: Diffusing and transferring new knowledge</td>
</tr>
<tr>
<td>Cross-leveling knowledge</td>
</tr>
<tr>
<td>Importing knowledge</td>
</tr>
</tbody>
</table>

(b) Knowledge creation is a process that allows an organisation to create or acquire, organise and process information in order to generate new knowledge through organisational learning. The new knowledge generated, in its turn, allows the organisation to develop new abilities and capabilities, create new products and new services, improve the existing ones and redesign its organisational processes. Table 2 supplies an analogy between knowledge creation models and permits inferences between their differences and likenesses.

2.2 The creation of an organisational space for knowledge, the enabling context or “Ba”

The creation of organisational knowledge is, in fact, the augmentation of knowledge created by individuals, once fulfilled the contextual conditions that should be supplied or enabled by the organisation. This is what Von Krogh, Ichijo and Nonaka (2001) call “Ba”, enabling conditions or enabling context. “Ba” is needed in the tactical level in order to bridge the existing gap between strategy and action. In this context, the understanding of the word “management” when associated with the word “knowledge” should not mean control, but promotion of activities of knowledge creation and sharing in the organisational space. Hence, KM assumes a new hermeneutic perspective – from knowledge as a resource to knowledge as a capability, from knowledge management to a management towards knowledge, from knowledge management to a management from and to knowledge. Nonaka and Takeuchi (1995) and Von Krogh, Ichijo and Nonaka (2001) list the many elements of “Ba”, namely: creative chaos, redundancy, layout, organisational culture and human behaviour, leadership, intention or vision of future and empowerment, not to mention organisational structure and layout, among others.

2.3 The “KM conceptual umbrella” metaphor

At last, the “KM Conceptual Umbrella” metaphor assumes that below its boundaries, many themes, ideas, managerial approaches and IT tools concerning information and knowledge in the organisational context are addressed and susceptible to communication and orchestration. It’s imperative to highlight a few of them, such as, ‘strategic information management’, ‘intellectual capital’, ‘organisational learning’, ‘competitive
intelligence’ and ‘communities of practice’. It’s exactly the interrelation and permeability between those many themes that enable and delimitate the upbringing of a possible theoretical framework which can be entitled “knowledge management”. Feedback is achieved by classifying the themes below the “KM conceptual umbrella” in the model proposed by Choo (1998). Competitive intelligence and environmental scanning are initiatives – managerial approaches and IT tools - that drive the strategic concept sense making into action. That is, sense making is a strategic concept and, e.g., competitive intelligence, an action-driven managerial approach - a way to turn strategy into action is by using the right managerial approach or IT tool that can be found in the “KM conceptual umbrella”. Communities of practice, strategic information management and organisational learning fit into the thematic of knowledge creation and so on. Figure 3 represents and summarises the integrative conceptual map used both as a theoretical framework and a guide for field research and data collection:

**Figure 3**: KM: an integrative conceptual model proposition

Last but not least, it’s desirable to recur to Choo (2002) once again for the closing of this section, as he suggests a conceptual framework that could be useful for the comparison of possible information and knowledge management strategies. Choo’s starting point is the “Johari Window”, an approach that describes the dynamics of human interaction and communication and has its genesis in the first names of its inventors, namely, Joseph Luft and Harry Ingham. His arriving point is the proposition of the “Windows of Knowledge Management ”, as shown in Table 3:
3. The method

Research should not be assumed solely as a rational task – the one that is approached with safety and assurance - but the one that has the side effect of augmenting fear and grief (Bourdieu, 1998). From this point of view, it’s a peremptory call to abandon the solely terminological discussion of KM and an essential condition to move on to the exploitation of a conceptual framework that is being designed in the field, as proposed by Alvarenga Neto (2002, 2005) and Souza and Alvarenga Neto (2003). In resume, it’s about elaborating a coherent system of relations that must be put to judgment as it is. It’s also necessary to achieve a comprehension that knowledge is something that is built of and from other knowledge from which we can exercise apprehension, criticism and lack of confidence. Another cornerstone is the fact that any attempt to represent reality will undoubtedly be more imperfect than what reality is and it’s absolutely necessary the process of socialisation among researchers in order to achieve field advance, bearing in mind that innovation occurs in the frontiers of creative minds in synergy of purposes.

As said before, this paper aims at trying to propose a conceptual demarcation for the thematic knows as “knowledge management”. Far from proposing a definite, quintessential solution or a hermetic model, it does aim to contribute to a better understand of the area/theme, as well as its borders and scopes. In order to study the visions and concrete initiatives of Brazilian firms in the knowledge management field, case studies in three large Brazilian organisations were realised, aiming at leaving behind the purely terminological discussion, which is inocuous and naive. The analytical model was divided in five analytical categories as guidelines to field research, namely: (i) reasons or motives that lead the organisation to KM initiatives; (ii) the firm’s definition or understanding of KM or/and KM’s concepts; (iii) aspects, managerial approaches and tools considered under the aegis of the firm’s KM area, program or project (“KM Conceptual Umbrella); (iv) the emphasis or priority aspects of KM; (v) main results related to or generated by KM initiatives.

A sine qua non condition in choosing the organisations was the fact that they should have already had KM implemented and, for this matter, three organisations - belonging each one to one of economy’s three sectors - were chosen, that is to say, Centro de Tecnologia Canavieira (CTC), Siemens do Brasil and Pricewaterhouse and Coopers (PwC). The qualitative research strategy used was the study of multiple cases with incorporated units of analysis and three criteria were observed for the judgment of the quality of the research project: validity of the construct, external validity and reliability. Multiple sources of evidence were used – semi-structured interviews, documental research and direct observation - and the proposal of Miles and Huberman (1984) was adopted in order to analyse the data collected in the field. Their proposal consists of three flows of activities: data reduction, data displays and conclusion drawing/verification (figure 4).
The field research was realised in the cities of (i) Piracicaba, SP, (ii) São Paulo, SP and (iii) Belo Horizonte, MG in the period of March, 19th, 2005 to April, 12th, 2005. A total of 17 interviews were conducted, which resulted in 35 hours of tape recording and 533 pages of transcriptions. As to documental research, approximately 1600 pages were analysed with a loss of 12%. Four data reduction cycles were necessary until data could be incorporated to the final work and eight reduction displays were produced based on the analytical categories created (Table 4).

Table 4: Data reduction processes–data analysis of field research (Alvarenga Neto, 2005).

<table>
<thead>
<tr>
<th>Data Reduction Processes</th>
<th>From (pages)</th>
<th>To (pages)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Reduction Process</td>
<td>2150</td>
<td>180</td>
</tr>
<tr>
<td>2nd Reduction Process</td>
<td>180</td>
<td>100</td>
</tr>
<tr>
<td>3rd Reduction Process</td>
<td>100</td>
<td>52</td>
</tr>
<tr>
<td>4th Reduction Process</td>
<td>52</td>
<td>Final work</td>
</tr>
</tbody>
</table>

The results will be presented in the lines bellow.

4. Results analysis

The main reasons or motives for the adoption of KM in the organisations of this study concerned the following aspects:

- Recognition that both information and knowledge are the mains factors of competitiveness of modern times;
- Need for the creation of an organisational space for knowledge, also known as “Ba” or “enabling conditions”, vis-à-vis the need to address cultural and behavioural issues.

Evidences and testimonies collected in field interviews confirm the statements above:

“[…] each part, area or department of our firm had idiosyncratic methods for storing and managing knowledge… […] nowadays the firm is concerned with knowledge because knowledge is the main factor of competitiveness. […] there were problems with information retrieval.” (CTC’s Coordinator of Technology Transfer)

“[…] thirty years generating technology and, as time went by, with turnover or retirement, knowledge was lost. […] a few areas or departments were mutilated and had to start from ground zero – they were unable to retain knowledge for reusing it for its own good. […] the loss of critical generated knowledge was a critical issue: lacking efficiency in information capture, people were taking their personal files with them…” (CTC’s Chief Executive Officer)

“[…] I think it was a threat: the entrance of new competitors in the market, mainly in the external market. […] and the need to do faster researches and face the new competitors: Australia, India and South Africa. […] we had a huge knowledge loss with downsizing and retirements. . (CTC’s Knowledge Manager)
“[..] both critical information and vital knowledge were lost and not shared.” (PwC’s Auditing Manager)

“[..] PwC’s greatest asset is the knowledge of its people… to make the knowledge of those professionals sharable” (PwC’s Director of the Auditing Department and Human Resources Department)

“[..] a transformation in the management model: from a very hierarchical model, stamp here, stamp there (sic), which is a slow model, to a much more network organic model. [..] that’s the idea of KM, to break all kinds of barriers: geographical, hierarchical, linguistic, temporal, and personal, among others.” (Siemens’ Knowledge and Information Manager)

“[..] quick access to organisational knowledge is a competitive differential.” (Siemens’ Sales Manager)

“[..] someone, somewhere in the world, has already solved this problem” (Siemens’ Human Resources Manager)

“[..] if Siemens knew what it knows… [..] KM is one of the processes that supports strategy through innovation, customer satisfaction and global competitiveness.” (Siemens’ Regional Director)

There was a lack of consensus concerning a definition for KM in the organisations of this study. Nevertheless, a few terms were common in the answers of interviewees (content analysis), namely, process, information, knowledge, innovation, tacit-explicit knowledge conversion, registration, sharing, organisational culture, access and use, among others. Here are a few testimonies of interviewees that confirm this assertion:

“[..] there is no consensus of what KM is or should be in the organisation – it’s a challenge. [..] there’s a delimitation of performance areas: information treatment, tacit knowledge, enabling of sharing… [..] KM is a process, it has phases but no end. [..] process that aims to enable information and knowledge sharing, intangible assets protection, (sic) where knowledge is focused”. (CTC’s Knowledge Manager)

“[..] it’s not very clear, but it’s all that is managed for obtaining knowledge, innovation”. (CTC’s Chief Executive Officer)

“[..] it’s a process that contributes to place the workers’ knowledge in a network”. (Siemens’ Regional Director)

“[..] it’s not a miracle, it’s not a (sic) ‘knowledge unlocker plus’. It’s a great change in the philosophy of the organisation’s strategic management. [..] tools for collaboration and the creation of channels”. (Siemens’ Knowledge and Information Manager)

“[..] KM is a process, it has no end. [..] process for capturing all the knowledge that permeates the organisation. [..] readiness, use and share for the firm’s good”. (PwC’s Documentation and Information Manager)

“[..] KM is sustaining an environment that enables the coexistence of creation, development, sharing and dissemination of strategic knowledge to the organisation – it’s creating the context, it’s a process that should permeate all the business processes of the organisation”. (PwC’s KM Coordinator for South and Central America)

“[..]KM is not a project, it’s a process that involves the organisation as a whole: to make knowledge available to the right people at the right time, being a key factor for maintaining an organisational culture of shared values, styles and behaviours.” (Documental Research, PwC, 2005)

The next step was to investigate the theoretical proposal entitled “KM conceptual umbrella”. Henceforth, the interviewees were asked to answer which aspects, managerial approaches and tools were considered under the aegis of the KM area, program or project in their respective organisations. Here’s a comprehensive summary of the answers: (a) environmental scanning, competitive intelligence, market research, (b) strategic information management, electronic document management, process mapping, (c) intellectual capital management, competencies and people management, intangible assets, (d) communities of practice – both real and virtual, (e) organisational learning, including e-learning, (f) decision making support and (f) creation of the enabling conditions or “Ba”.

“[..] yes, external environment information, competitor’s products, market trends,
clippings... [...] there's also an informal information collection made by workers that (sic) “fish” something in the market and put it in the intranet – even rumours”. (Siemens’ Sales Manager)

“[...] KM is an strategic area hooked to the directorship, providing information to support decision making processes, it’s directorship’s advisory". (CTC’s Knowledge Manager)

“[...] to implement a rigid taxonomy for all the organisational content”. (Documental Research, CTC, 2005)

“[...] strategic information management, creation of an appropriate context for sharing, like, for instance, the “Bank of Ideas” and the “Cultural Moment…” (CTC’s Information Analyst)

The interviewees were also inquired about the emphasis or priority aspects of KM in their organisations. Data analysis revealed that the starting point for KM initiatives – strategic information management – was reaching a stage of concept maturity, with consciousness that it is a permanent process. The organisations of this study were putting their efforts at advancing in aspects related to sharing, organisational culture and the creation of “Ba” or the enabling conditions. It’s imperative to highlight the existence of many initiatives that are genuinely Brazilian initiatives, adopted to address the creation of “Ba”, like the “Cultural Moment” at CTC and the “Knowledge Happy Hour” at Siemens. This last initiative is:

“[...] it is an informal practice of conferences, where essential organisational knowledge is shared in a tacit, spontaneous way. It’s a local specific initiative that fits general policies. The speeches last for one hour and are presented by the firms’ personnel”. (Documental Research, Siemens, 2005)

At last, the main results related to or generated by KM were nominated by the interviewees: (i) innovation cycle reduction and faster time-to-market solutions; (ii) market share and portfolio increase; (iii) facilitation of expertise and people location; (iv) creation of an organisational memory and repository; (iv) increase in the learning capacity and (vi) ability to anticipate competitors’ actions and movements.

5. Conclusions

This paper’s main goal was to investigate and analyse the concepts, motivations, practices and results of KM effectively implemented in three large Brazilian organisations. Far from proposing a definite solution or a hermetic model, it hoped to contribute for a better understanding of the field, its borders, scopes and connections. A KM integrative model/map was elaborated starting from that proposed by CHOO (1998), associated to the “Ba” or enabling conditions proposition conceived by VON KROGH, ICHIJO and NONAKA (2001), in addition to the several managerial approaches and tools metaphorically denominated as the “KM conceptual umbrella". These three ideas interconnected are contributive for the construction of a theoretical framework as a starting point. Another corollary of this work assumed the task of confirming this integrative conceptual KM framework through the discussion and analysis of a Brazilian research work in three Brazilian organisations committed to KM.

Both the presuppositions and the theoretical framework presented in the literature review (FIGURE 2) were confirmed. This framework integrates the strategic, tactical and operational levels of the organisations concerning KM initiatives, e.g.: the strategic concept “sense making” is driven into action by using managerial approaches or tools for this purpose – found in the “KM Conceptual Umbrella - such as competitive intelligence, market research or environmental scanning; the strategic concept “knowledge creation” is driven into action by using managerial approaches or tools such as “strategic information management”, “intellectual capital” and “communities of practices”, among others. From strategy to action, “Ba” is needed to bridge the gap as it creates the favourable context for creativity, innovation, empowerment and creative chaos, among others. It is interesting to observe that the managerial approaches and tools considered in the “KM Conceptual Umbrella Metaphor” are also interconnected: strategic information management is the starting point that can lead to the strategic management of intellectual capital, the organisation of communities of practice, the start-up of organisational memory and organisational learning and so on.

The results confirmed the fact that KM means a rethinking of the management of the knowing organisations or organisations of the information era. This statement has its origins in the comprehension that information and knowledge are the main factors of competitiveness for contemporary organisations and nations. It was
also identified that the main challenges facing organisations committed to KM have its focus on change management, cultural and behavioural issues and the creation of an enabling context that favours the creation, use and sharing of information and knowledge. Another remarkable challenge is the proposal or creation of a group of metrics and/or performance indicators to evaluate KM. In this particular issue, Siemens’ already taken a step forward by introducing its own metrics, named “KS-Enabled” and “Strategic Skill Gap”. The truth is that KM must use both quantitative and qualitative metrics. The conclusions suggest that KM is an oxymoron, perhaps an impossibility. Knowledge as such cannot be managed, it is just promoted or stimulated through the creation of a favourable organisational context. The word “management” when associated with “knowledge” must be comprehended as promotion or stimulus for the creation and sharing of organisational knowledge and KM assumes the meaning of a management from and to knowledge. There is strong qualitative evidence of a major shift in the context of the organisations contemplated in this study: from “knowledge management” to the “management of ‘Ba’ or the enabling conditions” that favours innovation, sharing, learning, collaborative problem solution, tolerance to honest mistakes, among others.

KM is highly political, demands knowledge managers and is an endless process that needs to be aligned with the organisations’ strategy and highly in tune with leadership premises. KM is not the same as information technology (IT), but it can be a process supported by information technology. Not all KM initiatives need IT, as demonstrated by CTC and Siemens with their “Cultural Moment” and “Knowledge Happy Hour” initiatives. It is recommended to test this model and also KM practices in small and medium firms in the Brazilian organisational context.

References


An Insight into Knowledge Flow in Biomedical Engineering Science

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Abstract: Technology has always played an important role in medical science by contributing to health care development. The use of technological instruments helps diagnostics of normal and pathologic states; and thus leads to a better understanding of human physiology. Once a diagnosis is established, a suitable treatment or surgical intervention can be considered, according to the available clinical capacities. In the last four decades, research in biomedical engineering science has led to the manufacturing of cutting edge medical instruments. For example, the introduction of endoscopes into surgical practice is considered one of the biggest success stories in the history of medicine. However in order to develop appropriate medical instruments or procedures, one key issue for successful biomedical research is the ability to understand in an efficient way the requirements of the medical practitioners. Furthermore, the two main actors namely biomedical universities and the biomedical industry involved in the development of new technologies need to collaborate and cooperate to a greater extent. This paper discusses the role and the process of knowledge flow between the various stakeholders involved in the design of medical instruments. The aim is the delineation of a general framework facilitating the understanding of the technical and medical requirements in order to develop new tools and methods.

Keywords: Knowledge flow, biomedical engineering, knowledge sharing and transfer process

1. Introduction

During the last decade the transfer to in-depth knowledge has surfaced (Corso et al., 2006). Previous studies indicate that there is a link between knowledge management and innovation processes (Arntzen 2006; Brännback, Renko, and Carsrud, 2003; Cormican and O'Sullivan, 2000). The emerging concept of the triple Helix described as the three way institutional spheres (public, private and academic) work together is considered as being the best approach to form an innovation system based on knowledge flow and interactive consultations (Leydesdorff and Meyer, 2000). Recent studies stress the point that a university in the triple helix; University-Hospital-Industry, represents the indispensable partner, which is able to grasp the concepts of a better innovation process through knowledge generation (van Baalen et al., 2005, Laestadius, 2004, Leydesdorff and Meyer, 2000). Furthermore, the value of research carried out by universities and research centres for industrial innovation and performance is well acknowledged (Grossman et al., 2001). However, it is commonly agreed that knowledge transfer from universities to industry is not optimal and that opportunities are overlooked due to the lack of a close and efficient collaboration (Brännback et al., 2003, Pérez and Sánchez, 2003). In addition, researchers at universities who work in an isolated context are often not aware of the needs and challenges of potential target users groups. Thus, some important research efforts can lead either to no concrete outcomes or to results that cannot be exploited or commercialised (Sandelin, 2003).

This statement is even more valid in the biomedical engineering field, where there is a stringent need to ensure a close cooperation between the University, Hospital and Industry, while developing specific tools and procedures to be used by clinicians. The cooperation and collaboration between the three stakeholders involves an effective knowledge transfer and sharing process mastering. Biomedical engineering (BME) is defined as the application of engineering disciplines and technology to the medical field. It combines engineering expertise with the medical expertise of the physician to help improve patient health care by designing suitable medical devices. As a relatively new discipline, much of the work in biomedical engineering consists of research and development. Therefore, it is crucial that heath institutions, research institutes and manufacturers work efficiently together. One way to ensure success in these types of cross-disciplinary activities is to examine the way scientific knowledge flows between engineers, researchers and physicians while they are involved in an effort to develop or improve diagnostic devices.
The paper focuses on the facilitators and limiters of the knowledge flow between industries, universities, and hospitals within a biomedical engineering context. The study intends to explore the nature and the role of knowledge transfer between the various stakeholders. It examines the socio-technical factors that play a role in knowledge management leading to technology innovation in the biomedical engineering field (Bechina, 2002). The research questions are:

- What are the requirements for enhancing collaboration and networking between Industries, universities and hospitals?
- What roles do the use of information communication tools and organisational change have in the transfer and sharing of knowledge for innovative activities in biomedical engineering field?

The next section introduces the concepts of knowledge and knowledge transfer. The part three describes the context of study and outlines why and how the knowledge transfer is taking place within the biomedical engineering field. And finally a model of knowledge transfer and sharing is discussed.

2. Knowledge and knowledge management concepts

One standard definition of knowledge exists. One of the most referenced definitions in the literature of knowledge is provided by Davenport and Prusak (1998): “Knowledge is a fluid mix of framed experience, values, contextual information, expert insight and grounded intuition that provides an environment and framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of the knower. In organisations, it often becomes embedded not only in documents or repositories but also in organisational routines, processes, practices, and norms.” (Davenport and Prusak, 1998a). Knowledge is defined as information in context with in background the idea to apply that knowledge (Brooking, 1999). It is also seen as a shared collection of principles, facts, skills, and rules (Pemberton and Stonehouse, 1999). In this respect, knowledge is what gives a “meaning”, thus the lack of significance leads to disorganised information (Bhatt, 2000). In addition, knowledge is seen as very subjective, because it depends on the believes, values, intuition and the emotions of the individual (Sunassee and Sewry, 2002). Furthermore, it is necessary to recognise the different type of knowledge in order to expose its potential contribution to the performance of the organisation and to determine the appropriate channels to transfer it (Pemberton and Stonehouse, 2000). The wide-based knowledge definitions highlight the presence of several forms of knowledge; tacit, explicit, implicit and systemic knowledge at the individual, group and organisational levels (Davenport and Prusak, 1998b, Dixon, 2002, Polanyi, 1958, Nonaka and Takeuchi, 1995, Inkpen, 1996).

Explicit knowledge has a tangible dimension that can be easily captured, codified and communicated. Explicit knowledge is referred to “know-what”. It can be shared through discussions or by writing it down and stored into repositories, documents, notes, etc. Instance of explicit knowledge might include a network directory, an instruction manual, or a report of research findings. In contrast, tacit knowledge is linked to personal perspectives, intuition, emotions, believes, know-how, experiences and values. It is intangible and not easy to articulate and tends to be shared between people through personal interactions. Tacit knowledge is both social and contextual, therefore storing and communicating it, is a complex task (Davenport and Prusak, 1998a, Sharif, 2005). The distinction between tacit and explicit knowledge is important since their management is quite distinctive and requires different channels or means to transfer or to share it. Additionally, the distinction determines who owns the knowledge. Tacit knowledge being hard to codify, remains the property of the knowledge worker, while explicit knowledge remains in the organisation (Alm, 2005). However, quite often use of tacit or explicit knowledge is entangled, and it is often hard to have a clear separation between them. The following figure provides example of tacit and explicit knowledge in the field of biomedical engineering.

![Figure 1: examples of tacit and explicit knowledge in the context of the biomedical field](image-url)

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For instance, accurate interpretation of medical image such as MRI (Magnetic Resonance Imaging) requires tacit knowledge of the physician. This type of knowledge comes from his/her experience of interpreting and will depend of contextual setting. Physicians can establish a diagnosis by following a medical protocol that is described usually as a set of rules. The Figure 2 outlines an example of tacit or explicit knowledge needed for the delineation of a physiological model.

**Figure 2:** Example of knowledge requirements for a physiological model development process; tacit and explicit knowledge are differentiated by dark and light grey backgrounds respectively.

The management of tacit or explicit knowledge has been defined differently in the literature; this is due to the diversities of the undertaken initiatives. They all enlighten central ideas around the concept of knowledge management, but there are some apparent diversity in the definitions. The following conveys a few chosen definitions in the field: “Knowledge management caters to the critical issues of organisational adaptation, survival and competence in face of increasingly discontinuous environmental change. Essentially, it embodies organisational processes that seek to synergistic combination of data and information processing capacity of information technologies, and the creative and innovative capacity of human beings” (Malhotra, 2001). Knowledge management (KM) is as well seen as an effort to increase useful knowledge within the organisation by encouraging communication, offering opportunities to learn, and promoting the sharing and transfer of appropriate knowledge artefacts (McIlmerney, 2002). Most of organisations are attempting to use knowledge management in order to improve business performances or to foster innovation process. Amongst the KM processes, the one that is considered as the most important to understand is related to the transfer of knowledge from one set of individuals to another. Alavi and Leidner(2001) emphasise the significance of knowledge transfer by discussing the need for an organisation to be successful in its ability to generate new knowledge and to transfer it. In the biomedical engineering context, it has been discussed that understanding the mechanisms and the channels for transferring knowledge is an important dimension for fostering innovation in this field that is high-tech (Brennenraedts et al., 2006). It relies on a close cooperation and collaboration of the triple helix University-Hospital-Industry for a successful innovative technology. The next section discusses the need for sharing and transferring knowledge in a biomedical engineering area.

### 3. Knowledge transfer and sharing model in Biomedical Engineering

#### 3.1 Context of study

In the context of fast technological change and emerging technology, organisations need to be...
highly innovative. Especially in biomedical area, where development of models based on new technologies has the potential to play an important role in improving the health care system. However specific constraints can be encountered like for example: how to make sure end-users will effectively use the systems in their daily routines? In fact, the last research studies showed that there is rather a latent or open hostility from some clinicians or administrative staffs to exploit fully the functionality of information systems or high-tech tools (McDermott and O'Dell, 2001). Furthermore, there is sometimes too little interest from the technical researchers in clinical applications or even little concern of academic researchers for marketing issues. Those can lead to strong challenges and prevent an effective exploitation of scientific knowledge in medical practices. It is recognised by medical communities, that although, several "breakthroughs" in scientific and technological knowledge have been validated through clinical trials, still many are not adopted by medical practitioners (Hilton et al, 2002).

In addition, it is as well acknowledged that innovation is led by research institutions and there is still too little interaction between the various stakeholder groups (e.g. different medical professionals, industrial scientists, academic scientists, managers, etc.) while developing new models or tools. The picture 3 illustrates the interaction between the mains actors.

Figure 3: Three clusters involved in Biomedical engineering effort

Obviously, the main characteristic of a biomedical project is the multidiscipline context and the need to foster integration of knowledge with various dimensions. The main challenge relies on understanding why knowledge integration and transfer processes are crucial between the different biomedical partners. As stated above, medical science has always been using technological tools to get understanding of the human body physiology in order to diagnose normal and pathologic state. Once, a diagnostic method is established the appropriate treatment and, or intervention can be considered according to currently available clinical capacities. The purpose of biomedical engineering science is to provide clinicians with appropriate equipments embedding new technologies (and models). A suitable set of medical tools will allow clinicians to enhance their clinical knowledge and know how, leading to a better treatment of patients. Then, one key issue for a successful biomedical research is the ability of technical partners to understand properly the requirements specified by medical practitioners leading to the technical specification of tools. Both biomedical universities and biomedical industries should be able to collaborate and cooperate closely with the medical specialists. Furthermore, most of the industrial partners developing such high-tech tools are medium enterprises, and do have research activities constrained by resources, time or lack of suitable competences. Therefore it is important to understand the mechanisms and channels of knowledge sharing and transfer between the triple helix University-Hospital-Industry. In order to illustrate how the knowledge transfer and sharing is taking place in this specific context, a scenario is outlined below.

3.2 Knowledge transfer process

A better understanding of the state and evolution of the human body physiology allows on one hand, the clinical researchers to improve health care quality and on the other hand, the technical researchers to develop more appropriate medical
tools. The conception and development of physiological models is necessary in order to figure out laws driving diverse complex biological processes, which can be based on physics, biology and chemistry. Therefore, clinicians are able to estimate or predict some parameters, which cannot be seen or measured otherwise. In addition, the defined model needs to be refined and validated by both fundamental researcher and clinicians. This common and shared model is, at a later stage, embedded in medical tools. Therefore, only a multi-disciplinary expertise approach resulting from collaboration of the triple helix University-Hospital-Industry is suitable to achieve efficient results. Fundamental research is alimented by specific knowledge related to physical phenomena indispensable to build sophisticated physiological models. The universities play an important role in advancing fundamental research since they have conjugated resources such as top expertise of researchers that have conducted computational and experimental studies. Computational methods like finite elements are nowadays used in order to solve numerically theoretical laws based on differential equations (van Loon et al., 2006). Phantoms and/or in-vitro experiments can also be used in order to validate theoretical results (Geven, 2004). Therefore, those fundamental findings used together with clinical knowledge can be employed to delineate new physiological models. This scenario of knowledge sharing and generation is depicted in the following picture 4.

![Research Process Diagram](https://via.placeholder.com/150)

**Figure4:** Scenario of knowledge sharing and process in biomedical field

During the design and development of such models, technical researchers need to define the relevant input parameters in accordance with the requirements specified by the clinicians. In addition, some parameters resulting from the use of the designed device should be as well determined. Once the model is created, the specific physiological input state can be considered given the expected output parameters. Different given inputs can be used in order to estimate some biological phenomena under a controlled environment. The clinical expertise and knowledge of the physicians is then crucial for a proper interpretation of the given data.

The next step is to perform an in-vivo study by adapting the design model to a patient specific case (S. de Putter et al., 2006). Thus, research studies are further conducted and are based on the use of a high number of clinical data. Obviously, such studies lead to a better understanding of biological phenomena and in consequence contribute to advanced medical knowledge serving to the specification of further requirements to be shared with the technical teams. Moreover, other requirements such as ethical issues (compliance) and medical legislations have also to be considered and discussed by all the partners. This interactive design process requires better methods and tools to facilitate the communication. The interaction is as well characterised by the need to provide a viable business model for the industry related to the development in a larger scale of the new medical tools. Of course those business considerations are as well integrated in the set of requirements leading to the technical specification of the medical tools. A sharing knowledge model should be clearly outlined for the three partners. Some benefits are outlined as follows:

- Quality improvement in development of appropriate medical tools due to feedback from the users (clinicians)
- Development of medical tools that suits better the need of user groups

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Universities will benefit by testing their concepts and by applying their fundamental research.

Industry will benefit from expertise from top specialist researchers and can expect to improve their own expertise and extend their portfolio with new competences acquired while designing collaboratively new medical tools.

3.3 Factors facilitating or inhibiting the knowledge transfer

Knowledge transfer and sharing process can take several forms but are categorised into three components. The challenge is to determine the right synergy by integrating people, processes and technology. The focus on one component or another one, depends of the strategy adopted by the managers and will be determined by the level of involvement of all the stakeholders. A successful knowledge sharing and transfer effort requires a right balance of these three components (Collison and Parcell, 2001; Hall and Andriani, 1998).

![Knowledge sharing and transfer model](image)

**Figure 5**: Knowledge sharing and transfer model

At the bottom level of the pyramid, the people-based layer is the most important and should be the pillars for the knowledge sharing process in a biomedical engineering project. In order to overcome the difference of the three communities, it is crucial to define a framework where technical and medical knowledge can flow without meeting resistance from people. The top level of the pyramid indicates that although technology can be very useful to transfer or share explicit knowledge, the implementation and use of technology should be the last knowledge management focus.

**People**: Knowledge management is first and foremost an effort to manage, develop and disseminate knowledge and the full potential of people at an individual, team-based and organisation-wide level. Providing the right culture environment is the most challenging effort but achievable by enhancing learning facilities, providing a trustful working atmosphere, where collaboration and sharing are encouraged. Others aspects that need to be considered include: motivating and rewarding people that create, share and use knowledge, encouraging communities of practice and promoting network creations.

**Processes**: Processes play an important role by providing support for any KM implementation. Organisations might need to restructure their internal processes or even the organisation structure itself in order to support KM processes such as knowledge sharing or transfer. Managers must identify knowledge that exists in various forms in the organisation. One way to achieve the goal would be, for example, creating a knowledge map by initially finding out where knowledge resides, point it and then provide instruction on how to get there.

**Technology**: Providing a knowledge portal, linking people by e-mail, building knowledge repositories contribute efficiently to sharing knowledge. However using technology alone will not ensure successful knowledge management as organisational factors such as adequate training needs to be taken into account as well.

Focusing mainly on using technology to support knowledge sharing or transfer as, building
knowledge repositories might actually slow down the process of sharing. This is mainly due to the fact that many clinicians are reluctant to use on a daily basis information communication tools. Therefore in this specific context, it is important to prioritise human side by encouraging training of biomedical engineers and clinicians under co-responsibility of educational teams composed of both medical and technical specialists. Such early stage collaborations should foster better communication by exposing involved stakeholders to different cultures. Focus on others processes such as for example, best practices dissemination, needs also to be considered (Bechina et al., 2005). Focusing mainly on using technology to support the knowledge sharing or transfer such for example building knowledge repositories might actually slow down the process. Since many clinicians are not comfortable using information communication tools. Therefore in this specific context, it is important to put great efforts on people by for example encouraging training of biomedical engineers and clinicians under co-responsibility of educational teams composed of both medical and technical specialists. Such early stage collaborations should foster a better communication by exposing involved stakeholders to different culture. Focus on the processes for example encouraging best practices dissemination, needs to be considered as well (Bechina et al., 2005). Following the suggested knowledge transfer and sharing model is not enough to control the flow of knowledge. It is crucial that managers consider the inhibiting factors including for example:

- The inability to recognise and articulate intuitive competencies such as tacit knowledge
- Diverse areas of expertise
- Internal conflicts and interests difference
- Lack of incentives and rewards for sharing tacit knowledge or using ICT for sharing explicit knowledge
- Problems with sharing beliefs, assumptions, and cultural norms
- Motivational issues

4. Conclusion
The paper discussed the need to establish a strategy for knowledge transfer in biomedical area. Some factors facilitating or inhibiting the transfer of knowledge have been outlined. Of course there is a need for a methodology. The following roadmap suggests the steps to undertake for an effective knowledge transfer process. Firstly, it is important to identify the key knowledge workers within the organisations, and launch a campaign of communication stressing the importance of sharing Knowledge. Some incentives or rewards need to be established in order to motivate all the knowledge workers involved in the process of developing new tools or technology. The third phase should be dedicated to the design of specific sharing mechanisms facilitating the knowledge transfer. One indispensable issue is related to setting up some metrics to measure the impacts of knowledge transfer process on the innovation process. It is clear, that the choice of metric relies heavily on the type of initiatives implemented for transferring knowledge. The focus might be either organisational change or the use of appropriate information communication tools. This study is at an earlier phase, and we intend at a later stage to collect qualitative and quantitative data from different stakeholders in order to understand the current knowledge transfer that is in place and to provide a set of recommendations in order to improve the flow of knowledge in the triple helix university-hospital-industry.

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References


The Story of Knowledge: Writing Stories that Guide Organisations into the Future

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Abstract: Many organisational gurus highlight the value of oral narrative or storytelling as a catalyst for organisational change or a way to share knowledge. Tomes of articles describe seasoned raconteurs single handedly inciting enormous transformation in organisations. Oxymoronically many written works are describing the power of oral narrative. Surely these printed exposés are themselves motivators for change; so why the continued emphasis on the face-to-face storytelling? There is no disputing the fact that oral narrative is a powerful form of communicating; however, it is not always feasible. In fact, there are times when the written word packs a more powerful punch. Often it is simply not possible to catch the ear of a wide audience simultaneously, or even at all. Many people simply will not take time from their busy schedules to listen to stories. Busy executives seem to prefer the written word to the spoken. In these cases, the power of the pen offers a persuasive substitute. This is a tale about such stories in action, each of which seemed to sow the seed of change. Of course, time will be the real test; however, anecdotal evidence seems to support the proposition that well-written futuristic stories provide an excellent alternative to face-to-face oral narrative. At least in these examples, the written story proved to be a motivator for organisational change and an effective way to share knowledge. This paper is about the use of narrative to share knowledge; it is part tutorial and part theory. Building on the foundational knowledge developed by Denning, Snowden, Prusak, and others this paper describes the “how to” of effective storytelling to create and share knowledge within organisations.

Keywords: storytelling, organisational change, knowledge management

1. Introduction

On a foggy autumn day nearly 800 years ago a traveller happened upon a large group of workers adjacent to the River Avon. Despite being tardy for an important rendezvous curiosity convinced the traveller that he should inquire about their work. With a slight detour he moved toward the first of the three tradesmen and said “my dear fellow what is it that you are doing?” The man continued his work and grumbled, “I am cutting stones.” Realising that the mason did not wish to engage in a conversation the traveller moved toward the second of the three and repeated the question. To the traveller's delight this time the man stopped his work, ever so briefly, and stated that he was a stonemason. He then added “I came to Salisbury from the north to work but as soon as I earn ten quid I will return home.” The traveller thanked the second mason, wished him a safe journey home and began to head to the third of the trio.

When he reached the third worker he once again asked the original question. This time the worker paused, glanced at the traveller until they made eye contact and then looked skyward drawing the traveller’s eyes upward. The third mason replied, “I am a mason and I am building a cathedral.” He continued, “I have journeyed many miles to be part of the team that is constructing this magnificent cathedral. I have spent many months away from my family and I miss them dearly. However, I know how important Salisbury Cathedral will be one day and I know how many people will find sanctuary and solace here. I know this because the Bishop once told me his vision for this great place. He described how people would come from all parts to worship here. He also told that the Cathedral would not be completed in our days but that the future depends on our hard work.” He paused and then said, “So I am prepared to be away from my family because I know it is the right thing to do. I hope that one day my son will continue in my footsteps and perhaps even his son if need be.”

In the past five years or so there has been tremendous interest in the value of oral narrative or storytelling as a catalyst for organisational change. Many of these accounts chronicle seasoned executives telling stories that spark massive transformation in their organisations. It seems, so the story goes, that these organisations were apparently reluctant or incapable of considering even the most modest change initiative. That is until the story was told. The opening story is an adaptation of a legendary example of how a well-told story can motivate men and women to make great sacrifices if they believe their work is important. One can imagine that most leaders would wish to have a team of cathedral builders rather than stonemasons. The question is, can a story really transform stonemasons into cathedral builders? To date most of the work in the domain has focused on the value of telling stories, in other words oral narrative. Take, for example, Steve Denning’s book The Springboard, the subtitle of which is
How Storytelling Ignites Action in Knowledge-Era Organisations (2001). In this seminal work, Denning describes his successes in telling face-to-face stories. Denning’s work has spawned a host of other papers and books, most of which focus on telling oral stories.

Surely these printed exposés are themselves motivators for change; so why the continued emphasis on the face-to-face storytelling? Perhaps there is value in examining writing stories rather than telling stories that spark change. This paper is a story of exactly that, writing stories that help guide organisations.

2. Literature review

‘Stories are a primary mode of human communication and thinking — and one that has been used since the dawn of time. Why? Stories have depth and multiple dimensions; they help us create human connections in a world that seems complex, sometimes (or often) threatening, and increasingly dehumanising. Stories give us context’ (Ivy Sea Online, 2005).

2.1 Envisage narratives

Before describing the stories, it is worth reviewing the literature with a view to determining the theoretical foundations of these stories. Much like the cathedral builder’s Bishop, many leaders use stories to electrify their subordinates and lead them into the future. The ability to relate to an audience using a story is a concept that has passed the test of time. Through a variety of approaches, present-day executives use stories to excite and invigorate their teams much as their predecessors did. Kaye and Jacobson (1999:50) remind us that “stories tap into our emotions and intellect in ways that get us to remember and use the information and wisdom of the past to help us make informed decisions in the future.” There is an enormous difference between relating a message to an audience and sharing a vision to alter the future of an organisation. The use of narration or storytelling envisage within a corporation can grant insight into an alternate course of action. Chartier, LaPointe, and Bonner (2005: v) state in Get Real – The Art and Power of Storytelling in Workplace Communities ‘Stories are a way to honour our past, describe our present and shape our future.’ The impact of conveying an envisioned story, which can change the future of an organisation, can be magnificent, in the sense that it can also change lives. Yet, how does one know that the envisaged narrative will be received and have the ability to alter the future of an organisation? How does the manager know if the message of their narrative has been received and that their team members can relate? In oral stories the receivers demonstrate an attentive and responsive reaction, sometimes signs of enthusiasm. However, with the written word the immediate reaction is often lacking.

2.2 The use of story

Throughout time, leaders have used stories to share knowledge, spark change and generally enlighten an audience. Some leaders use formal presentations to achieve these tasks. Although there are similarities in the techniques, there are also significant differences. More and more the evidence is suggesting the PowerPoint style of knowledge transfer is less effective than many believe. Janis Forman (1999: 1) argues that ‘Clear communications between executives and their audiences has been declining ever since the advent of souped-up computer graphics and Internet access to vast quantities of data.’ Neilson and Stouffer (2005) claim that PowerPoint presentations lack contextual meaning. According to McKee (2003: 51) we should ‘Forget about PowerPoint and statistics. To involve people at the deepest level, you need stories.’

Steve Denning (2004: 122), the celebrated guru of storytelling, claims to have moved from PowerPoint style presentations to storytelling after watching ‘my audience merely looked dazed.’ Larry Prusak (in Bell, 2004), respected knowledge management expert, goes one-step further by suggesting ‘I’ve taken PowerPoint off all my computers; it’s the enemy of thought.’ Though Prusak’s action may seem extreme, his point is very valid; knowledge sharing is sometimes impeded by an endless stream of charts and graphs. In their article Narrating the Vision, Neilson and Stouffer (2005) illustrate the effectiveness of using futuristic scenarios as a storytelling technique. They suggest that ‘futuristic scenarios – stories that paint a vivid picture of a future state – can help provide a vision and leadership in a narrative format as well as communicate the organisation vision’ (Neilson and Stouffer, 2005: 26). The ability to convey a message, as in the story Narrating the Vision, is a great example of a futuristic scenario. Nevertheless it is important to examine the effectiveness of the approach of futuristic scenarios within an organisation. Steve Denning (2005) stated recently that future scenarios aid in the exploration of other points of view yet concluded that a descriptive narrative to support the scenario is necessary.

2.3 Conveying futuristic views

‘As humans, we are wired to respond to stories in deep, sometimes unconscious
ways. We actually answer with our attention and focus, when all other efforts may fail. Watch sometime how body language changes when someone starts a joke or story. Notice the slight rise in alertness and increased presence of the listeners. People will almost always put down what they are doing and give full attention. If the teller is particularly good at storytelling, then the response is almost always deep focus’ (Baum, 2000, p. 159).

Visualising a future organisational course of action entails strategies and tactics to build loyalty, focus effort, and spark creativity according to Robert Mai and Alan Akerson (2003). The Leader as Communicator exemplifies the restructuring of several organisations, each of which uses stories to communicate a holistic viewpoint with one or more different angles. The basis of the story is a problematic statement posing a challenge for the organisations. The story is used to convey a guided future course of action for the organisation; a methodical approach occurs prior to this phase. Before the plot line can be portrayed, a data gathering process is needed. The data-gathering phase will answer questions on the past, current, and future course of action of the organisation. One should also consider the buy-in factor of stakeholders. According to Forman (1999) one method that can be used to evaluate or test their envisage narrative is an Analysis Tree. Determining coherence through a visual analysis illustrates phases within a story. The corporation’s past history, current course of action to take, and the envisaged future will be shown along with the structural ideas that show a link to strategic reality. The analysis tree is similar to a storyboard, which allows visualisation of how the process relates to another phase. Executives in the healthcare industry used this particular method. The advantage of the analysis tree is flexibility to adapt to the storytellers needs. The storyteller can adapt the analysis tree to the audience or stakeholders. Evaluating narratives through the analysis tree is valuable to an organisation based on the effectiveness of the story.

Contrary to Forman’s analysis tree, Allen (2005) suggests that storytelling will not substitute for analytical thinking, but only enhances organisational knowledge. However sharing of knowledge ignites change, which increases the possibility of success within an organisation. Altering duty into passion is a requirement to increase the level of accomplishments. Linking responsibilities with passions prevents burnout and remoteness among employees, therefore benefits the organisation. Storytelling provides the means to convey messages to an audience or a method for sharing knowledge. ‘Storytelling can be the catalyst for change . . . Telling your story complements analytical thinking and allows customers to engage feelings, leading to loyalty’ (Allen, 2005:64).

Storytelling can be advantageous to an organisation in a variety of ways. Matsui (7) stated ‘Stories can be told in a variety of modes that include: visual accounts, ballads, metaphors, text, and voice. Telling good stories serves the organisation with an effective means of collecting wisdom through experience.’ The use of storytelling, along with five other components becomes useful for an organisation to plan a future course of action. This form of planning is called Action Mapping and consists of assemblage, accumulation and production of wisdom, actions as hypothesis, conservation of energy, reflection on action, as well as storytelling (Matsui). The planning phase will consist of essential components from the data-gathering phase. Creating the story requires past, present, and future knowledge of the organisation, which will in turn be used to develop the future course of action. Involving the stakeholders in the process creates an increased success factor of the envisage narrative. Matsui (7) suggests that ‘The knowledge and experiences gained from a journey clarify future actions by identifying emerging patterns.’ Steve Denning (2001) uses the catalyst approach and takes storytelling a step further, through Springboard stories, which provide the audience or stakeholders with a deeper level of understanding. Visualising through the use of realistic events sustains the attention and consciousness of the audience. The significant aspect of a springboard story is the use of a simplistic approach, using fewer details to allow the audience to imagine the future possibilities that can occur within the organisation. This catalyst approach leads the audience without controlling their views based on an individual’s field or past experiences. Audience participation in the creation of the organisation’s future is met with less resistance and more enthusiasm, therefore obtaining buy-in from the participants.

2.4 Writing the future

Snowden’s (2002: 3) second heuristic of the new knowledge management generation is ‘we can always know more than we can tell, and we will always tell more than we can write down.’ These wise words seem to suggest that telling an oral story may be more effective then a written story. However, before dismissing the written word it is worth considering the context of his message. Snowden (2002:3) suggests ‘I can speak in five minutes what it will otherwise take me two weeks to get round to spend a couple of hours writing it down. The process of writing something down is
reflective knowledge; it involves both adding and taking away from the actual experience or original thought. Reflective knowledge has high value, but is time consuming and involves loss of control over its subsequent use. This deeper examination of Snowden’s second heuristic seems to imply that once one takes the time to create a written story the value may be higher than a less-reflective oral story. Snowden’s premise is corroborated by Denning (2004: 127) who wrote ‘A story can help take listeners, from where they are to where they need to be, by making them comfortable with an image of the future. The problem, of course, lies in crafting a credible narrative about the future when the future is unknowable.’ Together Denning and Snowden highlight the challenge of writing future stories – one must take the time to learn about the future and then articulate the ideas using the reflective knowledge Snowden described.

3. Methodology

The literature review concludes that, in theory, narratives help guide people into the future and share knowledge. The question remains, can one use this technique in practice? Perhaps more specifically, the question is can one use written narratives to share knowledge and guide people into the future? One way to answer this question is by chronicling the success of three recently written stories. Each was written with the express aim of guiding people into the future. Before describing the stories, it is important to understand that this paper is based on exploratory research that was designed to field test some concepts. This paper is not based on empirical research nor does it report the results of a true experiment but rather it describes the use of narratives in real organisations with real people dealing with real challenges. Most of the results are anecdotal in nature; nevertheless, it is believed that the outcome indicates that stories are a useful tool in some organisations.

One must use caution in determining how the results should be generalised. Clearly, the stories achieved the desired end state in the very unique organisation for which they were designed; however, it remains entirely possible the success of the narratives may not be replicated in other organisations. The results are presented in the spirit of sharing so that others may decide if the techniques are appropriate for their organisations. In addition, it is hoped this exploratory research will lead to a formal empirical study.

4. Practical Implementation

There is no disputing the fact that oral narrative is a powerful form of communicating; however, it is not always feasible. In fact, there are times when the written word packs a more powerful punch. Often it is simply not possible to catch the ear of a wide audience simultaneously, or even at all. Many people simply will not take time from their busy schedules to listen to stories, others may be geographically separated, and still others may simply be out to lunch or otherwise predisposed. In these cases the power of the pen offers a persuasive substitute. This is a tale about a trio of such stories, which seemed to sow the seed of change, help guide people into the future, and share organisational knowledge. Of course, time will be the real test; however, anecdotal evidence seems to support the proposition that well written futuristic stories provide an excellent alternative to face-to-face oral narrative. At least in these examples, the written story proved to be a motivator for organisational change and an effective way to share knowledge.

4.1 Story one – Guiding government leaders into the future

The first story was developed to excite change in a very large bureaucratic organisation – Canada’s Department of National Defence. The leader of the Strategic Knowledge Management cell was keen to explain how and why knowledge management could help Defence leaders. Clearly it would not be possible to meet face-to-face with all of the target audience, so what to do? Against the advice of many colleagues, pen was put to paper to create a story entitled Twelve Hours of Knowledge (see Appendix 1). The story was an overwhelming success and it was eventually included in the Canadian Military Journal – the journal read by the target audience (Girard, 2004: 24). The story, which was set five years in the future, intentionally blurred the real with the imaginary. Many facets of the story were commonplace in Defence, such as the type of equipment, ranks, organisations and jargon. Care was taken not to use any real people’s names; instead, position titles were used. The tale was about a Canadian Forces operation on a small Caribbean island nation, which was dealing with the aftermath of a natural disaster.

So what made the story a success? Clearly, there were a number of critical success factors; however, one of the most important was the look of the story. The story was designed to resemble the weekly newspaper of the Canadian Forces entitled The Maple Leaf. With the editor’s permission, a story was crafted that appeared to be The Maple Leaf’s cover story. This allowed the story to be distributed as a reprint from the paper. The look was especially useful in capturing people’s attention, countering to some degree the old cliché ‘Don’t judge a book by its cover.’ At
least in this case it seems the cover was important to many people. Attracting the target audience is just the first step; clearly, the content is the vital ingredient. The story must be believable, realistic, and most importantly perceived as achievable.

Although the story was set in the future, it did not rely on futuristic technology, but rather, it described technology that is commonplace today. This was a surprise to many readers as they expected some far-fetched, ridiculously expensive Star Trek type technology. Instead the narrative described leadership and culture as the keys to success – another surprise to many readers. A crucial component of the story’s success was executive support. An early draft of the story caught the attention of one very senior executive. His endorsement provided the necessary influence to sway a few less enthusiastic managers, who may otherwise have been unable to convince the readers that the story was believable and achievable. Once again, a vital component of the story’s success was executive support. The Dean replied ‘I wish we would have started sooner.’ Grinning, he continued: ‘the success of motivational stories.

4.2 Story two – Guiding faculty into the future

The second story was developed to excite change in a small mid-west university (see Appendix 2). A new faculty member was charged with the responsibility of integrating knowledge management into the core curriculum of the College of Business. This was no easy task, especially given the number of naysayers who were perfectly content with the status quo. One group believed knowledge management was just a passing fad and they had been involved with enough fads, thank you very much. A second group thought this KM stuff was a good idea, just as long as it did not affect them or their courses. The final group, which was the majority, had bought into the idea but did not really know what to do next. The story was a mock interview with the Dean five years hence. The story was published in a trade journal, entitled KM Today, shortly after the College was the recipient of the Most Innovative Knowledge Educator (MIKE) award. In the interview, the Dean described the implementation of the program and how it had improved the quality of education for the students. The final question asked by the interviewer was ‘What would you do differently?’ to which the Dean replies ‘I wish we would have started sooner.’ Grinning, he continued: ‘the success of the program makes me wish more folks could have benefited, had we started in 2003, we would have helped another cohort. That said I am absolutely delighted with our results.’

4.3 Story three – Guiding students into the future

Based on the success of the previous stories, another future based story was penned (see Appendix 3). This time the target audience was a group of executive graduate students completing an accelerated Master of Science in Management program. A key element to this program is a major research paper that must be completed before graduation. Historically all students have completed the course work based on the published schedule; however, there tended to be a handful of students who procrastinated on the projects. This procrastination caught the attention of the University administrators who seemed worried that this tardiness may jeopardise the program. In the past a variety of techniques were used to instil a sense of urgency in the students but needless to say the desired results were still not being achieved. Once again, the use of narrative was selected as the way ahead. This time the story was set just months in the future, unlike the previous stories that were several years in the future. Specifically the date of the story was the graduation date of the group with the following headline ‘Class of 2005 – The First Cohort to Graduate as a Group.’ The story was published in a newspaper that featured a striking resemblance to the University’s student newspaper.

The target audience for this tale was a group of geographically separated students who needed a moral boost. The story was printed and mailed to the students’ homes. At the end of the day, the story achieved its aim by helping focus the students on the few remaining months of the
program. Several students commented that the story allowed them to see the end of tunnel.

5. Moral of the story

All good stories should end with a moral and this story is no different. This saga began by reviewing the timeless story of a stonecutter and a cathedral builder. Having agreed that most executives would wish for an army of cathedral builders rather than stonecutters the literature was reviewed to see what the gurus were suggesting. The literature is rich with examples of raconteurs guiding the way ahead with oral stories; however, the domain of written stories was far less mature. After reviewing a trio of future-based written stories, it is clear that, at least in some cases, the power of the pen may be as effective as a well-told oral story. In each case, the written word proved to be a powerful motivator by capturing the imagination and attention of the target audience. Perhaps these types of stories are not well suited to all audiences; however, for some groups the written word is more powerful than even the best oral story. To quote a faculty member who was initially against the change initiate and now a supporter of the idea, ‘Now I get it.’ Just four words, but four words that mean one more team member is a supporter . . . those are four important words! The target audience seems to be a key to the success of these stories – it is not known or presumed that the success of these stories may be replicated in other groups.

For some groups it is simply not possible to capture the attention of all group members with an oral rendition. This is certainly the case with the three groups described in this paper. Two of the groups, the military and student groups, were separated geographically and it would have been extremely difficult to have them meet to hear the story. The majority of the third group, the faculty, were geographically collocated but as a group were not very receptive to a gathering to discuss the subject. Anecdotal evidence seems to support the premise that the target audiences for these stories prefer the written word to the spoken word. The moral of this story is that both written and oral stories are effective tools in sharing organisational knowledge, sparking change, and guiding people into the future. The wise executive should consider both forms of stories to help guide their organisations.

References
Appendices

This fictitious story describes the power of knowledge management in action. It was created with the kind permission of the Maple Leaf.
Twelve hours of Knowledge:

How knowledge sharing helped Op SAGE:

(Ottawa) On Monday 29 October 2007, the Canadian Forces’ Humanitarian Emergency Relief Team (HERT) arrived in Haiti to help the island nation deal with the aftermath of a natural disaster. HERT was the first international force to answer Haiti’s call for assistance. This speedy response, called Operation SAGE, was made possible by connecting people with people to share knowledge. Their story is below.

On Sunday, the Commanding Officer (CO) HERT awoke to the ringing of his personal data assistant. It was 0615 and his Operations Officer had just sent him a priority email. The note contained a news feed describing a hurricane, which suddenly changed course and was heading toward the small Caribbean island nation of Haiti. The CO was surprised by the news as he and his team had been watching the storm for a number of days and most experts believed the storm would not reach land.

After reading the note, CO HERT opened his tablet PC, inserted his Public Key Infrastructure (PKI) card and turned on his computer. Within minutes, through a wireless connection, the CO’s personal knowledgespace appeared, which included a dashboard showing the status of his unit. The dashboard was a collection of critical data and information maintained by his staff. The presentation of knowledge in an intuitive manner allowed the CO to quickly decide if he needed to take action or make any decisions. He was delighted to determine that his command group was available, less one officer who had agreed to be contacted for operational reasons. CO HERT added these details to the collaborative workspace. When he clicked on the 2004 staff list, he was surprised to find that a Staff College friend of his was the deputy commanding officer of the operation. Using People Finder, he determined that his friend is in Ottawa – this fact was added to the workspace.

The CO determined that the battlegroup commander retired in 2006 as brigadier-general; however, he remained a member of the Supplementary Reserve and had agreed to be contacted for operational reasons. CO HERT added these details to the collaborative workspace. When he clicked on the 2004 staff list, he was surprised to find that a Staff College friend of his was the deputy commanding officer of the operation. Using People Finder, he determined that his friend is in Ottawa – this fact was added to the workspace.

The CO saw a small flashing icon beside his friend’s name, indicating that he was online. Clicking on this icon an Instant Messaging (IM) box appeared and he typed a quick note to his friend. He asked if his friend had heard about the storm and received a quick response saying “AFK – WIMU 10” – which of course is shorthand for “I am away from my keyboard, I will instant message you in 10 minutes” – such shorthand is used when one is using a cellular telephone or other hand-held device.

While waiting for his friend to return the IM, he clicked on a link to the lessons learned library. The genesis of the library was an idea from a Community of Practice in 2005. With members from a variety of organisations that collect and analyse lessons, for example the Army Lesson Learned Centre, Director General Safety, Flight Safety, the community thought it would be a great idea to share information amongst each other. The Director Knowledge Management built on this great idea by sponsoring a project to consolidate the various sources. Today with a click of a button, the CO is able to search a variety of knowledge stores.

Next, he opened the staff list for the 1997 operation, but he did not recognise any of the names; in any case, he dragged the link to the staff list into the collaborative workspace. He decided to connect to the CF People Finder application to see where the 1997 battlegroup commander was now. Before being given access to the application, his profile was reviewed to see if he should be given access to the sensitive data. This is a relatively new improvement to the People Finder. In the past he would have had to contact ADM(HR-Mil) to gain access to the information. However, in 2005 decided that a more trusted environment was necessary to support operations. To guard against potential abuses, a sophisticated algorithm monitors all accesses to the People Finder and will lock out and report abusers.

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officer from Western Hemisphere Policy, a member of the intelligence staff, a lawyer from Director of International Law and others. He added the list of names to the collaborative workspace.

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The lessons learned library produced some very important lessons. First, he noted that during the 2004 operation, the battlegroup had problems using floppy disks to store data. It turns out that the sand from the island was corrupting the magnetic medium. Their solution was to use Universal Serial Bus (USB) thumb drives in lieu of floppy disks. Next, he discovered that in 1997 there had been a problem with the Status of Forces Agreement (SOFA) for the neighboring country of Cuba. Other issues were also highlighted, all of which were moved to the collaborative workspace and flagged for the Operations Officer’s attention. The SOFA issue was a priority so it triggered an automatic message to the Operations Officer, who reviewed the message and prepared a note to the lawyer identified by the CO as an authority in the area.

It was now 1000 and the CO’s staff college friend sent him an IM. He asked his friend a number of questions about the previous operation. After a few minutes, the CO received an IM from the COS J3 in Ottawa suggesting a Warning Order was being developed and would likely be signed off before noon. The CO parted company with his friend and they agree that if anything else developed they would talk again.

The CO sent an IM inviting COS J3 into the collaborative workspace and he provided an overview of his morning. COS J3 remarked that he did not know how they did it in the old days. He suggested that the CO drive from Kingston to Ottawa for an afternoon how they did it in the old days. He proposed that the CO drive from Kingston to Ottawa for an afternoon and flagged for the Operations Officer’s attention. The SOFA issue was a priority so it triggered an automatic message to the Operations Officer, who reviewed the message and prepared a note to the lawyer identified by the CO as an authority in the area.

At 1120, the CO received a priority message on his cellular phone. The message was from the collaborative workspace and it stated that COS J3 had just uploaded the warning order. The CO signed into his knowledgespace, received the order, added some additional information and forwarded a message to his Operations Officer who knew exactly what to do based on standing operating procedures.

At 1200, he grabbed his tablet PC along with a few other necessities and commenced the drive to Ottawa. At 1315, he was hit head-on by another vehicle and died instantly. At 1400, the COS J3 was notified of the tragic accident. After ensuring that all necessary arrangements were in place to help the CO’s family, the COS J3 returned his attention to the operational mission at hand. Clearly, a new CO had to be appointed as the Prime Minister had just announced that the CF would be dispatching the HERT within 24 hours.

The selection of the new CO was simple. Since 2006, the CF policy had been that all command positions must have identified successors. The nominated successor is informed of their selection and therefore is able to mentally prepare for transition. In this case, the successor was aware of her assumption of command in ten months and she had begun preparing to be a CO.

Knowing that she would be the next CO, she had been thinking about the storm and wondering if HERT would be involved. She had also been thinking what she would do if she were CO. She remembered visiting the HERT in Kingston and being briefed on contingency plans.

The new CO HERT was informed of her new position at 1500. As she lived in Ottawa, she was able to meet with the COS J3 later that day. In the meantime, she was given access to the collaboration space and was able to review her predecessor’s work. She too, knew the battlegroup commander from 2004 and decided to make contact. The two agreed to discuss the impending mission. As soon as they met face-to-face, the CO realised that her friend was uncomfortable about something. Soon he began to describe the details of a tragic incident on the island. The sharing of this experience would turn out to be very important in the days ahead. In fact, the story was so powerful that the CO never forgot the words of wisdom from her friend.

After the operation, during the after-action review, she noted that the war story had saved the lives of several soldiers – that is the power of sharing knowledge.

At 1815, CO HERT met with the COS J3, just 12 hours after her processor first heard about the disaster. She told COS J3 that she was up to speed and ready to go. HERT deployed the next morning. The speed of response for Op SAGE was the result of the COs’ ability to rapidly connect to the data, information and knowledge they needed to make decisions and take actions – this is the essence of knowledge management. This is a story of the synergy of technology, leadership and culture; this is a story of the power of sharing.

About this Story
This is a fictitious story that describes the power of knowledge management in action. It was created with the permission of the managing editor of the Maple Leaf.

For More Information
For more information about using stories to spark organisational change please contact Dr. John Girard (john@johngirard.net).

Please contact Dr. Girard if you wish to distribute this story.

Version Française
Il y a une version française de cette histoire, demandez au Dr. Girard (john@johngirard.net)
Minot State University: Leader in Applied Knowledge Management

Dr. Roderic Hewlett, Dean of Minot State University’s College of Business (www.minotstateu.edu), described “applied Knowledge Management as core business for faculty and students alike.” Dean Hewlett recalled that “in the early days [2004] some people questioned the value of the program; however, four years later, virtually everyone is united in the view that the program has added incredible value.”

Today, most students and faculty are members of at least one community of practice or interest, and students participate in after action reviews, collaborate virtually, and spark change through storytelling. According to Dean Hewlett “the applied aspect of the [KM] program is built on a solid academic foundation. Rather than simply exposing students to the theories of knowledge management, we create an environment in which we all may practice what we preach.”

In addition to offering graduate and undergraduate knowledge management courses, Hewlett stated that “KM learner outcomes are integrated into many courses in the College.” He proudly stated “that our combination of theory and practice provides a world class learning environment, one which is second to none.” Dean Hewlett is confident that MSU continues on page 2

Knowledge Management Modeling Research Continues at GWU

Great Western University’s (GWU) Lead Professor for Knowledge Management (KM) announced that GWU will continue its ground breaking research in knowledge management. A team of researchers will investigate the relationships between leadership, organization, technology, and learning. Early results are expected in the summer or fall of 2009

GWU continues on page 3

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- University review 14
- Personal toolkit 26

This is a fictitious story - to learn about using stories to spark organizational change, please contact Dr. John Girard (john@johngirard.net).
students are benefiting from the College’s profound commitment to knowledge management

“...our combination of theory and practice provides a world class learning environment”

Minot State’s journey toward a knowledge environment commenced in 2003 when Hewlett rallied the Faculty to endorse three themes for the College. Two of the themes were well known at MSU: International Business and Entrepreneurship - in each of these domains MSU was an acknowledged leader, much as is the case today. Hewlett recalls that “The third, knowledge management, was less well understood; nevertheless, the Faculty collectively agreed that the foundations of KM were sound and we agreed that KM should become a College theme.”

Over the next year the College recruited a KM faculty member to take the lead in the development of the core KM program. One the first tasks was to ensure that the team understood the tenets of knowledge management. Hewlett recalled “KM was new to many Faculty. We decided to offer some awareness seminars - these turned out to be very successful and really helped our team understand why it was important to integrate knowledge management into the College’s core curriculum.”

During the awareness seminars the Minot State team agreed on a clear, concise definition for KM. Simply stated, they believe KM is creating and sharing organizational knowledge. Although more than fifty definitions could be found in the literature, the MSU team desired a simple definition to help guide the development of their program.

Unlike many KM programs of the early 2000s, MSU decided not to design a bespoke KM degree, but rather, opted to incorporate the knowledge theories, tools and techniques into all College of Business programs. Although commonplace today, such a novel concept was unheard of only four years ago. MSU’s pioneering efforts are likely the reason this best-practice has been successfully replicated across America.

Time has proven Hewlett correct, as an after-action-review, or AAR in the KM parlance, clearly demonstrated earlier this year. AARs are now routine events at MSU; instructors use the tool to validate learner outcomes, students are encouraged to participate in AARs to improve the quality of programs, and the administration use AARs to ensure programs are meeting the stated goals. For example, the AAR of the KM theme demonstrated conclusively that students, faculty, and the administration were benefitting from the creative project.

KM is creating and sharing organizational knowledge.

Hewlett uses Storytelling as an example of how the applied nature of KM has been incorporated. The College’s core Business Communication Course includes a module on the theory of Storytelling, which is team-taught by two faculty members - one an expert in communications and the other in KM - together they provide a unique combination of experience. But it does not stop there, as students are expected to apply the concept of storytelling in Senior courses, such as the College’s International Management course. Hewlett is convinced that “the blended teaching approach combining the incremental application of tools and techniques is a recipe for success.”

“KM learner outcomes are integrated into many courses in the College.”

When asked what he would do differently, Hewlett paused reflectively, and then stated “I wish we would have started sooner.” Grinning, he continued: “the success of the program makes me wish more folks could have benefitted, had we started in 2003, we would have helped another cohort. That said, I am absolutely delighted with our results.”

The College of Business’ innovative program earned MSU the distinction of being the 2008 MIKE (Most Innovative Knowledge Educator) Award recipient for their outstanding application of knowledge management in an educational environment. When accepting the award, Dean Hewlett offered to share the secrets of their success with others.

About this Story
This is a fictitious story that describes the power of knowledge management in action.

For More Information
For more information about storytelling to spark change in your organization, contact Dr. John Girard:

john@johngirard.net

Use of this Story
The author is a believer in sharing ideas; however, he would like to know who is using his stories. Please contact Dr. Girard if you wish to distribute this story.
Conference a Huge Success

“An overwhelming success” is how Dr. John Girard, the Director of Job Corps Executive Management Program (JCEMP), described the recent JCEMP research conference. “I am absolutely delighted with the quality of research completed by the JCEMP Fellows,” stated Girard. Asked if he was surprised by the quality, Girard grinned and replied “Not at all - I would have been disappointed if the Fellows had not exceeded the standard normally expected of graduate students.” He continued “this was a very motivated group; early in the year they decided to work as a team to ensure all Fellows completed high quality academic research projects.”

Dr. Linda Cresa, Dean of the Graduate School, described the conference “as a huge success,” and said “I hope this [conference] will become an annual event and perhaps even a model for other graduate programs.”

In total twelve JCEMP Fellows presented the results of their research to a panel of College of Business faculty members and Minot business leaders. After each oral presentation the Fellows were subjected to a battery of questions by the panel.

Class of 2006 - The First JCEMP Cohort to Graduate as a Group

For the first time in the history of the Job Corps Executive Management Program (JCEMP) all Fellows graduated as a cohort. The twelve members of the Class of 2005 commenced their journey in June of last year by attending a five-week session here in Minot. All twelve returned to Minot this week for the today’s Commencement ceremony, also a first for the program.

Dr. Gary Ross, Dean of the College of Business, described the milestone “as a tremendous achievement and a testament to the group’s hard work, dedication and commitment.” Ross described the Class as “an exceptional group of individuals that transformed into a high performance team.”

After the Graduation ceremony the Program Director, Dr. John Girard, was seen Job Corps hugging each of the graduates, fulfilling a promise he made if the group graduated together. He commented that “he was very proud of each and every graduate.”

Speaking under the condition of anonymity, a group of graduates reported that the program was “easy peasy lemon squeezy” and that the prawject presentations were the best part of the course eh! Dr. Girard suggested “they were speaking gibberish - obviously a result of stress.”

This is a fictitious story. To learn about using stories to lead people into the future, please contact Dr. John Girard (john@johngirard.net).
Tacit Knowledge Revisited – We Can Still Learn from Polanyi

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Abstract: The field of knowledge management is still relatively new, with all but a few of its related papers and books published during the last 15 years or so. However, one of the most cited sources is a much earlier work on the topic of tacit and explicit knowledge, by Michael Polanyi (1958 and 1966). An examination of some 60 papers from three major knowledge management journals demonstrates that Polanyi's work has frequently been misinterpreted by some authors and further suggests that, in some cases, the citing authors may not have read the cited work. Further, this has led to misinterpretation of Polanyi's work in ways that have affected wider issues in knowledge management. Polanyi's work is still relevant today and a closer examination of his theory that all knowledge has personal and tacit elements, such that knowledge cannot be made fully explicit, can be used to both support and refute a variety of widely held approaches to knowledge management. In particular, it raises issue about the continued efforts to make knowledge explicit through the use of information systems, without consideration of wider social issues, as well as refuting those who use the issue of tacit knowledge to dismiss the field of knowledge management as a misguided concept. It provides support for more recent work on next generation knowledge management.

Keywords: Polanyi, Nonaka, tacit, explicit, next generation KM

1. Key citations in knowledge management

It is reasonable to argue that widespread interest in Knowledge Management (KM) both as an academic subject and as a business issue dates only from the mid-1990s. Early authors such as Stewart, Wiig and Sveiby published their first works around 1990. Serenko and Bontis (2004) found that fewer than 100 papers were written on the topic until 1995, followed by a rapid growth in activity. According to Serenko and Bontis, some 5,000 papers were published on KM and Intellectual Capital (IC) in the period from 1995 to 2002. Given this recent explosion of publication, it is surprising that one of the most cited references in KM papers is not to any of the work published in this 15-year period but to the work of an author from some 50 years ago - Michael Polanyi, a chemist turned philosopher. Specifically, the work thus referenced consists of two books, "Personal Knowledge: Towards a Post-Critical Philosophy" (1958) and "The Tacit Dimension" (1966); the second being a slim volume of essays building on one aspect of knowledge identified in the first, that of "tacit knowledge". Both books expand on ideas first presented by him at the University of Aberdeen, in the Gifford Lectures in 1951-2. Serenko and Bontis (2004) found, in a survey of all citations in three major KM journals (from first publication to the end of 2003), that Polanyi's two works are collectively the second most cited source. The most cited was Nonaka's "Knowledge Creating Company", which, in its two main forms (1991, 1995), was by far the most cited work, along with the very similar "A Dynamic Theory of Organisational Knowledge" (1994). With the exception of three papers (from 1978, 1982 and 1987), every other frequently-cited paper in the top 34 dated from the period 1990-2001. The top 10 citations are shown in Table 1.

Table 1: Top KM/IC publications ranked by number of citations, adapted from Serenko and Bontis (2004)

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<th>Rank</th>
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<th>Author</th>
<th>Year</th>
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<td>1995</td>
<td>202</td>
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<tr>
<td>2</td>
<td>Personal Knowledge</td>
<td>Polanyi</td>
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<td>Polayni</td>
<td>1966</td>
<td>60</td>
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<td>3</td>
<td>Working Knowledge</td>
<td>Davenport and Prusak</td>
<td>1998</td>
<td>58</td>
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<td>1997</td>
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<td>5</td>
<td>The New Organisational Wealth</td>
<td>Sveiby</td>
<td>1997</td>
<td>50</td>
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<td>6</td>
<td>The Fifth Discipline</td>
<td>Senge</td>
<td>1990</td>
<td>42</td>
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<td>7</td>
<td>Intellectual Capital</td>
<td>Edvinsson and Malone</td>
<td>1997</td>
<td>40</td>
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<td>8</td>
<td>Reengineering the Corporation</td>
<td>Hammer and Champy</td>
<td>1993</td>
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<td>Process Innovation</td>
<td>Davenport</td>
<td>1993</td>
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<tr>
<td>9</td>
<td>Organisational Learning and Communities of Practice</td>
<td>Brown and Duiguid</td>
<td>1991</td>
<td>32</td>
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</table>
As an additional support of the significance of Polanyi in the KM field, a simple citation count done on the EBSCO database in late 2004, using the key words "Polanyi and Knowledge" produced 965 links; the same search using "Nonaka and Knowledge" produced 1033. References to Polanyi tend to be mainly in two forms -- either as a general credit as an early and key contributor to the concept of tacit knowledge or as a more specific reference to some variant of a single quotation "We can know more than we can tell." What is less clear is whether, in a number of cases, the authors have actually read the work they are citing and whether the citation, when used, actually supports the authors' argument.

2. Nonaka and Polanyi

The Tacit-Explicit dimension of knowledge is one of the most widely discussed topics in knowledge management. The pivotal work might be seen as Nonaka and Takeuchi (1991), which presents a new description of knowledge in an organisational context. Its essence is that successful innovation comes from the mobilisation and conversion of tacit knowledge through four modes of knowledge conversion -- Socialisation, Externalisation, Combination and Internalisation (the "SECI" model). A subtext to this paper is an argument that a focus on the importance of tacit knowledge is more in tune with Japanese culture and could be seen as a reason for the success of major Japanese companies in the 1980s. It is in this paper that Polanyi's famous quote "We can know more than we can tell" is first given wide circulation. Nonaka has expanded on his interpretation of Polanyi (for example in Nonaka, 2004) and, in a crucial argument, makes the leap from "at a fundamental level knowledge is created by individuals" to "organisational knowledge creation in a corporate organisational setting" (2004, page 21). As stated in Nonaka and Takeuchi (1995), they derive "a new theory of organisational knowledge creation with an epistemological dimension of "tacit-explicit knowledge" and an ontological dimension of knowledge levels (individual/group/organisation/inter-organisation). Thus, Nonaka and his co-authors have taken Polanyi's work on "personal" knowledge and extended it to a new field of "corporate" or organisational knowledge.

3. Research questions

The genesis of this paper came from the author's growing personal concern that emerged in reading through the KM literature, following an examination of Polanyi's work. Specifically, while many theories of knowledge management start with some view on tacit/explicit knowledge and a large number of the papers and articles cite Polanyi as the source of this concept, there seemed to be little consistency in the use of his work. Indeed, given that it could be argued that current interest in Polanyi stems largely from Nonaka's use of Polanyi in developing his work through the Knowledge Creation Cycle, a cynic might be excused for thinking that some of the authors did not in fact actually read Polanyi but, more simply, re-presented what Nonaka reported, while still citing Polanyi as the reference. Since the tacit/explicit dimension is the root of much work in the field, has been used to justify major projects and has even been used by some to argue that explicit knowledge is not really knowledge at all, this seems worthy of further investigation. Thus, the objective of this paper is to reflect on the use of Polanyi and to consider three questions:

- Does the body of recent KM literature citing Polanyi accurately reflect the concepts presented by Polanyi in his two key works?
- If the answer to Q1 is no, then what implications does this have for the interpretation and use of his work?
- Given that Polanyi did his work some 50 years ago, can a deeper look at his work and its use shed a light on current challenges in KM?

4. Methodology

4.1 Review of polanyi's work

This review concentrated on his two books (1958, 1966). Each was reread and all references to tacit/explicit knowledge noted, and a summary of his related arguments was prepared.

4.2 Initial citation review

Using the same 3 journals as Serenko and Bontis (2004) -- "Journal of Intellectual Capital", "Journal of Knowledge Management" and "Knowledge and Process Management" -- all papers that cited Polanyi, between the initial publication of each journal and early 2006 were examined, some 60 in total. Each paper was examined to determine the degree of reference to Polanyi's work and whether there was evidence to suggest whether the original work had been read.

4.3 General literature review

A more general literature review was then carried out to examine the use of the tacit knowledge concept in knowledge management theory. Of necessity, since the topic is so widely referenced, this review was fairly selective.
4.4 Integration of findings
The findings from both the citation analysis and the more general literature review were then integrated, along with a re-visit examination of Polanyi’s work to position the findings in a framework and develop some responses to the research questions.

4.5 Identifying broader considerations
Finally, some conclusions were developed looking at the broader implications for the use and misuse of Polanyi’s concepts.

5. Analysis

5.1 Polanyi’s work on knowledge
Michael Polanyi was a leading chemist who became disenchanted with the scientists’ view of knowledge. Along with others in the early 20th century, he saw the weaknesses inherent in the scientific method and moved towards a more post-modernist view. As he says in his introduction to his major work, “Personal Knowledge” (1958), “The purpose of this book is to show that complete objectivity as usually attributed to the exact sciences is a delusion and is in fact a false ideal.” He does so, in part, by examining how individuals gain knowledge and share it, arguing that knowledge is highly personal and questioning the commonly held view of the dispassionate objective scientist, saying, “Into every act of knowing there enters a passionate contribution of the person knowing what is being known and that this coefficient is no mere imperfection but a vital component of his knowledge.” "Personal Knowledge," (1958) is a broad-ranging philosophical book examining the nature of scientific research and the nature of knowledge. He speaks much more of "knowing" rather than of "knowledge" and roots much of his argument on the role of language in communicating knowledge. While suggesting that language is a vital tool we can use to share knowledge, he also emphasises that we can often know how to do things without either knowing or being able to articulate to others why what we do works.

He distinguishes skills and how we learn them from knowledge. “The aim of a skilful performance is achieved by the observance of a set of rules which are not known to the person following them.” One of his examples is that of riding a bicycle (made possible by the offsetting of centrifugal and gravitational force) and has been widely used (but not normally referenced) by others as an example of tacit knowledge. But he does not say, as some suggest, that this tacit knowledge can’t be transferred. Rather he suggests that some types of knowledge have limited capability for transfer. “Art which cannot be specified in detail cannot be transferred by prescription, since no prescription for it exists. It can be passed on only by example from master to apprentice. This restricts the range of diffusion to that of personal contacts.” (Polanyi, 1958) He sets some elements of this in terms of Gestalt psychology and suggests two kinds of awareness — subsidiary awareness and focal awareness — we can achieve some wider objective by the use of a proximate device such as a tool (he gives the example of hammer and nail, others might think of a golf club and ball with the objective of putting the ball in a distant hole). Skilful individuals can focus on the overall objective; less skilled ones pay more attention to the proximate device (the subsidiary awareness).

He then extends this discussion to point out that “our beliefs are anchored in ourselves.” We have a whole set of presuppositions (to be distinguished from specific assertions) and we have no clear understanding of what these are and would find it difficult to express them. Mostly, we have assimilated these beliefs through learning and using specific language and by being part of specific societal groups. Some we learn (hitting the nail or golf ball) as bodily-learned skills, others we learn by using language, still others come from our experience in given situations. But there are key constraints to the use of language. To Polanyi, using a word confidently implies an acceptance of a meaning of that word to both speaker and listener. There is an underlying tacit element of confidence that the word will be understood. Thus, it is not “words that have meaning, but the speaker or listener who means something by them.” When we assert something this is both a statement and a tacit act. Belief is the source of all knowledge -- requiring tacit assent, intellectual passion, shared idioms and cultural heritage, affiliation to a like-minded community.

To him, there is not an either/or between tacit and explicit knowledge. It is not something amenable to conversion. But it can be transferred and made more explicit in certain circumstances. Indeed, for him, ALL knowledge has a tacit component. He discusses the process by which “the tacit cooperates with the explicit, the personal with the formal” (Polanyi, 1958, p 87). Further, tacitness is something personal, an ability or skill to do something or to resolve a problem that is based, in part, on one’s own experiences and learning. With the appropriate use of language, much, perhaps most, but probably not all, of this knowledge can be shared between individuals.
who share a mutually agreed language. When the tacitness predominates so that articulation is not possible, he calls this "ineffable" knowledge. (e.g. Ask Tiger Woods how he hits his golf shots.) “For just as, owing to the ultimately tacit nature of all our knowledge, we remain ever unable to say all that we know, so also, in view of the tacit character of meaning, we can never quite know what is implied in what we say” (Polanyi, 1958, p 95). This is rather more complex than the extensively used quote from "The Tacit Dimension" (1966), which is little more than an introductory remark on page 4 of the book, which more fully stated, says "I shall reconsider human knowledge by starting from the fact that we can know more than we can tell." He also points out that, in any "hierarchy" of knowledge, the higher levels cannot simply be derived from the lower levels but require additional context to be understood. This provides a complement to the often-used DIKW model, developed by (but frequently not cited as) Ackoff (1989).

5.2 Initial citation review

52 papers that cited Polanyi as a source were examined from the three journals examined by Serenko and Bontis, drawn from every issue from the foundation of each journal to early 2006. First, the use of Polanyi was assessed at one of three levels -- simple reference, some use of the concept, more significant discussion. Next, in any case where the content and context made it possible, a subjective assessment was made of whether the use did, in fact, correspond to Polanyi's work and whether there was evidence to support whether the author had read the original or not. The results were classified as "clearly read", "unlikely to have read, or "can't tell in the context." (For example, it is unlikely that anyone who had read either of Polanyi's works, even superficially, would cite Polanyi as the source of an either/or categorisation of tacit/explicit knowledge or use a common misquote, where the "can" is missed out from the "We can know more than we can tell." Indeed, it is difficult to understand why any author would cite the later work (Polanyi, 1966) as a source of the tacit/explicit distinction, since the book focuses on the implications of "the tacit dimension" and makes no significant mention of explicit knowledge.) Similarly, it might be argued that for several of these examples, there were many other elements of Polanyi's work that might have been better used to support the authors' thesis. The results are presented in Table 2.

This (somewhat subjective) analysis suggests that only about one third of the papers demonstrated clearly that Polanyi's work had been read and almost half (42%) were unlikely to have read it, based on their use of the related concepts. Further, some 23% seem to significantly misrepresent Polanyi's work. Typical misinterpretations include:

- The most frequent occurrence is the suggestion that Polanyi identifies two types of knowledge --tacit and explicit -- and that this is an either/or state. This is really in direct contradiction to his view that all knowledge has a tacit element and that the degree of tacitness varies.
- The suggestion that Polanyi was writing about knowledge in a corporate or organisational context.
- That it is impossible to convert tacit knowledge to explicit knowledge.
- That tacit knowledge is embedded in corporate processes and routines.
- That tacit knowledge is the same as implicit knowledge.
- That explicit knowledge is the same as information.
- That explicit knowledge can be expressed in computer systems.

Table 2: Analysis of 52 papers citing Polanyi's work in three KM journals

<table>
<thead>
<tr>
<th>ASSESSMENT</th>
<th>Significant</th>
<th>Some</th>
<th>Simple Ref</th>
<th>In Total</th>
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<tbody>
<tr>
<td>Number of Papers</td>
<td>16</td>
<td>12</td>
<td>24</td>
<td>52</td>
</tr>
<tr>
<td>Clearly read it</td>
<td>69%</td>
<td>8%</td>
<td>29%</td>
<td>37%</td>
</tr>
<tr>
<td>Unlikely to have read it</td>
<td>25%</td>
<td>42%</td>
<td>54%</td>
<td>42%</td>
</tr>
<tr>
<td>Can't tell in the context</td>
<td>6%</td>
<td>50%</td>
<td>17%</td>
<td>21%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Misinterpretation</td>
<td>25%</td>
<td>42%</td>
<td>13%</td>
<td>23%</td>
</tr>
</tbody>
</table>
6. Discussion

Building on the preceding analysis, responses to the three research questions are presented below.

Question 1: Does the body of recent KM literature citing Polanyi accurately reflect the concepts presented by Polanyi in his two key works? There are two quite distinct conclusions that can be drawn for this question. The first relates to the rigour expected of a researcher in social and business research. As Remenyi et al (1998) put it in their advice to doctoral researchers, "Related to plagiarism, but not quite of the same severity, is the issue of quoting an authority without having read the original reference, but rather having seen it published in someone else's work. It is considered unacceptable to do this. However, it is acceptable to use the 'cited by' approach." This analysis of the use of a single reference source suggests that, for this early authority in KM, a very significant proportion of those citing the reference (perhaps over half) have done so without reading the original, but have used content from another intermediate author, without using the "cited by" approach. This might be viewed as raising some questions about the responsibility of paper reviewers, however the primary role of the reviewer is not to validate the use of references. Interestingly this issue has been raised in other fields. For example, Simkin and Roychowdhury ("Read before you cite!" 2002, as cited in Muir, 2002), by examining misprints in 4300 citations of a 1973 paper on the structure of crystals, estimated that only about 20% of the authors had actually read the cited article. Not only does this raise questions about the quality of research papers, it also brings into question the relevance of citation counts as a method for determining the value of specific works.

The second conclusion, perhaps more important to KM researchers, is that the failure to read the original can lead to misinterpretation and, as Muir (ibid) suggests, "when misconceptions take root, they spread like weeds." In this review, limited to 52 papers in 3 journals, more than 20% of the papers present significant misconceptions on Polanyi's work on tacit knowledge. (Note: Of the 52 papers analyzed, almost half had little direct discussion on tacit knowledge, so the misconceptions really affected more than 40% of the relevant papers.)

Question 2. If the answer to Q1 is "no", then what implications does this have for the interpretation and use of his work? This brings us to the broader "so what?" question. Is the first finding simply a comment on the sloppiness of (some) researchers or does it have wider significance to researchers and practitioners in KM? The examination of the ideas attributed to Polanyi in a number of the papers revealed some significant misrepresentations, as discussed above. So Polanyi is being used as an authority to support a wide range of concepts that are quite at odds with his work. When we look beyond the 52 papers reviewed in the initial citation review, further examples can be seen. A brief review of some 30 additional papers from a variety of sources was broadly consistent with the 52 papers examined in depth.

Question 3. Given that Polanyi did his work some 50 years ago, can a deeper look at his work and its use shed a light on current challenges in KM? Building on the discussion in the last section, we can now look at the current relevance of Polanyi's work. The concept of tacit and explicit knowledge as expressed by Polanyi (primarily from pp 87-101, Polanyi, 1958) can be represented as a diagram, shown in Figure 1.

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**Figure 1:** The Tacit/Explicit Dimension, derived from Polanyi (1956, 1966)
This shows Polanyi's basic precept that, to some degree, all knowledge includes a degree of tacitness and we are looking at a continuum in which one or the other may have dominance. The continuum ranges from a situation where there is little tacitness to the knowledge, and it might be widely held by many with a limited background experience; through a situation where experts can share the tacit knowledge given their common background, specialised training and experience; to the situation where there is a strong personal element to the knowledge, that is very difficult to express; and, finally reaching the point that it is impossible to articulate the knowledge ("ineffable" knowledge). The degree of explicitness can be closely tied to the use of language. Where there is a high degree of acceptance on the use and specificity of the language used (spoken, written, represented) the knowledge can be highly explicit to most. Where a more sophisticated level of knowledge and experience is needed for the language to have meaning, the level of shared tacitness increases. It is in this last area that we might position the concept of "implicit" knowledge, a concept not discussed by Polanyi but often offered as an alternative to tacit knowledge. This model suggests that implicit knowledge might be described as tacit knowledge that could be made explicit but need not be, in a community that shares a common view of the necessary tacit knowledge.

7. The value of revisiting Polanyi's work in current research

So if we accept that many authors root (at least the beginnings of) their theories on tacit/explicit knowledge in Polanyi's work, what does this fuller review of his work suggest? A rejection of the either/or view of tacit/explicit knowledge: First, Polanyi's view of knowledge as a continuum between tacit and explicit raises questions on the validity of the two extremes of the tacit/explicit debate. At one end we get the claim that all knowledge is tacit and that explicit knowledge is just information (for example, see Wilson, 2002). At the other, we get the view held by many in the "Technocratic" school described by Earl (2001) and proposed by authors such as Davenport and Prusak (1998), who suggest that converting tacit to explicit knowledge (codification) is a key objective for KM and can be done largely by using information systems -- which remove the tacitness. It supports a more "social" view of knowledge: Alternatively, it provides support for those who argue for the social elements of knowledge. For example, the Communities of Practice approach, proposed by Wenger (1998) and others has a fairly obvious similarity to the part of the model identified as "explicit to experts" often through an implicit shared understanding.

It also suggests a need to revisit Nonaka's work more critically: It is also interesting to revisit Nonaka's work in this context. Given Nonaka's position as the most referenced author, who credits Polanyi as a key source on whose work he builds, there is certainly the possibility that, as we often find the two referenced together, that authors simply repeat Nonaka's reference to Polanyi, without looking at the source. Most uses of Nonaka's work in the KM literature focus on his SECI model, which describes how tacit becomes explicit and then leads to new tacit knowledge, in a corporate setting. However, an associated theory of Nonaka's -- that of "ba" is much less frequently referenced, but may have equal or greater importance. Nonaka (1998) proposes the creation of environments suitable for the support of knowledge creation, by taking the concept of ba proposed by the Japanese philosopher Kitaro Nishida and adapting it to a knowledge concept. For Nonaka, ba is "a shared space for emerging relationships." This space can be physical (e.g. office, dispersed business space), virtual (e.g. email, teleconference), mental (shared experiences, ideas, ideals) or any combination of them. In short, ba is a shared space that serves as a foundation for knowledge creation. He describes several types of ba that correspond to the stages of his SECI model. There would seem to be a solid argument to associate this idea of space creation with Polanyi's view of how individuals and groups develop the relationships, trust and agreement that allow complex knowledge to be shared.

In this context it is worthwhile to note that, while Nonaka's "corporitisation" of the tacit/explicit knowledge concept is quite explicitly stated in his work, it is often not mentioned by other authors. Since variations of his work have been used as support for the widespread use of IT to convert knowledge from tacit to explicit, often with very limited success (see Grant and Qureshi, 2006), we might suggest that it has quite negative effects in many organisations. Indeed this raises the wider question that, while we often cite Nonaka, there has been little effort to validate his theory (Gourlay, 2004). It provide support to some of the views of "Next Generation" Knowledge Management: Further, it can be used to support some of the assertions made by the proponents of "Next Generation Knowledge Management" (NGKM), such as McElroy (2003), Snowden (2002) and Wiig (2004), including the failure of IT to deliver expected results in KM, the limited usefulness of some of the models being used, insufficient focus on the ways to create "new"
knowledge and the highly personal and social nature of knowledge.

8. Conclusions

Three significant conclusions can be drawn from this work. The first is some confirmation of the commonly held view that authors can be sloppy in their research and frequently cite work which they have not read, relying on someone else’s interpretation of that work. Further this is more than a simple comment on research procedures, since it can lead to the misinterpretation of the original work and propagation of these misinterpretations. Secondly, in the specific case of Polanyi’s work, this paper has shown that this misinterpretation can cause authors to erroneously claim Polanyi as a key support to theories that are not consistent with his work. Indeed, it could be argued that this has been a contributory factor to major problems in both research and practice, through the adoption of an overly simplistic view of the tacit/explicit dimension and significant failures in practice, especially in IT-related projects. Finally, it seems we can still learn from Polanyi. Fuller examination of his work can be used to raise questions about some approaches to knowledge management, especially those of the Technocratic School. Indeed his work could be used to help explain many of the weaknesses of "First Generation Knowledge Management", that have been widely discussed in the last couple of years. In fact, when examining the work of various proponents of “Next Generation Knowledge Management” Polanyi’s theory of the tacit/explicit dimension could be useful in supporting and explaining some of the theories being proposed.

9. Limitations and further work

This paper is a first effort in a complex area. Some questions might be raised on the sampling technique. The examination of some 60 papers from leading journals is likely a reasonable first step in examining how Polanyi’s work is being used, but a wider review could well change some of these initial findings. Further, the papers were simply analyzed by inspection. No sophisticated methods of text or discourse analysis were used and the work is therefore subject to the opinions of the author in interpreting whether Polanyi’s work was accurately cited and used. (Indeed, as Polanyi might say, this is a personal "recognition of an orderly pattern" of misuse). A wider ranging literature review is in process to examine this issue in more depth. Each of the conclusions is worthy of revision in more detail and further research planned will look at the impact that the misinterpretation of Polanyi’s concepts might have had on specific IT KM projects. In addition more theoretic work will look at how the emerging view of NGKM could be helped by reference back to Polanyi’s theory.

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Intellectual Capital Management as Part of Knowledge Management Initiatives at Institutions of Higher Learning

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Abstract: Aspects such as human capital, structural capital and customer capital are important variables of the whole intellectual capital management programme, which forms part of the knowledge management initiatives of institutes of higher learning. The skills and expertise of university staff as part of its human capital are discussed. Structural capital will encompass aspects such as the role of innovation and intellectual property rights. Customer capital of the university and the knowledge of stakeholders in the field of tertiary education are becoming more important. The results of a study done at a South African university are used to indicate which of these aspects needs to be measured and a new framework for measurement and management of IC is discussed.

Keywords: knowledge management, intellectual capital management, higher education

1. Background

Bringing intellectual capital, knowledge management and enabling technologies together is an exciting challenge to leaders wishing to create an information age institution. When a university becomes a learning organisation with shared vision and shared institutional awareness, with participation by all, a dynamic interactive environment emerges where the lines between teaching and learning, and education and training, are blurred and lifelong education is the norm (Childs 2001). In view of the realities of the present funding system in higher education and the need to exploit alternative forms of income, specifically the “third money stream” (where funds are earned from other sources than students and government). South African higher educational institutions will be required to exploit their intellectual property rights to a far higher level than has been the case in the past. South African industry will, likewise, have to realise that research results emanating from tertiary educational institutions are no longer regarded as being in the public domain, to be exploited free of charge. Institutions themselves will have to implement

- Measures to protect, safeguard and market the intellectual property produced by staff and students; and
- Policies to ensure that all participants share in the income derived from intellectual property on a basis that is fair, equitable and of a nature that encourages disclosure of inventions and discoveries.

Universities are under an obligation to strike a balance between their obligations internally to their employee and student inventors, and externally to their potential commercial partners. The latter could be business organisations, government and semi-government departments, or statutory organisations. As an employer the university is bound to be fair and reasonable in its dealings with its employees. A complication is the fact that it is also a guardian of the welfare of its students, assuming an in loco parentis role. On the other hand, a university must be accountable and prudent (especially with regard to state subsidies), and commercially astute and realistic (particularly when dealing with the corporate world). The greatest challenge is to strike a balance between these very different considerations to ensure that, ultimately, the university stays true to its ideal of searching for truth and knowledge in the spirit of academic freedom, and to applying such knowledge to the benefit of mankind. The question thus arises how universities can manage and measure intellectual capital as part of their knowledge management initiatives. To address this question the following issues will be discussed:

- The role of knowledge management at institutions of higher learning
- Intellectual capital
- Existing frameworks for managing Intellectual capital
- Existing models for measuring Intellectual capital
- Models that may be applied to South African Universities and the variables that should be included in a proposed framework for intellectual capital management at these universities.

2. The role of knowledge management at institutions of higher learning?

For the best part of four decades it has been a dictum among economists that developing countries should target national investment at the basic education level since this offers the highest
social returns. The orthodoxy has been eloquently challenged in a recent World Bank study (2003) that argues for new investment in higher education. This asserts that participation in the Knowledge Economy requires the ability to renew economic and social systems constantly; to extend knowledge and specialist skills; to engage effectively in knowledge production and a higher education system; to be socially responsive; to be in close contact with industry; and to produce top quality graduates (Asmal 2000). The development of academic research capacities carries within itself the seeds of future economic and social development in the form of human capital, tacit knowledge and intellectual property. Channelling knowledge flows into new sources of technological innovation has become an academic task, changing the structure and function of the university. Realisation of the benefits of this potential resource occurs through organisational innovations such as technology transfer offices, incubator facilities and research centres with industrial participation. The change in emphasis from sole concentration on the production and dissemination of knowledge to technology transfer and the formation of firms places the university in a new alignment with the productive sector (Etzkowitz and Leydesdorff 1997:1).

The cultural functions of teaching and research have been the primary function of universities, whereas the human capital function of preparing trained persons has played a secondary role. In the late twentieth century, universities received attention for their inputs to economic and social development. This is not an entirely new phenomenon: academic institutions contributed to agricultural innovation during the Experiment Station movement of the mid-nineteenth century in the USA and were instrumental in the foundation of the chemical industry in Germany during the same period. Nevertheless, the advancement of knowledge was formerly primarily the concern of the university, whereas capitalisation of knowledge was the concern of industry. However, the growing interest of the university and its faculty members, often encouraged by government policies, in reaping capital from knowledge is moving academic institutions closer in spirit to the corporation, a type of organisation whose interest in knowledge has always been closely tied to economic utility (Etzkowitz 1997:141).

Knowledge management is often seen as an alternative to, or complementing, other organisational initiatives such as the Total Quality Management (TQM) and Business Process Re-engineering (BPR) programmes of the 1980s (Newman, 1996). The view that knowledge management is vital to achieving business success is a general theme in literature on the subject. Sveiby (2001) defines knowledge management as "the art of creating value from an organisation's intangible assets". Prusak (1996:6) said: "The only thing that gives an organisation a competitive edge… is what it knows, how it uses what it knows, and how fast it can know something new." In other words, how it applies knowledge management. For Koulopoulos (1997), knowledge management is "rooted in the idea that mobilising an enterprise's intellectual resources is essential in breaking free from the enterprise's rigidly held … suppositions about its competitive touchstones… exposing it to compete based on Y

3. Intellectual capital

It may be said that intellectual capital deals with articulate, reasonable, knowledgeable and substantial fruits of the mind. It claims intangible (tacit) and tangible (explicit) dimensions, which do not mutually exclude, but actually complement each other. The conversion of knowledge into a valuable asset has come to be known as an intellectual asset or intellectual capital. In 1994, Klein and Prusak forwarded what has become to be the standard definition of intellectual capital, popularised by Stewart in Fortune magazine (1994) and in his book Intellectual capital: the new wealth of organisations (Stewart 1997). According to Klein and Prusak (1994), one can define intellectual capital operationally as intellectual material that has been formalised, captured and leveraged to produce a higher valued asset. While many authors use the terms "intellectual asset" and "intellectual capital" interchangeably, there are subtle differences between the meanings of the two. In balance sheet terms, intellectual assets are those knowledge-based items that the organisation owns that will produce a future stream of benefits for the organisation. They are the "debits" or individual items that comprise intellectual assets on the balance sheet, whereas intellectual capital is the total stock of balancing "capital" or knowledge-based equity ("credits") that the organisation possesses. Ideally, the total value of intellectual assets should be equal to the total intellectual capital (Lynn 1998). The distinction between the terms is subtle but not unimportant. Intellectual assets are often intangible assets. They do not have a hard shape like property, for example, or plants and equipment, nor do they have obvious financial value, as do receivables and short-term investments. Indeed, intellectual assets have been characterised as hidden assets because they are sometimes difficult to identify and to assign an economic value to. One way that has
been used to uncover and derive the value of this hidden, intangible intellectual capital is to compare the market value of stock to its book value. In fact, the difference between a firm’s market value and the replacement value of its physical and financial assets has been used as a definition of intellectual capital. This market premium has also been used to measure Intellectual capital.

3.1 Elements of Intellectual capital

Many practitioners suggest that Intellectual capital consists of three elements. [See for example Sveiby (1997), Saint Onge (1996), and Bontis (1998).]

- Human capital, which includes experience, the know-how, capabilities, skills, and expertise of the human members of the organisation
- Structural capital (or organisational capital), which includes the systems, networks, policies, culture, distribution channels, and other “organisational capabilities” developed to meet market requirements as well as intellectual property
- Relational (customer) capital, which includes the connections that people outside the organisation have with it, their loyalty, the market share, the level of back orders, and similar issues.

3.2 Models for managing Intellectual capital

Various models exist for managing intellectual capital. Some of the most well-known models are Sullivan’s Model (Van den Berg 2002); the Skandia Intellectual Capital Value Scheme (Roos, Roos, Dragonetti and Edvinsson 1997); the Brooking’s Model (Brooking 1996); Roos and Roos’s Categorisation (Roos and Roos 1997); St Onge’s Model (Westberg and Sullivan 1998:71); Sveiby’s Model (Sveiby 1997); and Wiig’s Model (Wiig 1997). For the purpose of this study, only the Skandia Intellectual Capital Value Scheme will be discussed.

3.2.1 Skandia intellectual capital value scheme

Leif Edvinsson is widely acknowledged as one of the world’s leading experts on intellectual capital. He was appointed as the first Director of Intellectual capital at Skandia, an internationally operating Swedish insurance company. Skandia propagated an alternative taxonomy. Thus, Edvinsson’s approach seems to be motivated by a practical orientation, similar to that of Saint-Onge. Edvinsson considers intellectual capital primarily as the hidden values constituting the gap between market value and book value. Hence the equation

\[ \text{Market value} = \text{Book value} + \text{Intellectual capital} \]

In 1992, when Skandia started stock-taking of the hidden values of intellectual capital, a list consisting of more than 50 valuable items such as trade marks, concessions, customer databases, IT systems, or key persons was compiled. Since the list was perceived as too long and unmanageable, items had to be grouped into fewer but decisive categories, the human dimensions, and the structural dimension, which led to a simplified definition of intellectual capital:

\[ \text{Intellectual capital} = \text{Human capital} + \text{Structural capital} \]

The dimensions that are “left behind when the staff has gone home,” according to Edvinsson (Roos et.al. 1997), are referred to as structural capital. He emphasised the fact that human capital cannot be owned, it can only be rented. Structural capital, on the other hand, may be owned or traded from a shareholder’s point of view. Skandia then create an initial model for defining the different categories of intellectual capital (Figure 1). In this model, market value is divided into financial capital and intellectual capital. The latter is further subdivided into human capital and structural capital. Structural capital encompasses customer capital and organisational capital, and the latter encompasses process capital and innovation capital. However, at Skandia Edvinsson provided a more detailed perspective and divided organisational capital further into two additional building blocks. Within organisational capital the value of process capital (intangible assets) could be deducted, resulting in innovation capital (intellectual property) as the balancing item. The model is illustrated by using the following constituent parts:
3.3 Intellectual capital management at institutions of higher learning

It became clear that intellectual capital is by definition intangible and that the only possible measurements are proxy variables, or indicators. These indicators are expressed in the most diverse units of measurement (Roos et. al. 1997:78). In the next section, existing measurement models, and how they can be used in compiling a new model for implementation at institutions of higher education will be discussed.

4. Existing frameworks for measuring Intellectual capital

Models, frameworks and methodologies for measuring knowledge assets and intellectual capital exist in the domains of accounting, economics, human resource accounting and intellectual property. Such models have focused at the firm level analysis with an accounting, economic, or strategic focus. None of these have been applied in the public sector or, more specifically, in the tertiary environment. The objective of this section is to determine what can be learned from the available frameworks/models and how their key components may be adapted to measure intellectual capital management practices at tertiary institutions.

According to Edvinsson (2002:7), intellectual capital management is not a management technique but rather a fundamental approach to the management of resources and assets in an organisation. Klein (1998) therefore states that institutions that adopt a strategic approach to the management of their intellectual capital see this as an opportunity to enhance their market position. Brennan and Connell (2000:213) support this view and state that successful organisations manage their intellectual capital better than the less successful firms. This may also be true for institutions of higher learning.

Institutions of higher learning that manage their intellectual capital effectively are strategically focused on managing the following aspects:

- Human capital management and measurement
- Intellectual capital asset systems and competitive technology assessments
- Intellectual property systems.

Intellectual capital is of substantial and growing importance in innovation and productivity growth, organisational competitiveness and economic performance. Intellectual capital, which may include aspects such as R&D, human resources, organisational structure and processes, and customer relations, is often poorly identified and measured. Information on intellectual assets is collected in widely different ways, and financial accounting and reporting practices generally fail to recognise these assets. Where this information is available, it is ad hoc, difficult to verify, and not comparable across the
institution. The gaps in transparent, reliable and accurate information interfere with the effective management of intellectual capital, and between intellectual and other forms of capital (OECD 1996).

According to Lank (1997:408), the interest in intangible assets provides an opportunity to develop new and creative business measures that are much more likely to be indicators of future business success than the traditional snapshot of historically focused measures. Institutions may use information on intellectual assets in various management processes. Consequently, the growth and decline of intellectual capital in an institution is increasingly interpreted as an early warning system of subsequent financial performance. Thus it is important that appropriate measures of performance, other than balance sheets, are developed (Roos and Roos 1997:417).

Leibowitz and Wright (1999:99) are of the opinion that there are two schools of thought with regard to measuring knowledge assets. Researchers try to find appropriate metric ways to measure knowledge or they look for indicators of knowledge because knowledge in itself cannot be measured. They support the latter way of thinking since they believe that only the outcomes of knowledge activities can be measured. According to Roos and Roos (1997), one of the aspects of managing intellectual capital is measuring it. The vehicle for measuring this performance is the set of indicators used for each intellectual capital category. As these indicators permit measurement, it is important to investigate these models further.

4.1 **Classification of Intellectual capital measurement models**

According to Sveiby (2004) and Malhotra (2003), there are four basic methods to classify measurement models for intellectual capital:

- **Market capitalisation method** – The difference between market capitalisation and stockholders’ equity is calculated.
- **Return on assets method** – Tangible assets and the annual financial figures are compared to the industry average. Above-average earnings are then used to estimate the value of intangible assets.
- **Direct intellectual capital method** – Components are identified and valued.
- **Scorecard method** – Various components of intellectual capital are identified and reflected in terms of scorecards and graphs.

4.1.1 **Market capitalisation method**

In the market capitalisation method intellectual capital is computed as the difference between the firm’s market capitalisation and stockholder equity. This method is useful for illustrating the financial value of intellectual capital and for inter-firm benchmarking within the same industry. One of the disadvantages of this method is that it does not provide information on the components contributing to intellectual capital. The exclusive monetary focus provides only a partial perspective, which is not suitable for the holistic socio-economic and human development approaches often sought by an organisation (Malhotra 2003:12).

4.1.2 **Return on assets method**

With the return-on-assets (ROA) method, the ROA is computed by dividing the pre-tax earnings of the firm by the average tangible asset and then comparing the result with the industry average. The difference is then multiplied by the organisation’s average tangible asset to calculate an annual earning from the intangibles. Dividing this average earning by the organisations’ average cost of capital or an interest rate gives the value of the organisation’s intellectual capital (Malhotra 2003:12).

Malhotra (2003:12) is of the opinion that this model is not very relevant to government and public sector organisations, it is of relevance for industry benchmarking and for illustrating the financial value of intellectual capital. Because it is built on traditional accounting rules it is easily communicated between accountants. The disadvantage of this model is it does not contain information about the components that contribute to intellectual capital. It also has an exclusively monetary focus and is unsuitable for holistic socio-economic and human development approaches.

4.1.3 **Direct intellectual capital measurement model**

With the direct intellectual capital measurement model the monetary value of the intangible assets is estimated by identifying the various components. This model may be used in conjunction with the scorecard method, as it has limited use for assessing and analysing specific aspects of intellectual capital. If it is used to derive standard indicators, these standards must be valid and reliable.

This model allows for the valuation of separate components of intellectual capital. It also allows for combinations of monetary and non-monetary
valuations. The model provides a comprehensive overview of all the intellectual capital in the organisation. It is event-based and therefore better for relating cause-and-effect compared to financial metrics. The biggest disadvantage is that it is difficult to compare and benchmark (Malhotra 2003:10).

4.1.4 Scorecard model
In the scorecard model various components of intangible assets or intellectual capital is identified and indicators and indices are generated and reported in scorecards. Composite indices based upon the synthesis of all components of intellectual capital can be created. This model allows for measurement closer to actual inputs, processes, and outcomes. Reporting can therefore be faster. It is also particularly suitable for detection and correction of errors in aligning inputs and processes with the outputs and outcomes. The indicators capture contextual nuances, which result in rich data analyses that can provide useful insights for policy making. However, contextual influences that facilitate more corrective policy responses make comparison across different contexts somewhat challenging (Malhotra 2003:10). The scorecard model is one of the most widely used models in knowledge management.

This model is also the most applicable for measuring the intellectual capital of institutions of higher learning. It measures currently unmeasured intangible assets. An adaptation of the Skandia Navigator and the Skandia Value Scheme seems to be the most appropriate for this study as the scheme focuses on the present, past and future of an organisation. Although the past of the organisation (financial reporting) is not relevant to this study, it will be a major component of future reporting by the university, as the financial willingness to increase intellectual capital will be directly influence by the availability of financial resources. With the Skandia Navigator the different areas that comprise intellectual capital are placed within the same framework as financial capital.

5. A South African case study: variables for measurement
A framework for measuring the success of reaching organisation goals through the management of intellectual capital was developed for the former Rand Afrikaans University (RAU), Johannesburg, South Africa (now known as the University of Johannesburg). If RAU is placed within the context of its intellectual capital and its intention to grow and increase this intellectual capital, the following may be said about the institution (RAU 2000b):

Human capital: RAU prides itself on striving to equip men and women to make an impact on the South African labour market. The University caters for the needs of employees from various walks of life in order to address all the needs of the employee. The University strives to ensure that all training is focused on “training for competence.” Training helps employees to attain the necessary knowledge and skills to perform their tasks according to required standards without undue fatigue, preferably within the shortest possible time and with the minimum use of training resources. In order to reach its goals RAU places a high premium on research and staff members are encouraged to engage in relevant quality research.

Structural capital: The University is structured into six faculties, viz. Arts, Natural Sciences, Law, Economic and Management Sciences, Education and Nursing, and Engineering. The major infrastructural support system for teaching and research activities at the University includes the traditional facilities such as the library, information technology, and laboratories.

Customer capital: The University places its resources at the disposal of external stakeholders who can benefit from its expertise and is involved in various community development initiatives and outreach programmes. This is based on the principle that university teaching comprises a dynamic interaction between lecture halls, laboratories and society. The emphasis is on sustainable, holistic development, which is beneficial not only to the current communities, but will also serve as a heritage for future communities.

With this in mind, certain variables, which need to be measured, can be identified. These indicators should have the following characteristics:

- They must promote a visualisation that allows actions to be translated into a system of indicators.
- They must have an array of indicators that describe the University’s value creation process.
- They must include indicators from all three components of intellectual capital.
- They may contain a mix of financial and non-financial indicators.
- All indicators must be verifiable (Meritum Project 2005:25-6).

The point of departure for the evaluation of the intellectual capital variables at RAU was reached...
by dividing the twelve key success factors set out in RAU’s the strategic planning into the major areas according to the Skandia Intellectual Capital Management Model.

- **Human capital**
  - The ability to attract and retain staff of good calibre
  - Dedicated staff
  - Implementation of effective staff and student equity measures

- **Structural capital (customer capital)**
  - Projecting a highly visible positive image
  - Ability to attract good students

- **Structural capital ( organisational capital: innovation capital - intangible assets)**
  - Technological support
  - Quality research
  - Relevant tuition programmes

- **Structural capital: process capital**
  - Visionary participative strategic management
  - Adherence to mission

- **Financial capital**
  - Financial health of the institution

For this new framework to be successful, all of the critical success factors must be measured in terms of some variables, which will indicate the contribution that each will make to the management of intellectual capital at the University. A set of 67 variables for measuring intellectual capital was used to determine the success of measuring different aspects of the components. The most important measurable variables of each component of intellectual capital included in this study will be discussed in the next section.

### 5.1 Human capital

In this section on Human Capital, variables were chosen which would indicate the staff component of the university and indicators, which highlighted the flow of knowledge in the institution, were used. The following indicators were used:

<table>
<thead>
<tr>
<th>Human Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of staff</td>
</tr>
<tr>
<td>Full-time</td>
</tr>
<tr>
<td>Part-time</td>
</tr>
<tr>
<td>Proportion of instructional/research staff to total number of staff (%)</td>
</tr>
<tr>
<td>Proportion of non-professional/administrative staff to total</td>
</tr>
</tbody>
</table>

### 5.2 Structural capital

In this group of indicators attention were paid to Customer Capital and Organisational Capital and it associated indicators.

#### 5.2.1 Customer capital

In Customer Capital attention were paid to knowledge about the customers of the university. The focus was on the student as customer as well as on government as stakeholder for whom universities do their research. Important indicators were as follows:

- Customers, image and stakeholders
- Curricular contact students
- Curricular distance students
- Extra-curricular students
- Total number of students
- Growth in student numbers
- Students per employee
- Per academic and research staff
- Per non-academic staff
- Market share
- Customer satisfaction
- Marketing expenses
- Image of RAU

<table>
<thead>
<tr>
<th>Project cooperation and networking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of researchers per category</td>
</tr>
<tr>
<td>Number of National Research Foundation categories</td>
</tr>
<tr>
<td>Percentage of grants received</td>
</tr>
</tbody>
</table>
5.2.2 Organisational capital (intangible assets)

The intangible assets such as the Information Technology Department and the Library and Information Service as infrastructure for knowledge support were taken into account. The research output of students and staff also indicated the level of knowledge flows at the university. The following indicators were used:

- Technological support
  - Number of PC’s per employee
  - Number of individuals linked to the network
  - Volume of IT use
  - Cost of IT per student
  - Satisfaction with IT service
  - Total IT expenditure
  - IT expenditure per employee
  - Reliability of hardware and software
- Library and Information Services
  - Total cost of LIS
  - Expenditure per employee
  - Total number of book volumes
  - Total number of book titles in stock
  - Total number of journal volumes
  - Total number of current journal titles
- Diffusion and networking per academic and research staff
  - Total number of international events attended
  - Total number of national events attended
  - Total number of contributions at international events
  - Total number of contributions at national events
  - Total number of chapters/contributions to books
  - Total number of A and B type research articles published
  - Total number of C type (non-peer-reviewed) articles published
  - Total number of master’s students
  - Total number of doctoral students
  - Total number of staff on management committees of professional societies
  - Total number of staff on editorial committees
- Internationalisation
  - Overseas visitors received
  - Overseas research visits

5.2.3 Organisational capital (intellectual property)

Intellectual Property plays an important role in the distribution of knowledge, but also needs to be safeguarded. The intellectual property of the organisation was measured as follows:

<table>
<thead>
<tr>
<th>Intellectual Property</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patents registered in the name of the RAU</td>
</tr>
<tr>
<td>Income from patents</td>
</tr>
<tr>
<td>Income from copyright</td>
</tr>
</tbody>
</table>

5.2.4 Organisational capital (process capital)

Process Capital involves the satisfaction of stakeholders and how they perceive knowledge flows in the organisation. The following indicators were used:

<table>
<thead>
<tr>
<th>Structural Capital - Process Capital:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satisfied employee index</td>
</tr>
<tr>
<td>Direct communications to customer/year</td>
</tr>
<tr>
<td>Community involvement</td>
</tr>
</tbody>
</table>

6. Conclusion

The management of intellectual capital by institutions of higher learning is becoming more important day by day. In the study on existing intellectual capital management and measurement frameworks, it has become clear that specific models are needed to be developed for these institutions. As a result, a framework was developed which was used to manage and measure Intellectual capital at an institutions of higher education. The testing of this model at the Rand Afrikaans University clearly indicates that it can be used with great success in reaching the organisational goals. From the empirical work done at this institution, it is clear that the effective management of the institution’s intellectual capital can indicate problem areas and determine gaps that need to be addressed. As this institution has gone through a process of merging with other similar institutions, this framework could be used with great success at the University of Johannesburg as well as other institutions of higher education that wish to measure their intellectual capital. A follow-up study at the University of Johannesburg may be useful for determining what the influence of the merger was on the management of knowledge, and more specifically intellectual capital.
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Intangible Assets Identification and Valuation – a Theoretical Framework Approach to the Portuguese Airlines Companies

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Abstract: Intangibles have emerged in the last decade as an important issue among companies’ accounting theories. Companies have implemented strategies based on the robustness of their own intellectual capital. Competitive advantage is based on the capacity to anticipate, innovate and make shared use of opportunities. In the air transportation sector, strong changes have also occurred – traditional value chains based on linear activities alignment, were replaced by a new perspective: the innovation cycle (specific intangibles recognition associated with new business models) and its impact on the operational cycle. This paper presents a theoretical framework approach about intangible assets identification and valuation in the air transportation sector as a whole. The first step of this empirical evidence is based on the Portuguese Airlines companies.

Keywords: intangible, knowledge, intellectual capital, valuation, air transportation

1. Introduction

Intangible assets appear, nowadays, as an important issue in the accounting rules frontier – a tension between those responsible for accounting standards establishment and those who use the information, are indeed evident. Intangibles have a value but due to their volatile nature and difficulties in their measurement, they are normally excluded from the financial statements. However, according their linkage and contribution for certain businesses, their importance for stakeholders is irrefutable. Traditional financial reports, based on traditional accounting rules that exclude the potential return, seem to be irrelevant for decision-making. Thus, intangibles identification and measurement approaches can contribute for a better decision-making. Innovation cycle or the innovation value chain claims for a deep analysis on the intangibles identification, measurement and reporting. Radical changes have been occurred in the last two decades of the twentieth century. New business models have also emerged in which knowledge creation, capture, re(use) and diffusion constitutes the way ahead to value creation. Companies need to identify the drivers that contribute for a higher value level and intensity. Investment in intangibles is probably the first step to innovation and consequently for wealth creation. Intellectual capital management and reporting can, on a feasible basis, support the gap of perception between accounting and market value.

2. Aims and objectives

This paper focuses on the importance of intangible assets in the entire value creation process. Although the standard accounting rules specifications, intangibles act as a key driver in businesses value creation and are strongly interlinked with several strategies effectively followed. Innovation is probably the most visible face on this topic, which results from prior investments in intangibles such as human and structural capital. Despite the importance of intangible assets, we underline a theoretical framework approach for the Portuguese Airlines companies. Specific intangibles should be evidenced that contribute for value creation in this particular branch of activity. Thus, our objective is to underline the importance of intangibles in those companies and define a theoretical approach to identification, measurement and reporting of their intellectual capital assets.

3. Intangibles: an interlinked approach

The term “Intangible” is as concept to which no consensus exists on their definition. Dependent from accounting rules and measures, authors like Cohen (2005), Andriessen (2004), Lev (2001) and Brockington (1996) argue about their impact on businesses and on company’s value creation. Thus, historically, intangibles have been treated as an aggregated amount (goodwill), without impact on national wealth neither included in financial statements of firms. Goodwill, in nature, represents a residual, which incorporates all
intangibles that cannot be measured separately. In this paper we focus on those ones that can be identifiable and be measured under impairment approaches, having or not an indefinite lifetime (Epstein and Mirza, 2005: 234).

According Blair and Wallman (2003:451) "intangibles are non-physical factors that contribute to, or are used in, the production of goods or the provision of services or that are expected to generate future productive benefits to the individuals or firms that control their use".

Broadly, a typical intangible asset cannot be bought or sold in an organised market, the verification of its existence may be impossible, it may not have a finite life, its value can fluctuate (which means that it should be submitted to the impairment analysis) and sometimes it is strongly interlinked with a specific activity, product/ service or business. Hence, intangible assets are commonly development expenditures, patents and trademarks, brand names, databases, human know-how, strategic alliances and processes. Despite that, individuals and companies have an expected future return and benefits based on the intangibles management. Nevertheless, accounting systems defined by FASB has a very conservative nature. Expenditures in research and development, advertising and other similar ones, should be immediately expensed even tough they traduce expected future returns. However, as stated by Lev and Sougiannis (2003:145), firms' RandD capital was found to be associated with subsequent stock returns.

It is, nowadays, irrefutable that intangibles identification, management, measurement (income, cost or market approaches) and reporting is a key burner on the value creation process. Lev (2001:5) defines intangibles as

"a claim to future benefits that does not have a physical or financial (a stock or a bond) embodiment. A patent, a brand, and a unique organisational structure (for example an Internet based supply chain) that generate cost savings are intangible assets".

Intangible assets measures and risks such as research and development capitalisation, organisational innovation processes and intellectual capital approaches act as key drivers in the value creation process. Knowledge arises as the main way to the wisdom achievement and wealth creation. Although intangibles have non-physical nature that contributes to the production of goods and services, companies expect for their future benefits and returns. Individuals and companies responsible to manage them look for the market; adjust their business processes through customisation approaches. Broadly, strategies followed by companies such as alliances, mergers and acquisitions, internal and external diversification or disinvestments, even driven by integrated and innovative market approaches, are based on intangibles in particular research and developments programs. Thus, knowledge based assets are responsible for the major business changes occurred in those decades. From an accounting point of view, intangibles identification is the first step towards a better financial reporting. Although those assets are not included in the balance sheet, they should be reported to the stakeholders. Accounting systems stagnation and its conservative nature has the primarily responsible for the perception lack between accounting value (based on equity) and market value (based on information perception and integration). We underline that the intangibles identification can contribute to a better company's analysis even those assets are not included in the financial statements. Creating value for companies through intangible assets also requires the implementation of strategies based on innovation processes, strongly supported by investments in intangible (Lev, 2001).

4. New value throughout intellectual capital approaches

As already previously mentioned, value has been assuming a major role, reaching a multidimensional plan. Intellectual capital approaches (Edvinsson et al. 1997), efficient knowledge management systems and intangible assets management constitute strong burners on the value creation and retention process. Whereas the customer acquisition aims at measuring in absolute or relative terms the capacity of the company in attracting or acquiring new customers for business, the client satisfaction aims at measuring how well the company is functioning. Retention capacity indicates the level of customers that are set in each business segment. However, to know the customer satisfaction level is not by itself a condition to assure high retention or profit level. Thus, high levels of customer satisfaction are needed to assure a recurrent behaviour in terms of purchase. To ensure a deep customer satisfaction level, it has strongly important the product or service intrinsic characteristics (functionality, uniqueness, quality, price and sense of opportunity). Companies should acquire the possibility of acting pro-actively regarding their customer needs and answering them on time. It results from the conjugation of several domains
Internal business dimension is an important variable in achieving value. It matches customer needs in providing them with a set of attributes, which are also interlinked with shareholders expectations by affording an excellent financial return. Focusing on the processes with a significant impact on customer satisfaction and on the results achievement, it has an impact in the creation of a new value chain, supported by new business internal processes (Kaplan and Norton 1996). Traditional value chain was primarily directed on focusing the processes and activities, which supply products and/or actual services to actual customers. This wave of value creation begins by ordering a product and/or service already in existence on the part of the actual customer and finishes with their delivery. According to the traditional value chain, the company has created value based on production activities, delivery and after-sales services. The new view upon the value chain, which takes on a long-term financial outlook, requires a structure that can create new products and/or services, which match the emerging future needs or potential customers. The process of innovation (Kaplan and Norton 1996:27-28) has become, for a large number of organisations, a more important mean of a future financial performance than can be in itself, their operational cycle. This means that, in the emerging markets, already catalogued as new business models, the success states on the organisation’s capacity to successfully manage the products and services development and in reaching new categories of costumers with an highly retention power.

An approach based on the innovation value represents a strategic logic in which the orientation does not lie on the fact of wanting to be constantly ahead of competitors. In fact, it was a characteristic over the last decades in the conventional logic, in which the competitors become irrelevant on the prosecution and on the value creation. Knowledge management was not induced by processes or businesses by themselves. Thus, it seems to us appropriate to identify these two logics that seem to direct the creation value on the strategic outlook. The underlying differences of those strategic logics can be reached throughout some key dimensions. These differences intend to emphasise the main questions that managers have to face: which opportunities are diagnosed or sought after and how is the business risk dealt with? Actually, the value-based strategies are not established on the industry conditions as a starting point, but in the fundamentals in which the strategic options are founded. Strategic focus is on confronting their strong and weak points with those of the competitors and, from they’re, identifying the best way to establish a competitive advantage, opposing the idea that the competition only works as a simple benchmarking.

Conventional logic has oriented strategy for the expansion of the customers’ data, always responding to each of their specific needs. Innovation based strategies have been directed towards an opposite logic in the sense that they are directed towards what the different customers have in common, even if it means, in some cases, loosing some of them. On the other hand, conventional logic treats opportunities according with its actual recourses and capacities whereas innovation logic would never admit any kind of constraint caused by that level or resources and/or capacities. The supply of products and/or services does not obey to this logic, the traditional limits rule imposed by the industry - it focuses the overall solution and, thus, on the generic value chain, even if that leads the organisation to the brink of a new business. In this manner and in the ambit of business, the search for synergy ceases to limit itself to the main activities and the support activities of the value chain to assume the most diverse shapes: knowledge sharing, strategy coordination, physical resources sharing, vertical integration, negotiation sharing and the creation of combined businesses (Campbell and Goold 1998:133). That synergy may be of great help to the organisation but it is essential in a first phase to know how to distinguish true opportunities from illusions. Sometimes the results obtained from that synergy are more productive in cases where a minor number of initiatives are pursued.

It has been also mentioned that organisations have been seen for many years as value chains or even as systems in which the value is created by transforming certain inputs in more refined outputs. Strategic changes associated with the value chain management are related with the production of goods with a proper quality at the lowest possible cost. This cost reduction or the value increase was initially associated to the effect of economies of scale, to the efficiency in the resource use capacity, to the learning effect, to the information circuits about products as well as to the quality measures. The key success critical factors identified in this process of creation value certainly include a whole set of relations between the principal and the support activities. Nowadays, this approach has also extended to other means of value creation such as the networks development. Besides the value chain approach identified and formalised, two more configurations of value were emerged: value
networks and value shops. In the former, organisations create value by sharing activities, whereas, in the latter, competencies of helping them to resolve a problem are sold.

The key factors of competitiveness which have directed the evaluation of industry attractiveness in the last decades continue to constitute an essential basis for that evaluation, although due to the differences of performance deriving from the followed strategies, they have been complemented with the analysis of the competition position. Market development, strongly marked by technology development, even by the evolution of quality concepts and by the business ethics in itself, has been demanding the development of new techniques, which enable us to measure the business-related performance but also the business own risk measure. The importance lost within traditional analysis of the industry attractiveness has revealed over the last decades. We are now oriented to the emergence of new performance measures and to the identification of new key factors that create value, tangible or intangible assets, framed in the domains of knowledge and/or in the information and communication technologies - the knowledge management system revolution. The impact of its development is not due to the fact that the companies are becoming more profitable by increasing the rate of hourly production, but on allowing access to a greater diversity of information sources, but in its velocity processes. Nowadays, there is a global market for the technology and for the individual skills. The goal is not only on developing competences that represent by themselves a competitive edge, but also on developing them economically and faster than the competition. Clarifying the value system and making it work is the major contribution that each individual can give to the value creation. This logic is the one, which has prevailed on the last few decades and which seems to persist in the digital economy, although in a more integrated, aggressive and volatile way.

5. Intangible assets measurement approaches

Literature focuses on three valuation techniques towards intangible assets measurement: income, market and cost approaches (Reilly and Schweihs 1998; Cohen 2005). Income approach is a straightforward application using discounted cash flows methodology, which are associated to the expected future returns. Assuming the basic principles of the financial theory, three main steps should be followed in order to achieve a feasible measurement: identify the asset from which we expect an economic future return, estimate the expected cash flows over time and finally assign an appropriate measure of risk to our prediction (using Capital Asset Pricing Model, Arbitrage Pricing Theory or any other financial approach). These approaches present, however, the weakness that it may be very difficult to come up with reasonable and unbiased expected future cash flows. Under a market approach, we assume that an asset can be related to the value of comparable assets priced in the marketplace (comparable method). The more heterogeneous assets are the more difficult is to use the market approach. For intangibles, comparable approach cannot be followed once there is no active market for those intangibles. Some evidences exist that market approach can be followed for patents, licences, strategic alliances and other intangibles with a definite lifetime and subject to impairment analysis. The cost approach for intangibles is probably the most linear which considers the book cost (recorded in the traditional financial statements) or the replacement cost (with a wide range of interpretation. Broadly, equals reproduction cost less curable functional and technological obsolescence). Reilly and Schweihs (1998:144) argue that

“the cost approach is one fundamental way of estimating the value of intangible assets and intellectual properties. There are several cost approach valuation methods, the most common being the reproduction cost method and the replacement cost method”.

Thus, for intangibles without an active market or under a comparison limitation, this approach would be followed on a systematic basis.

6. The Portuguese airlines sector

6.1 Generic intangible assets identification

The Portuguese Airlines Sector aggregates 38 companies, developing several activities, namely: regular air transportation, charter activities and emergence activities. All of them are certified by the National Institute of Civil Aviation (NICA) for those activities (Figure 1). However, in 2004, only seven companies were certified to regular air transportation activities (regular flights), as mentioned in table 1. In the last two years, other seven companies have been certified as regular air transportation operators.
TAP Air Portugal (Public company) represents more than 80% of the sector activity, followed by Air Luxor, a private company. PGA – Portugália Airlines, a regional airline company, was classified in 2005 as the best regional European company. In 2006, other seven companies were certified to regular transportation. However, relative position for the companies mentioned in Table 1 was not been modified. In this paper we present a theoretical framework approach: our assertion is that there are several intangibles not included in the financial statements nor adequately included in the management reports. In some cases, we argue that some intangibles are incorrectly expensed. In this preliminary step, our hypothesis include the identification of several intangibles (having or not a definite lifetime), which should be feasibly analysed, in order to improve the management information available to the stakeholders as a whole. Those intangibles can be identified as follows: preventive maintenance programs, specific learning programs, cod share agreements, strategic alliances (e.g. Star Alliance), brands, frequent passengers programs, flying certificates granted by NICA, research and development investments, software and databases and other rights. These intangibles should be measured and integrated in the financial statements or specified in the management reports.
Intangible assets included in the financial statements relate to goodwill, research and development (RandD) investments, property rights and installation expenses. There is no evidence about other intangibles identification included in the annual financial reports. Thus, the supremacy of TAP Air Portugal and PGA – Portugália Airlines has no significance if we compare the intangible assets impact on the net balance sheet value. Intangibles like maintenance programs, specific learning programs, cod share agreements, strategic alliances, brands, frequent passengers programs and flying certificates are not included nor reported. Most of them are immediately expensed and included in the profit and loss account. Intangibles identification in the balance sheet is evidenced in Table 1, as follows:

Table 1 – Intangibles reported in the annual financial statements

<table>
<thead>
<tr>
<th>Company Airline</th>
<th>Goodwill</th>
<th>Research and Develop.</th>
<th>Industrial Property and Rights</th>
<th>Installation Expenses</th>
<th>Other Rights (contracts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAP AIR PORTUGAL</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>AIR LUXOR</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>PGA – PORTUGALIA AIRLINES</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>SATA INTERNATIONAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OMNI – AVIAÇÃO E TECNOLO.</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>SATA AIR AÇORES</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>ATA – AEROCONDOR</td>
<td>●</td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

Source: Annual financial reports (2004)

As stated in the Table 1, intangibles recognition or identification is not a strategic issue. We have focused our attention to intangible assets as value sources but we are also aware that the essence of value, although strongly conditioned by that assets typology, wears itself out. Nevertheless, integrated outlooks of the possible factors, which can influence the value creation or destruction from the stockholder’s point of view, are required. For instance, strategic commercial based alliances are usually formed between companies that try to enter into new markets or expand their existing ones. Stakeholders seem to perceive those alliances as advantages and as a value creation source.

Strategies in this type of company are based on the capacity to anticipate, innovate and make shared use of opportunities and knowledge. Other more wide-ranging factors were also identified, which cause fluctuations in the value of companies: strategic alliances as “Star Alliance”, diversification by international acquisition, and use of “outsourcing”, mergers and disinvestment decisions. Companies should anticipate the value migration process focusing on their innovation cycles and customers needs. Create value arises...
in the new economy as the key burner to maintain a sustainable competitive advantage.

In the previous analysis to financial reports, traditional intangible assets have been recognised in the financial statements namely “goodwill” (as an aggregate value), research and developments investments, industrial property and rights, company installation expenses and other intangible as contracts. This is the traditional approach based on the Portuguese accounting rules and, since 2004, based on international accounting standards. However, our concern relates to other intangibles that are not accounted and/or not reported in the financial statements. Our assertion is that those intangibles strongly drive the company value. Some of them, emerging from air transportation literature review are: brand names, cod share agreements, international alliances, frequent passenger programs, preventive maintenance programs, and human capital typologies, license typology granted by INCA, local agreements, and specific contracts, among others not yet identified.

6.2 A theoretical framework approach for specific intangible assets identification

In order to achieve our investigation goal, a theoretical approach is proposed, for the Portuguese Airlines sector, as shown in Figure 4:

![Intangibles framework approach I](image)

*Figure 4: Intangibles framework approach I*

We assume, in our investigation, five hypotheses relating intangible assets identification and measurement. These are shown in Table 2.

**Table 2 – Investigation hypothesis**

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>H₁</td>
<td>There is an information gap about intangibles in the Portuguese Air Transportation Sector, depending from:</td>
<td>Company size</td>
</tr>
<tr>
<td>H₂</td>
<td>Air Transportation Sector evidences specific intangible assets that should be measured and reported, depending from:</td>
<td>Company size</td>
</tr>
<tr>
<td>H₃</td>
<td>Intangibles are not included in the traditional financial balance sheet statement. It depends from:</td>
<td>Company size</td>
</tr>
<tr>
<td>H₄</td>
<td>Intangible assets are not adequately reported in the stakeholders’ management reports:</td>
<td>Legal reports</td>
</tr>
<tr>
<td>H₅</td>
<td>There is a positive correlation between intangibles valuation and potential future returns. It depends from:</td>
<td>Company size</td>
</tr>
</tbody>
</table>
Meanwhile, the theoretical construct is evidenced by figure 5. In figure 5, hypothesis and theoretical framework approach matching, is presented.

Figure 5: Theoretical framework approach II

After fieldwork completion, we expect that most of the assertions assumed in this paper, will be effectively confirmed. From an accounting point of view, we expect that intangible importance and consequent recognition depends from company size, organisational culture and company maturity stage. Accounting barriers in their fair measurement will also affects the intangible non-recognition. In air transportation sector, strong changes have also occurred – traditional value chains based on linear activities alignment were replaced by a new perspective: the innovation cycle (intangibles recognition) and its impact on the operational cycle. A new market approach has also emerged which is based on customers needs identification, the inclusion of those needs in the innovation cycle and thus, their consequent integration in the operations cycle management.

Air transportation companies also compete by their innovation capabilities (human and structural capabilities). Value migration (also dependent from the innovation intensity), as stated by Slywotzky (1996:58), requires that companies recognise their value drivers that, on a feasible and continuous base, contribute to the company growth. That migration process, strongly embodied on innovation capabilities, enables companies’ airlines to acquire/develop competencies (organisational learning process) that can easily create value and maximise the future expected returns. It is today irrefutable that value creation is the main objective for companies’ stakeholders.

Value became the key pointer for those stakeholders. Searching information, design systematic learning processes about companies’ innovation and operational cycles, and match them with customers needs, can contribute for the minimisation of value losses in the value migration process.

6.3 Specific intangibles revised

As stated below, specific intangible assets are indeed underlined for air transportation sector (Table 3). However, further investigation is required in order to point out their relative importance. Questionnaires approach will be followed in order to meet this objective in a feasible basis.

Table 3 – Intangible assets (first approach)

<table>
<thead>
<tr>
<th>Intangible assets</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brand names</td>
<td></td>
</tr>
<tr>
<td>Fly share agreements</td>
<td></td>
</tr>
<tr>
<td>Preventive maintenance programs</td>
<td></td>
</tr>
<tr>
<td>Logos and trademarks</td>
<td></td>
</tr>
<tr>
<td>Strategic alliances</td>
<td></td>
</tr>
<tr>
<td>Frequent passenger programs</td>
<td></td>
</tr>
<tr>
<td>Human capital categories (e.g. pilots and maintenance Human Resources)</td>
<td></td>
</tr>
<tr>
<td>Regional agreements</td>
<td></td>
</tr>
<tr>
<td>Contracts between air transportation companies</td>
<td></td>
</tr>
<tr>
<td>Licences to fly</td>
<td></td>
</tr>
<tr>
<td>Restructuring strategies</td>
<td></td>
</tr>
<tr>
<td>Fiscal planning strategies</td>
<td></td>
</tr>
<tr>
<td>Quality certificates</td>
<td></td>
</tr>
<tr>
<td>Airports certification</td>
<td></td>
</tr>
</tbody>
</table>
As in Portugal, within Europe, some changes have occurred in air transportation companies - strategic alliances have taken place and deep restructuring programs were implemented. Should they be reported as intangible assets? According to the potential financial return stated by IAS 38, we are aware about that approach.

Strategic alliances require “that the partners come to some agreement on the value of their respective contributions to the collaborative entity” (Inkpen and Madhok 2001:49). Every partner has access to new skills and knowledge, increased return is expected. In fact, each alliance is established on payoff to learning approach and on the cost of continued collaboration analysis. In air transportation sector, several companies join the alliance (e.g. Star Alliance) in order to over new destinations with higher passenger’s fidelity. Synergies are the most important outcome in this particular value creation process. Fiscal planning and restructuring strategies can also be considered as intangible assets and subject to a patent process (and thus subjected to patent portfolio management analysis). Since 1998, in the United States of America, 49 fiscal planning strategies were patented. Know-how embodied in those strategies can be, in essence, translated into strong future financial returns for stakeholders (opportunity for competitive advantage or process complexity risk increase?). Nevertheless, no consensus exists about this approach.

7. Final remarks and further investigation

Intangible asset concept is associated with expected future returns. It is viewed as an identifiable non-monetary asset without physical substance, controlled and the source of future returns for the enterprise. In this respect, one of the most visible sources of intangible assets is patent registration, supported by the intensity of research and development. This evidence is consolidated at a later date by the number of patents actually registered and granted by the international agencies. Innovation management is, therefore, a source of competitive advantage for national economies in general and the business sector in particular. Broadly and according to modern economic theories, knowledge is the most subjective asset that appears directly associated to connectivity, information, technological and organisational convergence, and complementary, to mobility. It appears as the main source of competitive advantage, responsible for the organisational productivity improvement. As a dynamic process, it is also understood as the capacity to transform data, to use information, to learn, to test results, to interpret, to support decisions and to take sustainable advantage.

Portuguese airlines companies present poor rates about intangible assets in their financial reporting systems. Our assertion relates that several intangible assets exist that are not included nor adequately reported in the financial statements/stakeholders reports. Future research is required relating intangible assets identification and measurement throughout an income, cost or market approach. A theoretical framework approach was presented in order to identify and quantify the intangibles impact on the financial statements and on value creation process. This investigation is currently in the field. In the same way, similar approach can be followed for worldwide air transportation sector. Other companies should be included in the sample in order to support the assertions issued in this paper.

8. Acknowledgements

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References


Comparison of Approaches toward Formalising Context: Implementation Characteristics and Capacities

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Abstract: Existing relevant literature regarding approaches to context formalisation is analysed in search of a characterisation that explains the links - suggested by knowledge theory of the firm - between knowledge integration capability and common knowledge types. The ontological and the syntactic-semantic-pragmatic continuum approaches reveal an extensive description of context, which contributes to the understanding of the knowledge integration process, and to an eventual operationalisation of common knowledge types. This theoretical development opens possibilities for the elaboration of prescriptive models that support the integration of knowledge during routine operations of the organisation.

Keywords: knowledge integration, common knowledge, context formalisation

1. Common knowledge in management

One relevant proposition of the knowledge-based theory of the firm is that the ability of an organisation to integrate existing knowledge builds up its competitive advantage. The capacity to integrate existing knowledge, not the knowledge itself, is emphasised here (Grant, 1996). Another theorist, Schendel (1996), proposes that developing new organisational knowledge creates competitive advantage. With a different vocabulary, but referring to same concepts of organisational knowledge, March (1991) and Spender (1992) refer to “knowledge exploitation” as the application of existing knowledge to deliver goods and services and to “knowledge exploration” as the generation of new knowledge. According to all of these theorists, there is a consensus that knowledge is a key component of organisational capability, whether in the exploration or exploitation approach. This work will elaborate on the knowledge exploitation approach. The postulate that integration of existing knowledge to deliver goods and services in organisations relies upon common knowledge for their undertakings is voiced by Grant (1996). In this same line, Nonaka and Takeuchi (1995) refer to common knowledge as “redundancy” that allows a loose coupling among members of a group. In the communications literature Cramton (2001) refers to “mutual knowledge” as the knowledge that the communicating parties share in common and know they share (Krauss and Fussell 1990), that is the “common ground” integral to the coordination of actions (Clark, 1996). Grant adds that common knowledge is constituted by those elements of knowledge that are common to the members of an organisation; namely, the intersection of their knowledge sets and enables the sharing and integration of the aspects of their knowledge that are not common to all of them. Common knowledge, here, accepting these Deweyan pragmatic approaches, is the kind of knowledge that makes members of the organisation communicate well, avoid misunderstandings, and be able to solve business problems together.

Grant (1996) goes further, he identifies different types of common knowledge and argues for a positive relationship between the level and sophistication of common knowledge types - common language, shared meaning, and recognition of individual knowledge domains - and the efficiency of the knowledge integration process. In spite of Grant’s convincing arguments it is problematic to understand and corroborate such relationships given the broad scope of the independent variables: common language, shared meaning and recognition of individual knowledge domains. To my best of knowledge, considering this pragmatic view, a set of operational measures have not been proposed nor tested to support or not the theory. This paper looks into existing approaches to context for the understanding of these common knowledge types with the purpose of giving them a tractable and consistent scope.

2. Common knowledge and context

While organisational common knowledge is described as the common collective knowledge of the members of an organisation, the reference domain to which this knowledge is common has been admitted as a tacit issue but without adequate explanation. Common knowledge is common in regards to what is widely shared among members of a group, community or organisation: their context, their environment.

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Reference this paper as:
Here, the idea of “context” is chosen over “environment” given that it denotes a stronger link to language and meaning than the idea of “environment”. So, in advocating for an approach for understanding the knowledge integration process in organisations it is necessary to understand the domain to which common knowledge types - common language, shared meaning, and recognition of individual knowledge domains - belong to; that is, the understanding of “context” in organisations. Conceptualisations of knowledge in organisations (Davenport and Prusak, 1998; Bell, 1999; Tsoukas and Vladimirou, 2001) (see section 4) include context as key part of their explanations and even they denote a role to it. However they do not elaborate on the definition of the concept, neither in its specification. In such situation, considerations to the general definitions of “context” are in order.

The Webster’s English Dictionary tell us that context is a) “the parts of a discourse that surround a word or passage and can throw light on its meaning”, and b) “the interrelated conditions in which something exists or occurs”. It is acceptable to conclude that these acceptations of context relate to narratives, situations, and events, their relations to its surroundings and the possibility of inferring meanings from them. This starting point achieved to identify essential properties belonging to the concept of context, however they do not bring yet sufficient light to the problem of providing a tractable and consistent scope to common knowledge types.

3. Analysis of approaches toward formalising context

It is necessary at this point to look into existing approaches to context in order to reveal how context - the domain to which common knowledge is common - characterises common language, shared meanings and recognition of individual knowledge domains. Context is a concept that has called the attention of many disciplines - philosophy, history, psychology, cognitive science, linguistics, information science, organisational sciences, artificial intelligence - and there is even an interdisciplinary conference dedicated to the modelling of context. However, the disciplines of information science and artificial intelligence are the ones that have made the most significant contributions to its formalisation. This literature review will look into approaches to context that try to formalise its externalisation, that is, its structure and content. Three publications, Akman and Surav (1996) with “Steps toward Formalising Context”, Brézillon (2002) with “Modelling and Using Context - Past, Present and Future” and finally Strang et al (2004) with “A Context Modelling Survey” provided the elements to assemble a schema for the understanding and evaluation of approaches. Representative proposals for each model are described and critically evaluated from the common knowledge type perspective (see Table 1).

Key-Value Model, (Schilit et al, 1994) allows a basic representation of context. The most it can be expected from it, a structure that offers an identifier and its value for each element constituting context, is the capacity to share a list of terms related to a situation or event (a basic form of common language). Markup Schema Model (Held et al, 2002) allows publishing of an inventory of elements related to a context by means of tags and associated attributes following a schema that describes context structure (a proxy to common language and a basic form of sharing meanings). This approach separates context schema from its content; however new contextual relationships are complex to incorporate (it asks for markup language expertise).

Object Oriented Model (Schmidt et al, 1999) exposes the properties – names and values – of a context and relationships among properties – thru events and methods - following a class model that describes context structure (a proxy to common language and a basic form of sharing meanings). This approach separates context structure from its content and allows reusability of existing context structures, however extensibility of a context structure is complex to achieve (it asks for object oriented programming knowledge). The main motivation for studying contexts in artificial intelligence is to approach the problem of generality brought by McCarthy (1987). This problem is exemplified by McCarthy through a system that advise physicians on treating bacterial infections of the blood and meningitis; system which has embedded rules for recommending two weeks of tetracycline treatment and nothing else to a patient case that has cholera vibrio in his intestines. These rules resulted in a case where patient would die long before the bacteria are gone due to the diarrhoea. The traditional approach to correct this flaw would be to add a rule to specific cases so it considers the diarrhoea symptom. As an alternative, a general approach is to incorporate patient contextual information – including symptoms - so that the system can use it for all cases. In this case, considering contexts explicitly ease the knowledge integration process.
<table>
<thead>
<tr>
<th>Main implementation Approach</th>
<th>Key-Value Model</th>
<th>Markup Schema Model</th>
<th>Object Oriented Model</th>
<th>Logic Model</th>
<th>Graph Model</th>
<th>Ontology Model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First-order logic</td>
<td>Modal Logic</td>
<td>Extended Logic</td>
<td>Model Based</td>
<td>Rule Based</td>
<td>UML Diagram</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
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<td>No</td>
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<tr>
<td></td>
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<td>No</td>
<td>?</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Evaluation of Capacities</td>
<td>--</td>
<td>Not available</td>
<td>-</td>
<td>Limited</td>
<td>+</td>
<td>Functional</td>
</tr>
<tr>
<td>Formalization of common language</td>
<td>-</td>
<td>+</td>
<td>++</td>
<td>+</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Formalization of shared meanings</td>
<td>--</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Formalizing recognition of individual knowledge domains</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>+</td>
<td>--</td>
</tr>
</tbody>
</table>

Table 1. Comparison of existing approaches toward formalizing context - implementation characteristics and capacities
Logic Model (McCarthy 1993; Barwise 1986; Guha 1991; Giunchiglia 1993; Attardi and Simi 1993; Shoham 1991; Buvac and Mason 1993) approaches from artificial intelligences allow sharing of well formed propositions - first-order logic or modal logic - about context (a proxy to common language), consistent evaluation of contextual propositions (a proxy to share meanings) and identification of expertise (recognition of individual knowledge domains). However, with the exception of situated theory framework (Barwise 1986; Akman and Surav 1996), logic model asks that members of the organisation have to decide by themselves what constitute a contextual proposition in order to formalise a particular context. In the other hand, logic model using situated theory framework has the advantage of offering a contextual schema (time, location and participants) besides the capacity to add contextual propositions to the specific context. Logic Model approach merges in the positions the structure and content of context, a model that makes new contextual relationships complex to incorporate, especially if predicate calculus is not part of the common knowledge of the organisation. Rule-based model (Brézillon, 1999) approach to context representation is described by its well-known example of a screening clause (Clancey, 1983), which succinctly exemplifies its implementation strategy. If

- The infection which requires therapy is meningitis,
- Only circumstantial evidence is available for this case,
- The type of meningitis is bacterial,
- The age of the patient is greater than 17 years old, and
- The patient is an alcoholic,

Then: There is evidence that the organisms, which might be causing the infection, are diplococcus-pneumoniae (.3) or Escherichia coli (.2). In this case Brézillon (1999) points out that clause 4 acts as a screening clause which sets the rule as valid in the context of an adult, it is a constraining clause that does not arbitrate in the problem solving, it just define the applicable context. It should be obvious at this point that the Rule-based approach uses natural language syntax in contrast with the mathematical syntax of the Logic Model approach. Context structure in this approach is blended in, and described in terms of the problems it helps to confine. Contextual Graph Model (Pasquier, 2000; Brézillon 2002) is proposed as a unifying framework that associates explanation, learning and knowledge acquisition. The subjacent logic of contextual graphs resides in the classification of the knowledge needed for a decision to be made:

a) Proceduralised context: “knowledge that is shared by those involved in the problem and is directly but tacitly used for the problem solving”,
b) Contextual knowledge: “knowledge that is not explicitly used but influences the problem solving” and
c) External knowledge: “knowledge that has nothing to do with the current decision making step but is known by many of those involved” and
d) Context: the sum of all the knowledge possessed by the decision makers on the whole task (Figure 1).

![Figure 1. Different type of Contexts. Brézillon (2002)](image-url)

Based on this framework, Pasquier (2000) proposes a contextual graph to represent the actions to carry out according to the context of an incident. This is an acyclic graph, in which the action nodes (rectangles) represent actions to carry out to achieve a goal while the event nodes (circles) become contextual nodes describing the possible contextual issues of a specific event. Contextual graph represents the part of the context that has been proceduralised. Proceduralised context is compiled knowledge that can be decompiled to explain its reasoning.
Cognitively speaking, the scarcity principle leads to try to reuse well-known procedures as soon as possible thru macro-action (MA rectangles) or sub-graphs (bigger rectangles).

At first glance, contextual graph could be thought as a notation to draw incident workflows, but its proposed framework, based on focal and subsidiary knowledge (Polanyi, 1962) does describe a knowledge externalisation model that looks for customary incident handling thru the characterisation of context and embedded self explanation. A contextual graph is a prescriptive approach that helps the understanding of the level and sophistication of all common knowledge types; however it requires incident by incident context structuring. Finally, Ontology model (Otzturk and Aamodt, 1997; Strang et al, 2003) is an information systems approach to context formalisation. Ontology, as described by Smith (2003), is the inventory of relevant entities of a domain externalised as a vocabulary of the terms that denote these entities with their commonly accepted, concise and unambiguous definitions. The formalisation of the vocabulary varies from loosely expressed in natural language to meticulously defined terms with formal semantics recurring to first-order logic or modal logic (Uschold and Gruninger 1996). In this sense, the Ontology Model to organisational context argues for a syntactic and semantic standardisation of shared and consensual knowledge structures (a proxy to common language and shared meanings) related to corporate competencies (Vasconcelos et al, 2000) to describe everyday information (Strang et al, 2003).

These knowledge structures, proposed as taxonomies, have differences within in their composition, however general consensus in some characteristics of the taxonomy of real objects exists (Chandrasekaran et al, 1999): 1) there are objects in the world, 2) objects have properties that can take values, 3) objects can exist in various relations with each other, 4) properties and relations can change over time, 5) there are events that occur at different time instants, 6) there are processes in which objects participate and that occur over time, 7) the world and its objects can be in different states, 8) events can cause other events or states as effects, 9) objects can have parts. Existing ontological models to context (Otzturk and Aamodt, 1997; Strang et al, 2003) show similar implementation characteristics than the Logical Model approach; however the ontology approach, in general, proposes an abstraction layer by means of context taxonomy, and a context content mechanism which needs not to be technologically approached but systematically approached which is more likely to be part of common knowledge in organisations.

In summary, the critical evaluation of the approaches from the common knowledge type perspective, reveals that: a) Key-Value Model capacity is limited to share an inventory of terms about situations or events without meanings associated to them; b) Markup Schema Model separates context structure form its content and allows sharing of a friendlier common lexicon thru a pre-established context model; c) Object Oriented Model has similar characteristics of previous model but differs in that context structure extensions requires object oriented programming knowledge; d) Logic Model offers proxies to the three common knowledge types but dealing with the context structure and content ask for a not very common knowledge language for management: predicate calculus; e) Rule-based Model has similar characteristics of the previous model but with a natural language interface, yet still blends context structure and content which prevents the sharing of context; f) Contextual Graph model is a knowledge theory based prescriptive model which provides a notation to draw incident workflows that incorporates contextual information and helps in the understanding of the common knowledge types, however it requires incident by incident context structuring; and finally the g) Ontology Model, which is a general purpose model characterised by a meta-structure that describes syntactic and semantic sides of context, separation of context structure and content, and a systematic and not necessarily technological implementation approach. The reviewed approaches to context formalisation offer different levels of characterisation to common knowledge types; however the ontological approach provides the most descriptive capacity and consistent scope given its structure (guidelines for context taxonomies) and context content (procedures of definition).

4. Knowledge and context conceptualisations

This section will work on conceptualisations that argue in favour of characterising context as a boundary object (Star, 1989). These conceptualisations will help on the understanding of the links between common knowledge types and knowledge integration capability. A boundary object, basically, is an artefact (physical or mental) that allows members of different practices to share common grounds (Arias and Fischer, 2000). Boundary object supports the distinguishing of differences but also provides
common points of reference (Harvey and Chrisman, 1998).

Knowledge management research makes use of the boundary object abstraction to explore the interactions between knowledge and people. Carlile’s (2004) “integrative framework for managing knowledge across boundaries when innovation is desired” is one relevant research example that presents a case of an “automobile clay model”, considered as boundary object, to explain the dynamics of the knowledge exploration approach. Carlile (2004) recalls Shannon and Weaver (1949) seminal work on information theory, which describes the three levels of communication complexity. Shannon and Weaver relate the available repertoire of distinct symbols and their syntax - rules between symbols - to the syntactic or technical level of communication. Then, they identify the process by which symbols actually get meaning as the semantic level; and finally, they consider the desired effect of a particular message on a message destination as the effectiveness or pragmatic level. Even though Shannon and Weaver avoid much elaboration on the semantic and pragmatic level of communication, these three boundaries – syntactic, semantic and pragmatic – have been referenced by several authors as a boundary framework for the analysis of data, information and knowledge, correspondingly (Carlile, 2004; Boisot and Canals, 2004). Carlile argues that in order to achieve novelty different capabilities are needed at different boundaries of communication. The transferring capability asks for the development of common lexicon, it deals with the syntactic issues; the translation capability takes care of semantic issues and asks for the development of common meanings and the transformation capability ask for common interest, that is the pragmatic level (see Figure 2). Here, I am ready to accept Carlile’s knowledge exploration framework and at the same time I argue for a search of a knowledge exploitation (integration) framework linked to an understanding of context as the boundary object.

Choosing to follow this theorising approach – the data-information-knowledge continuum – is not fortuitous; it involves the need to describe domains and boundaries of common knowledge in doing so it is necessary to consider the existing explanations regarding this continuum. Ackoff (1989) defines data as “raw ... it simply exists and has no significance beyond its existence ... it can exist in any form, usable or not ... it does not have meaning of itself” and posits that information is “data that has been given meaning by way of relational connection ... meaning can be useful, but does not have to be”, and that knowledge is the application of data and information. Ackoff emphasises the assignment of semantics and relations to information, and states that knowledge is instrumental; but his definition of data does not tell us much. Davenport and Prusak (1998: 2) posit that “data is a set of discrete, objective facts about events” and that “Unlike data information has meaning” (1988: 4), and describe knowledge as “a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers” (1988: 5). Davenport and Prusak suggest human involvement and relationships among data to define information – contextualised, categorised, calculated, corrected, condensed - and at a
personal level they describe knowledge as an individual capability to capture more information. In a way, they describe knowledge as a complicated, and not very clear, mixture of processes that incorporates contextual information; but still data is not yet well described. Davenport and Prusak also posit that knowledge “In organisations, often becomes embedded not only in documents or repositories but also in organisational routines, processes, practices and norms” (1988: 5). The position here is that knowledge is personal and that Davenport and Prusak are confusing knowledge with representations of data and information.

Bell (1999) has a more integrated description of this continuum. He states that data is an ordered sequence of given items and events, that information is a context-based arrangement of items and their relations, and that knowledge is the judgment of the significance of events and items which comes from a particular context and/or theory. In the case of Bell’s knowledge definition it is revealing that a judgement of the significance of information can be based on context and not only on theory. I will come back to this issue later on. However, it is the work of Tsoukas and Vladimirou (2001) that stresses the ideas behind this continuum. In their research case at a customer care department at Greece’s leading telephone provider, the personnel at the customer care department were exposed in their work to a lot of discrete items (names, addresses and phone numbers) and business rules (if applicable business rules and adapting action to the particular context – explains the data-information-knowledge continuum and the relevance of context in this continuum.

In a different, but consistent, line of research, Boisot and Canals’ (2004) proposal, after their revision of information theory and social studies, is consistent with the level of human involvement identified by Tsoukas and Vladimirou (2001). Boisot and Canals (2004: 62) state that “Effective cognitive strategies extract information from data and then convert it into knowledge. Effective cognitive and behavioural strategies vary from agent to agent as a function of their situation, of their prior individual knowledge …” making explicit the cyclic aspect of the continuum and show that the outcomes of information and knowledge extraction depend on the effectiveness of human involvement. Analysing the assessments of this continuum, it can be argued that its description accomplishes the identification some basic categories of data: items and events, which can be related to the interrogative primitives “what/who” and “when/where” and that perception is the type of human involvement linked to data. Boisot and Canals (2004) are explicit about perception when they posit that perceptual filters guide the senses to certain types of stimuli and only stimuli passing through this filter get registered as data.

The issue of perception involves a neural processing that takes place between the reception of a stimulus and its sensing as data by an individual (Kuhn, 1974). Appealing to Shannnon and Weaver (1949), it can be added that data is registered using an agreed established symbolic repertoire and syntactic rules – alphabet, vocabulary and the language syntax rules (Boisot and Canals, 2004). So data is conditioned by each individual’s perceptual filters and at the same time it is referenced by means of an agreed shared language – an inter-subjective objectivity (Popper, 1959). But, where does this agreed shared repertory come from? Polanyi (1966) argues that our knowledge of the things denoted by words will have been largely acquired by experience – mental or physical; so these words incorporated in discourses, or associated to situations or events were previous experiences in the chain of perceptual filters and it’s sensing. The extension of the use of language when referencing data is mnemonic and syntactic, that is, we attach a name to each datum and use it following syntax rules, but in order to name data a certain level of human involvement has to be applied (Tsoukas and Vladimirou, 2001), we need to discriminate between “this” and “that” (Dewey, 1934). Then, the reference to data through language implies that data is part of a recurring process, as posited by Boisot and Canals (2004), who propose that our perceptual filters are affected by our existing knowledge.

Considering the achieved understanding of data and the given acceptations of context, it could be said that:

Perceived context is data about the entities that have been sensed and filtered from a discourse, situation or event – mental or physical experiences – by the individual, and referenced by a mnemonic and syntactic common language via a process of discrimination; then, perceived context is
characterised as a sequence of the what, who, when and where of experiences.

Ackoff (1989) relates information to meaning; Davenport and Prusak (1998) suggest relations between data to define information; Bell (1999) links information to context-based interrelated data; and Boisot and Canals (2004) assert that extracting information from data constitutes an interpretation of data according to some pre-established mental models. These descriptions imply the individual capacity to discover relations between data and assign meaning to them, whether in reference to context or mental models or both. This latter assessment requires some elaboration. Mental models theory (Byrne 1991) focuses on semantic procedures and explicit formal rules of inference and it has been tested that context helps the finding of counterexamples of presumed conclusions (Byrne, Espino and Santamaria, 1998); from here it can be posited that one role of context is to assist formal mental models. In the other hand, there are theorists of natural logic like Politzer and Braine (1991) who argue that the mind is provided with tacit rules of inference. They tested that changes in context facilitate performance on conditional reasoning tasks; from here it can be posited that another role of context is to assist the tacit rules of inference.

Thus, the capacity to discover – infer – meaning from data – in general - is principally guided by formal explicit rules of inference and subsidised by perceived context, and that in this discovery meaning carries information. Complementarily, as a subset, the capability to discover meanings from perceived context is principally guided by tacit rules of inference, and this discovery of meanings carries contextual information of a specific experience – discourse, situation or event. "How" and "why" are posited as propositions that help to describe the meanings discovered, establishing relationships between the what, who when, and where of the data in general and perceived context in particular.

Summing up, contextual information involves the inference of meanings from data of a specific experience; these meanings are discovered guided mainly by tacit rules of inference, base on the interpretation of examples and counterexamples. Namely, contextual information is characterised by the interrelated what, who, when, where, how and why of a specific experience.

Once that an understanding of context have been established at the synthetic (perceived context) and semantic (contextual information) levels, the exploration of knowledge theories may shed light on the pragmatic level of context. Recalling from earlier, for Ackoff (1989) knowledge is instrumental; Davenport and Prusak (1998) describe knowledge as a capability for using experience, values, contextual information, and expert insight, to evaluate new experiences and information. Tsoukas and Vladimirou (2001: 976) is a more enlightening reference work to depart from, they dissect Bell’s (1999) description of knowledge - the judgement of the significance of events and items and that this judgement can be based on context and not only on theory – and argue for incorporating the idea of "domain of action" to propose a definition that states knowledge as the:

“Individual capability to draw distinctions, within a domain of action, based on the appreciation of context or theory, or both” (Tsoukas and Vladimirou, 2001).

This definition merits some consideration. Tsoukas and Vladimirou (2001) supported in Polanyi (1962) and in a Wittgensteinian view, posit that to know how to act within a domain of actions is to make competent use of the distinctions constituting that domain. Domain of actions is a generalisation that refers in terms of organisations to the community of a specific scientific or professional practice. Within this specific domain – practice – is where the standard of knowledge is measured through theory and/or context. Social construction of reality (Schutz, 1970; Berger and Luckmann, 1967) is brought to our attention to argue in favour of context equipped as theory - “we routinely bring to situations of interaction a tacit awareness of the normative expectations relevant to them and an intuitive appreciation of the consequences that might follow from breaking them” (McCarthy, 1994: 65). Normative expectations and consequences imply shared tacit propositions. It is in this ethnomethodological sense that context supports the capacity to exercise judgement (Tsoukas and Vladimirou, 2001). Anchoring on the knowledge propositions of Tsoukas and Vladimirou (2001) and Boisot and Canals (2004), which capture the most relevant arguments and criticisms regarding the data-information-knowledge continuum, a subset definition of knowledge is posited:

Contextual knowledge is the individual capability to exercise judgment and act based on generalisations discovered mainly by tacit rules of inference regarding a domain of experiences – appreciation of context; that is, based on the appreciation of contextual information regarding a domain of experiences; that is, characterised by the interrelated what, who when, where, how and why about a domain of experiences.
5. An ontological context continuum approach to knowledge integration

Now, understanding context as continuum and approaching its formalisation from an ontological perspective allows retaking the understanding of the knowledge integration process.

- Increasing the level and sophistication of organisational common language is a syntactic issue that in terms of the context continuum ask for the articulation and sharing of the what, who, when, where of organisational repertories. This articulation is the equivalent of a back-of-the-book index (Pepper, 2002) of what the organisation is about. Like in books, different type of taxonomies can be conceived, each comprising different organisational themes - business lexicon, stakeholders, products concept, services concept, business processes, and technology platforms. In each of these taxonomies there is a list of relevant organisational terms and their synonyms. For each organisational term in the taxonomy there are references to the occurrences of specific practice experiences – the “what, who, where and when” of specific experiences. The described organisational taxonomies closely represent the perceived organisational context.

- Improving the level and sophistication of organisational shared meanings is a semantic issue that in terms of the context continuum asks for the discovery of propositions that establish interrelationships among the organisational terms of discourses, circumstances and events. It involves the identification of practice experiences revealed as examples or counterexamples of such a relationship. Briefly, it includes a) propositions that interconnect - associate - topics of organisational repertories – those taxonomies defined to increase the level of common language, and b) the identification of the occurrences of practice experiences linked to the terms that participate in such association.

- Facilitating the recognition of individual knowledge domains is a syntactic and semantic issue; it is related to who knows what. In terms of perceived context, it calls for a) the identification of organisational stakeholders’ roles and b) a categorised knowledge domain inventory. In terms of contextual information, it calls for propositions that associate the categories of the knowledge domain inventory with organisational stakeholders’ roles. Briefly, this implies a mapping characterised by: a) knowledge domain taxonomies associated with organisational stakeholders’ roles.
with stakeholder taxonomies, and b) the identification of occurrences of practice experiences - what, who when, where – that reveal examples and counterexamples of such association.

- Integration of knowledge in products and services is a pragmatic issue mainly assisted by contextual knowledge, that is, it implies the use of generalisations and execution of work related activities base on the appreciation of contextual information.

These organisational taxonomies, their associations and the reference to occurrences of practice experiences can be understand as the constituting characteristics of an ontological approach to the formalisation of context and provide a framework for the understanding of the link between common knowledge types and the efficiency of the knowledge integration capability and contribute to its eventual operationalisation.

6. Discussion and conclusion

Knowledge-base theory of the firm argues for a positive relationship between the level and sophistication of common knowledge types - common language, shared meaning and recognition of individual knowledge domains, and the efficiency of the knowledge integration process which have been proposed to have a link with the strategic advantage view. Considering that in this view, to the best of my knowledge, common knowledge types have not been tested or operationalised and that given the broad scope of these independent variables, this paper takes the challenge to elaborate on conceptual specificity that allows the understanding and formalisation of an approach to common knowledge types that contributes to its eventual operationalisation. In this endeavour, it is necessary to understand common knowledge and their types, but in particular, it is essential to achieve a characterisation of the domain in regards to which “common knowledge” is common. This domain was identified as the organisational context and found that context definition has been admitted as an obvious issue but without adequate explanation. Existing relevant literature reviews regarding approaches to context formalisation were considered in order to compare, analyse and reclassify the context approaches. This effort was a search for the characterisation of a boundary object that explains the links between knowledge integration capability and the identified common knowledge types.

Among the reviewed models, the ontological model, given its capacity to handle all common knowledge types and its general purpose context formalisation mechanism, was the selected approach to elaborate on. The boundary objects approach and the data-information-knowledge continuum approach reveal: a) an extensive description of context - a subset related to the syntactic-semantic-pragmatic continuum; b) a continuum human involvement dependence: data and perceived context are related to discrimination capacity and information and contextual information are related to inference, and knowledge and contextual knowledge are related to judgment and action. This ontological contextual approach contributes to the understanding and eventual operationalisation of the knowledge integration process, as follows: 1) organisational common language is a syntactic issue that in terms of the context continuum requires the articulation and sharing of the what, who, when, where of organisational repertories, 2) organisational shared meanings is a semantic issue that in terms of the context continuum demands a) propositions that relate the topics of organisational taxonomies and b) the identification of the occurrences of practice experiences linked to the terms that participate in such association; 3) recognition of individual knowledge domains is a syntactic and semantic issue; it is related to who knows what. In terms of perceived context, it requires a) the identification of organisational stakeholders’ roles and b) the identification of a categorised knowledge domain; 4) integration of knowledge in products and services is a pragmatic issue mainly assisted by contextual knowledge. The ontological context continuum approach to common knowledge does not only configures a proxy to Grant’s (1996) knowledge integration process – the case of the knowledge exploitation approach; but also it complements Carlile’s (2004) integrative framework for managing knowledge across boundaries when innovation is desired - the case of the knowledge exploration approach. Finally, it opens possibilities for the elaboration of prescriptive models that support the integration of knowledge during routine operations of the organisation.

References

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Becoming a “Sense-and-Respond” Academic and Government Organisation

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Abstract: The Information Resources Management College is the largest of four colleges of National Defence University, the pre-eminent U.S. graduate-level institution responsible for educating military and civilian senior leaders across government for national security. The college, dedicated to developing information leaders who can leverage information and information technology for strategic advantage, is rapidly becoming an adaptive enterprise. The college is transforming into a “sense-and-respond” organisation (Haeckel, 1999), that is increasingly netcentric and agile, an essential quality for survival in a dynamic Information Age environment. By engaging more directly with stakeholders, the college is sensing the learning needs of government organisations. In response it is re-designing current, and designing new, educational programs, re-framing its courses into professional development seminars, and designing tailored educational services to meet the learning needs of government organisations. Via its large distributed learning program, the college reaches students around the world, and is expanding its current global reach by supporting communities of practice aligned with perceived stakeholder interests. It is also encouraging faculty participation with networks of government, academic, and private sector stakeholders to enrich learning. Cross-boundary communication, collaboration, and leadership are valued as essential to better government and the agility of the college, and are infused as curricular organisational goals. As part of its transformations, college leaders streamlined the organisational design to create teams of faculty to develop and deliver programs. Replacing command-and-control systems, the leaders are adapting the organisational context by re-framing the organisation’s reason for being, governing principles, and high-level business process design. While continuing to offer credit-bearing courses and programs consistent with the academic traditions of a graduate school, the college is transforming from a “make-and-sell” organisation to a “sense-and-respond” organisation that models agility in today’s information-driven federal government environment.

Keywords: Agility, sense-and-respond, transformation, netcentricity

1. Introduction

Ubiquitous information and communication technologies are defining the Information Age. Our personal, professional, and organisational lives are radically changed by 24/7 communication and information on demand at our fingertips. Resulting freedoms from the constraints of real time and space are leading to the globalisation of the economy, culture, and values. Decision cycles are compressed because of nearly synchronous communication and accelerating expectations for engagement. The behaviour of customers and competitors is no longer predictable. Annual strategic planning cycles are being overtaken by demands for greater responsiveness that can only be achieved through increased organisational ability to gather information from the environment and to respond effectively and quickly. Rapid prototyping and speed to market are essential. Successful organisations need to leverage information and information technology for strategic advantage to survive, be sustainable in, and help influence the unpredictable world. They need to develop new capabilities for global connectivity, real-time collaboration, rapid and continuous information-sharing that facilitate shared situational awareness, boundary-less interaction and leadership opportunities, ubiquitous access and transformation of organisations to the Information age. In the defence arena this set of capabilities is called net-centricity, defined as people, processes, and technology working together to enable timely access to information, sharing of information, and collaboration among those who need it the most (Grimes 2004). Netcentric communication and collaboration will allow large, complex organisations to survive by adapting systematically, with flexibility, agility, and responsiveness (Haeckel 1999). They must go beyond the traditional model of “make-and-sell” to develop their information-gathering, decision-making capabilities, and internal operations to “sense-and-response” to meet evolving customer needs.

While all organisations will need to operate to some degree as “make-and-sell” organisations, they will need to grow their capacities to sense and respond if they are to compete in the 21st Century marketplace. By gathering and leveraging information, these organisations will be able to customise products and services to meet the needs of their current and new customers. The more customer-focused, net-centric, and agile they become, the more real-time information they seek, receive, process, and use to make
decisions in response to the unknown and unexpected. But how can government, the quintessential hierarchy, transform its bureaucratic systems and organisations for the 21st Century? The specialised and rule-based processes of the Industrial Age federal bureaucracy grew in response to the size, complexity, and demands of government of an earlier time. Today, however, the inefficiency, opacity, cost, and unresponsive nature of government are out of line with Information Age opportunities and expectations, demands for efficiency, and impatience of citizens, suppliers, and employees. While there are some innovative efforts for e-government underway, the fundamental culture, nature, and core processes of government have changed little so far in the Information Age. Despite its traditional hierarchical structure based on command-and-control systems and culture, the U.S. Department of Defence is committed to transform to netcentricity to make agile and sense-and-respond behaviour and cultures possible. Higher education is another very tradition-bound institution. While it is taking advantage of information and communication technologies for many of its functions, the culture and core functions of teaching and learning at most institutions are still very traditional. A few innovative, responsive, “sense and respond” units of traditional universities or the new entrepreneurial universities are becoming net-centric and agile, but both higher education and government are still primarily “make and sell” institutions, and by their very nature adapt very slowly to environmental changes.

In the mid-1990 the Information Resources Management College, National Defence University, began to embrace the concept of netcentricity. While maintaining and enhancing its academic rigor as a college in a regionally accredited graduate institution the college began transforming from a traditional Industrial Age to a net-centric college. Currently, the college leverages the power of the underlying concepts of the network and is now reaping its benefits including: 1) a global student body who demands continuous life-long professional learning; 2) a 24/7 virtual learning environment that allows students, faculty, and staff to meet their needs from any location when they are ready to learn or do business; 3) faculty who are globally networked with their scholarly and professional colleagues in order to develop and deliver dynamic leading-edge curriculum; and 4) a network of partners who collaborate to advance the institutional mission of preparing national security leaders to leverage information for strategic advantage. Being net-centric allows the college to sense and respond to today’s dynamic unpredictable environment. The college pulses current student, stakeholder and organisational needs and business environments worldwide, and anticipates the future. It fosters an agile culture in which innovation and initiative, self-organisation and governance drive its operations and policies. The college is actively engaged in its network of respected partners. Its business processes meet the dynamic information demands and expectations of its students, faculty, and staff. The appropriate hardware, software, courseware and databases enable information gathering and sharing, and support of an engaged academic community. This paper describes the essential elements and stages of transformation to a net-centric agile - sense-and-respond - organisation and how one college strategically transformed. The final section of the paper proposes the college as a model for a net-centric agile government and academic organisation that might serve as a model for other organisations.

2. Sense-and-respond organisations explored

Net-centricity, as defined for business in the 21st Century or the future military force, has five capabilities: global connectivity; real-time collaboration; rapid and continuous information sharing that leads to shared situational awareness, boundary-less interaction and leadership opportunities; and ubiquitous access (Lentz 2002; Office of Force Transformation 2005; R. H. Smith School of Business 2004; Peat 2003; Zavin 2004). “Net-centricity creates an information-rich environment populated by vastly increased number of valuable information sources that can be effectively discovered and utilised by those who need and can benefit from it” (Fritzson 2005, p. 2). It is a “transformation enabler that empowers all users with the ability to easily discover, access, integrate, correlate and fuse data/information that supports their mission objectives” (Zavin 2004, p. 4). The desired outcomes of net-centric communication are decision-making that is timely, informed, more robust and dispersed, and authority and responsibility dispersed across a flatter organisation (Lentz 2002; Myers 2004). Initiative, adaptability, and innovation are encouraged because members of the net-centric network are engaged, informed, and empowered (Peat 2003).

Effective real-time information allows an organisation to develop its capacity to sense and respond. According to Haeckel (1999), in sense-and-respond organisations adaptiveness takes precedence over efficiency because change is continuous. In contrast with make-and-sell
organisations in which change was predictable, efficiency was the priority, and planning could take place on long-term cycles, sense-and-respond organisations are designed to gather and act upon their dynamic and unpredictable environment. The needs of customers become the engine driving a company's operation. In response, the organisation changes, and context and coordination replace command and control. Employees are empowered to respond to customer needs within the well-understood mission and parameters. The organisation is engaged in anticipating and pre-empting the actions of customers and competitors.

If growth is finding and developing new ways to establish sustainable competitive advantage, operational effectiveness, productivity, and efficiency though necessary, are not enough. According to research conducted by Gartner, today's companies must innovate and create new market segments, distribution channels, product categories, service offerings, and production processes (Austin, 2006). Companies must be agile in order to deal with, explore and analyse the unknown or unexpected, and collaborate with others. "Agility is the ability of an organisation to sense environmental change and respond efficiently and effectively to that change" (Plummer and McCoy 2006, p. 1). Four fundamental capacities enable organisations to increase their agile performance: awareness, flexibility, adaptability, and productivity. Awareness is proactive sensing and data gathering. Flexibility is the ability to respond appropriately to expected changes, while adaptability is the ability of the organisation to respond to unexpected changes by adding options. Productivity is the capacity to respond effectively and efficiently with substantial internal changes that require innovation, involve risk, and are potentially disruptive (Plummer and McCoy 2006).

In order to sense and respond effectively and efficiently the leadership of adaptive and agile organisations must be more distributed than in command-and-control hierarchical organisations. Decision-making must be more decentralised in a culture in which the purpose and scope of the business are clear to everyone (Haeckel 1999, p. 93). Governing adaptive organisations requires a context for behaviour, not a means for dictating it. The context consists of three elements: a reason for being that articulates the organisation's essential purpose, governing principles that set boundaries on allowable behaviour, and a high-level business design for how critical elements interact to fulfil the reason for being (p. 103-4). Transforming to a sense-and-respond organisation requires leadership commitment to create a new culture, capacities, systems, rewards, and behaviour.

3. One college's transformation to net-centricity and agility

During its mid-1990s environmental scan, the Information Resources Management College assessed and anticipated the changing needs of its students and stakeholders. Its prospective student population (mid to senior level government leaders) would soon realise its need for continuous life-long learning, flexible, reliable, and robust information, and on-demand communication systems driven by the global nature and information intensity of their jobs. The operational tempos of their organisations would likely continue to increase, keeping these professionals chained to their offices or in the field, and out of traditional classrooms. Budgets were almost guaranteed to be tightened with support for traditional in resident learning at risk. In response, the leadership deliberately set a course toward agility and net-centricity. To achieve this vision they evolved five enterprise practices (Figure 1: Practices of Agile and Net-centric Organisations): sense and respond to the current environment while anticipating the future, transform and model leadership of a net-centric agile culture, build and link to collaborative networks, create processes that are net-centric enablers, and identify and resource technologies that are net-centric enablers.

Figure 1: Practices of Agile and Net-centric Organisations

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3.1 Sense and respond to current environment while anticipating the future

Only by scanning the environment and anticipating its direction, characteristics, and potential opportunities can a net-centric
In response, the college now offers courses in at least four formats that vary in length and delivery mode. The longest program of eight courses leading to the Chief Information Officer Certificate is fourteen weeks in residence, but the same certificate can be earned by taking eight separate courses over four years in three delivery modes. Most students still come to campus for courses. Approximately 20 percent of all course enrolments are interactive seminar distributed learning offerings that have no residential component. For about 5 percent of enrolments, the college conducts residential course offerings at the students’ location to accommodate their particular constituencies’ needs. The college has expanded the array of programs into specialised areas (e.g., enterprise architecture and information technology project management) in response to requests by students, alumni, and stakeholder organisations. Listening to stakeholders who report that a segment of their workforce needs learning delivered in individual courses but are not interested in credit for certificates or graduate degrees, the college is now actively recruiting students for professional development as well as certificate and graduate credit. The college is also offering workshops on requested topics of varying depth, for various audiences and purposes. This responsiveness to expressed stakeholder needs and interests has led to exciting engagements for many faculty members and increased the college’s reputation. Being responsive requires adjusting the workload metrics and rewards for faculty, as well as curriculum development and contracting for new products. The college is also expanding its global reach to offer courses and to share curriculum with faculty in collaborating international institutions.

Government employees who become students of the college require access to education that offers them opportunities to think strategically about Information Age issues and challenges with their multi-agency peers. The college’s students and faculty are technologically savvy and demand global 24/7 access and efficiency to satisfy their learning and business needs. To stay relevant to students, stakeholders, and faculty the college has become more net-centric and agile in its educational offerings and delivery systems, leadership and culture, networks, learning and business processes, and supporting technologies.

3.2 Transform and model leadership of a net-centric agile culture

The college leadership is transforming the college into a net-centric agile organisation from one that was more traditionally governmental and military in its culture, hierarchy, internal focus, department-centric, residential location, and paper-based curriculum and business processes. To become an agile organisation the college leadership must model and support collaboration, rapid and continuous information access and exchange, and global connectivity. The college leadership is evolving the culture by encouraging, rewarding, and modelling collaboration across diverse functions and departments both internally and externally. By sharing information and pushing responsibility for decision-making downward to department chairs and faculty members means that the leadership is distributing accountability and responsibility for quality. The leadership of the college regularly and deliberately communicates its expectations for curriculum and instruction to become net-centric, i.e., every course is to be enriched by e-learning so that enrolled students, even in resident offerings, can access e-learning lessons in the distributed learning formats in case a natural or man-made emergency prevents delivery of instruction on campus. The leadership expects faculty to foster valuable network partnerships in their academic and professional fields. To set the context, leaders articulated a clear sense of mission and purpose, the governing principles that set boundaries for distributed leadership and responsibility, and a high-level business design (Haeckel 1999). The college leaders set strategic goals that require net-centric operations to provide learning opportunities for students, business processes of the college, and professional and organisational partnering, cross-boundary collaborating, and global connectivity in physical and virtual space. To increase its partnerships the college expanded its engagement with private sector and public institutions, domestic and global, for concept development, academic programs, and timely learning. The college’s pioneering efforts in telework policy that led to a national award in 2004 required the integration of new technologies, business process, and policies for communication,
productivity, and trust. Faculty are equipped with the appropriate hardware, software, and communication resources to facilitate learning, advise students, conduct research, and participate in college operations 24/7 remotely, even internationally, as necessary. The college facilitates net-centric teaching via its very successful interactive distributed learning (DL) model by weighting DL teaching as time and a half credit in calculating faculty teaching loads. In every one of its academic programs, the curriculum explicitly addresses the net-centric concepts of cross-boundary leadership, communication, and collaboration.

3.3 Build and link to collaborative networks

Effective networks are composed of partners who participate for mutual benefit (Peat 2003; Zain 2004). The networks of the college are composed of stakeholders, academic and professional colleagues and organisations. Fluid self-organising student- and faculty-accessible ubiquitous communities of interest are forming to share information, knowledge, and businesses processes across these networks. In net-centric organisations networks must be extensive and robust, and connectedness with networks must be ongoing, meaningful, and sensing. The college recognises the value of building and maintaining its reputation as a partner of choice in its niche, information leadership and information resources management. It is committed to engage appropriate stakeholders in the private sector, international, defence and federal government organisations, and other strategic decision makers and communities of interest in knowledge sharing and creation. Students while enrolled in courses over a two- to four-year period are repeatedly and deliberately encouraged to be active members of the learning community in and out of class to meet their professional and organisational needs, and to continue as alumni. Connected and involved alumni provide essential feedback on current and future issues in their organisations, offer students perspectives that enrich theory and research, and contribute as valuable members of the college-supported communities of practice that underpin the college’s network. Effective networks engage partners from international, domestic federal, state, and local governments as well as the academic and private sectors with common interests who appreciate the power of, the need for, and benefits of sharing. Network-centric organisations recognise that knowledge shared is stronger and more valuable than knowledge that is held, especially information with a short shelf life, and particularly in situations with increased operational tempo. Through its expanding network of partners, the college enlarges its knowledge base, satisfies student demand for network growth (McCully and Schulin 2004), connects to key stakeholders and experts in multi-levelled networks, and looks for opportunities to collaborate as a respected global network partner.

One year ago the college embarked on a multi-faceted outreach initiative. In focus groups stakeholders were invited to articulate their perspectives about the uniqueness and value of the college. Their perspectives led to key messages and branding of the college and its programs, and new outreach products such as brochures, posters, a website, a student centred command briefing, and conference booth. These products are designed to communicate with stakeholders about the college and its courses, programs, and services to meet their workforce needs and to offer strategic partnership opportunities. The college is keeping track of interfaces, constituencies, and stakeholders with whom faculty and leaders have contact, and the follow up that is necessary and desirable. As a result, the network of partners is expanding exponentially, enabling the college to collect more real-time information, which it is using to adapt its courses, programs, and services to meet stakeholder needs. The college, consistent with its new key message, “a learning community for government’s most promising information leaders”, launched a web-based system to support communities of practice in the information resources management field. Faculty and other organisations, supported on the system purchased and managed by the college, have launched approximately six communities. The college’s community of learners, formal and informal, local and global, as well as U.S. and international, is growing and expanding virtually everyday.

3.4 Create processes that are net-centric enablers

Net-centric organisations create processes that enable global connectivity, real-time collaboration, rapid and continuous information exchange that is boundary-less and ubiquitous, and access to data and information that is secure and reliable. In a net-centric agile higher education organisation, these capabilities require processes very different from those used in the traditional hierarchical academic, government, or military organisation. They involve processes at the learning and business levels that virtually reach and connect beyond the campus to deliver equal or better e-services to faculty, students, and partners. In the mid-1990s, the college began exploring tools and technologies to create media-rich instructional
materials and experimenting with e-learning environments to support the interactive seminar model, first for students in residence and then online. By fostering innovation and developing consensus about the learning principles and models, technology, and tools, the college began creating its highly effective virtual learning environment. In this environment student are active builders of knowledge and faculty are innovators in the teaching and learning process. Another core process, the collaborative development of interdisciplinary curriculum, engages faculty from across the college and relies on net-centric 24/7 access from campus, home, or any global location to each other and to curriculum materials and courseware on shared network drives. Curriculum documents are electronically available and archived, as are instantiations of each distributed learning offering.

The ability of adult students to travel to campus for resident course offerings is often limited by competing job requirements and organisational funding. But students continue to need and want access to high quality professional development, graduate learning and opportunities to network with others engaged with the same professional challenges. In response the college offers all courses in residence on campus as well as in asynchronous distributed learning (DL) format to meet student needs for learning and networking anytime and any place. Both modes create very interactive learning environments and are of equal high quality (McCully and Schulin 2004). Currently over 20 percent of the college’s total offerings are in the DL mode for students who live locally, across the country, and around the globe. Enrolment in DL continues to increase. Most of the college’s other core processes have become net-centric, enabling all members, on and off campus, to meet their needs effectively when conducting the business of education. Student (and faculty) access to all the library resources is another process that is transformed. All enrolled students have 24/7 password-controlled web access to library resources. The college’s processes for application and registration for courses and programs are now web-based for global student access and action. Faculty, staff, and students are able to access course content, schedules, and password-controlled student records that reflect real-time reliable data information. The faculty and staff can order course materials; schedule classes and rooms; arrange, approve, and request reimbursements for travel using the web-based 24/7 systems.

3.5 Identify and resource technology that are netcentric enablers

Netcentric capabilities allow the college to sense and respond to student, stakeholder, and practitioner interests and needs, share information, and facilitate learning. A networked college community is enabled by information and communication technologies that are based on an architecture that considers security, reliability, affordability, expandability, interoperability, and is deemed user-friendly by faculty, staff, and students on site and in remote locations. Net-centric technologies enable global connectivity, real-time collaboration, continuous information sharing, boundary-less interaction and leadership, and ubiquitous access. The software that supports the college business processes is web-based, user hardware-independent, and accessible remotely. Courseware, all of which satisfies federal legislative mandates to meet the access needs of students and faculty with disabilities, is supported on the Blackboard course management system. It allows faculty to conduct interactive courses that are globally accessible via dial up or digital high-speed link connections by students across town, country or globe, or in the campus classroom. Access to all data and course information is password-controlled to protect the student privacy, comply within the copyright laws, and respect intellectual property of faculty. Instructional designers partner with faculty to develop media objects to enrich learning materials.

Mobile communication devices support global connectivity of the faculty and leadership to promote shared situational awareness, informed decision-making, and self-synchronisation. Relational databases are being designed populated and access friendly to provide onestop-shopping for most business activities. A new curriculum management system is being implemented to facilitate the management of a collaborative curriculum development process, and knowledge management to support version control and archiving of documents, media, and curriculum. Commercially developed software supports the communities of practice initiative that is expanding the college's traditional role in education with more continuous, informal, just-in-time, facilitated communities of practice. As described, the net-centric mission and strategy are driving the major resource decisions of the college.

4. Conclusion

In the mid-1990s when it scanned the environment and anticipated the frontier beyond the horizon, the Information Resources
Management College deliberately and enthusiastically embraced evolving net-centric concepts as essential to it ability to sense and respond to the ever changing needs and expectations of its future students. These students wanted, needed, and more importantly, expected global boundary-less and ubiquitous access, and an “information rich environment populated by vastly increased number of valuable information sources that can be effectively discovered and utilised by those who need and can benefit from it” (Fritzon 2005, p. 3). The college sensed the power of the network paradigm, now called net-centricity, and commenced a transformation to exploit it, thereby creating a new model for a government and academic organisation. The college recognised this comprehensive initiative would demand a significant investment of time and money, and require major departures from the familiar and comfortable traditional hierarchical academic and government models. The college would have to change its systems for sensing and responding to the environment, its leadership policies and derived culture, its role in an expanded partnership community, its internal processes and educational models and products, and the priorities and capabilities of its technologies. The college’s students, life-long learners employed around the world in demanding senior-level positions, information and technologically savvy and already very cognisant of the power of networks, were demanding net-centric educational models and e-services. The decision was obvious – transform to meet their needs and become an agile organisation.

The leadership set the course for the college to become increasingly net-centric and agile, and continues to resource the commitment. The college now has a global student body engaged in life-long professional learning and networking. Its students, faculty, and staff access the learning environment to meet their learning needs 24/7 from any location, when they are ready to learn or do business. The faculty, active participants in global networks in their areas of expertise, develop and deliver leading edge curricula in near-real time. Global and domestic partners from the private and public sectors seek opportunities to collaborate with the college on a variety of critical issues, initiatives and levels. These outcomes indicate that net-centricity, an essential element of the transformation of higher education from a hierarchical to an agile institution, meets the evolving needs and expectations of students, faculty, and stakeholders in the Information Age. As higher education institutions explore and embrace the power of the net-centric model, colleges and universities across the world are beginning to transform. This transformation requires continuous sense-and-respond behaviour toward the learning models, environment, leadership, organisations, processes, and partnership capabilities of the organisation. The innovations, evolved by the Information Resources Management College over the past ten years, will become common best practices across higher education, and innovators will continually evolve processes to meet learner needs in a competitive environment. These needs in turn will expand with higher expectations, interactive leadership, synergised partners, refined processes, and technical capabilities. Considering the rate of change we have experienced and embraced in the past ten years, the future remains unpredictable, truly challenging, and very exciting for those institutions that are responsive to the needs of their students and stakeholders. These institutions of higher education, like their students, will themselves become life-long learners with the potential for sustainable growth.

5. Disclaimer
The views expressed in this article are those of the authors and do not reflect the official policy or position of the National Defence University, the Department of Defence, or the U.S. Government.

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An Analysis of Collaborative Group Structure Technological Facilitation from a Knowledge Management Perspective

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Abstract: A range of collaborative group structures are analysed from the perspective of knowledge management enabling technologies. A framework is developed demonstrating the application and role of specific technologies in supporting collaborative group structures including Communities of Practice, Centres of Practice, Special Interest Groups, Centres of Competence and Communities of Competence. In evaluating the utilisation of such technologies, the nature, purpose and capabilities of such group structures are analysed.

Keywords: communities of practice, knowledge management, communities of competence, knowledge management technologies

1. Introduction

It is widely claimed by contemporary organisations that their most valuable asset are their employees, or more precisely the human capital these individuals possess. Human capital (HC) is defined as the “combined capabilities of knowledge, skill, innovativeness and the ability of individuals to meet the task at hand” and intellectual capital (IC), being the value creation aspect, consists largely of human capital as well as intellectual property (O'Sullivan and Stankosky 2004). In the current knowledge based economy, filled with intense competition, globalisation and rapid technological change, IC is the future basis of sustained competitive advantage (Perez and de Pablos 2003). Ulrich (1998) defines IC, in mathematical terms, as the product of competence and commitment. He further asserts that IC is the firm's only appreciable asset, and therefore, must grow if the organisation is to prosper. However, competent and committed individuals will not be able to fully contribute towards the development of IC if they don't have the opportunity by means of work autonomy (Burr and Girardi 2002). On the collective level, just getting people together will prove insufficient, unless they are also empowered and offered a chance of self-management (Mohamed, Stankosky and Murray 2004). We assert that this work autonomy dimension of IC can be activated by nurturing, facilitating and investing into highly synergetic groups such as CoPs and CoCs within knowledge intensive organisations.

In this paper we examine the differences and common ground between the different collaborative group structures in use in contemporary business organisations, namely Centres and Communities of Practice (CoPs), Special Interest Groups (SIGs) and Centres and Communities of Competence (CoCs). For many years, organisations have strived to create more effective ways to get work done and fully utilise the maximum potential of their employees. This paper is focused on establishing a guideline for the use of collaborative structures in terms of increased productivity and the optimisation of innovation.

Organisations have started to manager their intellectual capital and knowledge as assets of the organisation. Similarly, as organisations have embraced the group approach to work processes, the value of sharing knowledge in an effective manner has become extremely important. Extending this model and introducing the concepts of Knowledge Management (KM) to the mix and we end up with Communities of Practice, organic self-organised groups of individuals who are dispersed geographically or organisationally but communicate regularly to discuss issues of mutual interest (Lave and Wenger 1991). The CoP approach has been well established and has met with great success when implemented and managed correctly. However, the CoP approach is not the only methodology for achieving goals that transcend business units or organisations. In fact, if the incorrect group approach is selected, the desired results may not be achieved, or if they are achieved at all it may in a less than optimal way. Other methodologies discussed include Centres of Practice, Special Interest Groups, Communities of Competence and Centres of Competence. Throughout this article we shall examine the selection criteria for these methodologies, identifying their appropriateness for the tasks to be performed, the time frames involved in achieving those goals and the necessity and degree to which management involvement is necessary.
From the individual’s perspective, group membership positively affects individuals. Members communicating in an open forum where ideas are judged on their merit and originality rather than authority position, will experience increased self-efficacy and self-esteem. Innovative and “heretic” ideas will not be held back in a supportive and open group. Job satisfaction will be high when meaningful relationships evolve from personal contact with specific individuals (Liedtka 1998) such as fulfilling mentor relationships and further intellectual collaboration. Newer employees can gain access to more experienced practitioners (Lesser and Storck 2001) and learn from their knowledge and wisdom. Job satisfaction will be high when members are involved in challenging work in their core areas of expertise (Smith 2005) and have greater control on how to perform their work. Learning “loops” must be established as part of day-to-day work and processes involved allow individuals to continually improve themselves (van Marrewijk and Timmers 2003).

2. Collaborative group structure approaches

Prior to evaluating the appropriate technological resources for a specific group approach, it is important that an understanding of the nature of such group constructs be established. From our research we have established a range of group structures that are in common use in the contemporary business environment. Our research has also indicated that many organisations commonly do not correctly establish the form of group structure that is used to achieve organisational objectives. This may be explained by a lack of understanding in the business world as to the nature of such structures, or by a tendency to refer to all collaborative group structures as Communities of Practice. Based upon our research we have established five distinct categories of collaborative group structure with an additional structure that encompasses some of the features of the other structures. This sixth structure, Centre of Excellence, is not a major focus of this paper as there is significant enough evidence to indicate that for most organisations the establishment of a Centre of Excellence is more of a statement of capability rather than an actual collaborative structure. However, given the frequency with which this structure is used within the business environment it was felt that it at least deserved a cursory consideration within this paper.

<table>
<thead>
<tr>
<th>Structure</th>
<th>Community of Practice</th>
<th>Center of Practice</th>
<th>Special Interest Group</th>
<th>Community of Competence</th>
<th>Center of Competence</th>
</tr>
</thead>
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<td>Medium Term</td>
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<td>Formal or Informal</td>
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<td>Legitimate</td>
<td>Legitimate</td>
<td>Legitimate</td>
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<td>Moderate</td>
<td>Narrow</td>
<td>Narrow</td>
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<tr>
<td>Dispersion</td>
<td>Wide</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Narrow</td>
</tr>
</tbody>
</table>

Table 1: A Comparison of Collaborative Group Structure

As illustrated in Table 1, the nature of these collaborative group structures can be examined from a number of different perspectives. For the purpose of our research we have selected the aspects of group structure, the time frame that the group exists for, the authority by which the group operates, the power structure that tends to exist in such groups, the focus of the mandate of the structure and the geographic dispersion of the group members. Of course, we discuss these structures and the aspects of their nature in general terms and in application the structure of the group may be adapted to the specific task(s) for which the structure was established. We shall now examine these structures in greater detail so that appropriate technological requirements can be derived. However, we have illustrated the differences between these structures in Figure 1, Figure 2, Figure 3, Figure 4 and Figure 5.

2.1 Communities of practice

In examining the nature of communities of practice, it is essential that we do so from the perspective of what differentiates them from other forms of group structure. CoPs can be defined as consisting of “groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise by interacting on an ongoing basis” (Wenger, McDermott and Snyder 2002). Although, such groups have traditionally been viewed as being beneficial to the individual’s interests, they can be strongly tied to sustained competitive advantage and, thus, creating organisational value (Liedtka 1998). Importantly, they maybe collocated or dispersed geographically and may communicate by face-to-face meetings or through virtual collaboration tools. Such teams usually consist of a number of experts from similar functional areas who work together on a set of related issues or themes. The transformation of
traditional off-line communities of practice into virtual communities can improve the scope of the community. For example, the scope can be improved by extending a community of practice to another geographical site of the organisation. The transformation to virtual communities can also improve interaction efficiency and information and knowledge sharing (Koh and Kim, 2004).

It is widely established that learning is an integral and inseparable aspect of social practice (Lave and Wenger 1991). The value of social context in learning is critical because individuals discover knowledge through interaction within communities facilitated by a socially constructed process (Mohamed, Stankosky and Murray 2004). Lesser and Storck (2001) state that CoPs actively create organisational value by being an engine for the development of social capital that leads to a broader behavioural change where knowledge sharing becomes the way of doing work. CoPs can prove instrumental in helping employees achieve supportive interpersonal relationships aiding in career development and advancement by deriving information, knowledge and inspiration from social and world-related networks of peers (Smith 2005). A distinguishing and valuable feature of CoPs is their ability to operate beyond formal boundaries of an organisation. CoPs may bring together practitioners, experts and curious individuals from an array of organisations, communities and industries. In the face of a digital economy, an organisation’s ability to react and operate at rapid web-speed is becoming increasingly important. However, many organisations today still lag behind with hierarchical structures and bureaucratic processes in place. Such obstacles make it difficult to quickly respond to rapidly occurring challenges and opportunities. By fostering a motivated group of practitioners, bonded in the shared context of community, CoPs operating beyond rigid boundaries can create an agile organisation capable of increased innovation.

The largely informal and self-evolving property of CoPs creates a membership collective that is highly interest-based and voluntary. Individuals truly interested in discussing, learning and sharing in a network of the like-minded usually are members of such teams. Ulrich (1998) notes that such “volunteers” are committed to their cause because of their emotional bond to the organisation and are more interested in the meaning of their work and how it contributes to the big organisational picture than mere economic compensation. Members are constantly involved in efforts to share best practices, learn from each other and keep abreast of the latest developments in their field. From an internal organisational perspective, the long-term focus of CoPs has implications in a strategic sense. By constantly engaging intellectually curious and intelligent minds on a long-term basis, these self-organising groups can prove to be instrumental in retaining and sharing organisational knowledge, which remains largely tacit in nature. Lesser and Storck (2001) note that due to worker mobility and other factors there is a strong need to retain organisational memory. They state that CoPs can attain this goal through their ability to allow members to more easily reuse existing knowledge assets, thereby, reducing rework and preventing “reinvention of the wheel”. They also assert that CoPs are breeding grounds for innovation by serving as an interactive forum in which individuals can share a variety of perspectives on common topics and challenges.

The value creation potential of CoPs can be explained by another important characteristic. Liedtka (1998) attributes organisational competitive advantage to CoPs as they aid in the development of a broad-based set of capabilities, such as learning, collaboration, strategic thinking, and participative leadership, which are transportable across products and markets. Therefore, the power of CoPs lies in attaining these capabilities proving invaluable in a variety of settings and not restricted to a specific discipline or unit. As firms increasingly recognise the value of meaningful relationships between individuals promoting synergy, they must more importantly realise the value of these relationships in that how they can be leveraged, developed and maintained through participation in collaborative communities.

An important factor positively impacting CoPs is multifaceted dialogue among members. Unique perspectives arising from the different individual backgrounds (cultural, organisational experiences, education, training etc.) favour creation, transfer and integration of knowledge in CoPs (Zarraga and Garcia-Falcon 2003). This capacity also implies an openness to sharing one’s thoughts, a willingness to listen and understand the perspective of others and to challenge one’s own, as well others’ thinking (Liedtka 1998). Team heterogeneity is a source of synergetic collaboration because people with unique experiences and backgrounds can inject totally eccentric ideas into the process (Mohamed, Stankosky and Murray 2004). In this way, such intellectual conflict and reasoning can be seen as positive and beneficial in developing viable processes, decisions and strategies. CoPs can serve as an intellectually stimulating environment where cutting-edge solutions to unstructured problems are formulated by means of open discussion and exploration of new ideas.
Importance is placed upon ingenuity, effectiveness and applicability of ideas rather than formal authority. Members, with their unique experiences, create and share new knowledge that is not only useful today, but also serves as the basis of future knowledge acquisition.

2.2 Centres of practice

Centres of Practice have been used from an organisational perspective for many years and follow the standard management practice of the hierarchical approach of span of control. Of course, this does not preclude centres of practice from utilising knowledge management technologies in assisting in the accomplishment of team, business unit or organisational goals. This form of group is similar to Communities of Practice, but internal in nature with a formal management structure with power derived from a position of authority. Individuals with skills or capabilities in common are grouped into a practice that provides assignment and management oversight. In terms of the scope of utilisation of such groups with knowledge management technology, O’Sullivan and Stankosky (2004) analysed the level of success of managing intellectual capital with such technologies and found that the size of the organisation or group was a major influence on the success of a particular technological group. Other influences include the proximity of the group members in special and whether communications were best served on a synchronous or asynchronous basis.

2.3 Special interest groups

Special Interest Groups (SIGs) are open forum groups that may be either internal or external to an organisation with a particular area of focus. They tend to be more narrowly focused than CoPs in that they target specific objectives. Once the objective has been accomplished the group disbands. From the perspective of control, SIGs generally have formal leadership appointed by the sponsoring organisation. Sponsoring organisations may be companies or CoPs, for example the Knowledge Management Working Group (KMWG) of the US Federal Government, a CoP charged with the promotion of knowledge management activities within the federal government, has in itself created a SIG. The KMWG CoP SIG serves as a network of people interested in learning and sharing experiences in establishing and supporting CoPs as a means to address compelling business needs within their organisations. The CoP SIG seeks: To collect, document and share good practices related to
CoPs through site visits with the organisations willing to share their experiences in CoPs.

- To create and maintain a network for knowledge exchange on CoPs.
- To serve as a resource for the federal government on CoPs.
- To act as a “sounding board” for CoP SIG members, and use its collective wisdom to provide insights for success” (US Government Knowledge Management Working Group 2006).

SIGs are transitory in nature in that they have stated goals that once achieved lead to the disbandment of the SIG. Similarly, the membership of the SIG is dynamic as members’ interest is peaked or they become disinterested. Participation in a particular SIG tends to be a factor of member interest and availability, hence, the ability of a SIG to conform to strict timeframes is often very limited.

2.4 Communities of competence

Communities of Competence are a highly flexible and dynamic form of teams evolving from the concept of Communities of Practice. Smith (2005) proposes CoC as a new form of collaborative workgroup “whose members apply their state-of-the-art skills, abilities and knowledge to come up to speed” and which facilitates combination of separate strengths and core competences of individuals, groups and organisations into a meaningful goal-oriented whole. The most prevalent rationale behind CoCs is their fluid nature aligning well with the volatile state of the business realm full with fast growing opportunities and unexpected threats. One of their most important flexible aspects is the fact that they are assembled on an as-needed basis only for the duration of the project or goal at hand. At the very heart of CoCs lie the core competencies of their members at work and their ability to ensemble their collective competence towards the achievement of a specific goal. These groups are brought together to work on a very specific problem, attain an exact goal or new venture creation. Members must overcome learning curves in order to find solutions to the problem in question. Authority in such groups is moderately formal, but based upon competence and leadership skills. The goal-driven nature of CoCs sets them apart from CoPs and similar teams. However, there are several other characteristics that make CoCs different.

<table>
<thead>
<tr>
<th>Technology Basis</th>
<th>Community of Practice</th>
<th>Centre of Practice</th>
<th>Special Interest Group</th>
<th>Community of Competence</th>
<th>Centre of Competence</th>
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<tr>
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<tr>
<td>Extranet Based</td>
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<td>Medium</td>
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</table>

Table 2: Application of KM Technologies to Groups

An important aspect of CoCs is their cross-functional nature. Since tacit knowledge is difficult to codify and extract from documentation, a face-to-face elicitation is the an effective way to share such knowledge, hence, cross-functionality provides this platform and an effective means of leveraging knowledge to solve problems or to make decisions spanning across multiple disciplines and functions (Mohamed, Stankosky and Murray 2004). However, it is to be noted that such groups may also be virtual in nature overcoming temporal and spatial boundaries using appropriately selected knowledge management technologies as we have shown in Table 2. CoCs combine individuals from different business units, departments, positions, experience levels and functional roles. They must rapidly and intensely focus on solving a challenging problem, which requires expertise across the board.

Membership criteria for CoCs are highly selective and based on individual competence or demonstrated potential to perform at a desired level of competence. “The opportunity to function at a high level of competence is a strong intrinsic motivator” and allows individuals to be become recognised as distinguished leaders in their respective fields by becoming champions for change (Smith 2005). Being a member in such groups is reputable and prestigious as the members have access to vast intellectual capital while working with the best minds. Members of a CoC:

- Operate autonomously by self-managing and, hence, self-initiating on critical steps to complete the goal at hand.
• Must quickly overcome steep learning curve and any possible gaps in levels of current and required competence (Lewis, Wright and Geroy 2004).

• Are capable of moving fast, in that they must form collaborative relationships quickly and perform at higher speeds than traditionally expected (Lewis, Wright and Geroy 2004).

• Are predicted to outperform other traditional forms of workgroups by producing higher quality products, being innovative and completing work projects more (Smith 2005).

Mohamed, Stankosky and Murray (2004) emphasise that much improvement needs to be achieved in terms of capturing and retaining collective knowledge of such groups during their lifeline as much of the collective knowledge can get lost when CoCs disband. After a CoC wraps up, members may reassemble into new teams and the trust building must also begin anew. The authors and we assert that these teams must be integrated within the larger constrict of Communities of Practice, which promote intellectual relationships and knowledge sharing practices on a much wider scale. Therefore, allowing CoCs to be formed from existing CoPs will prove to be a more effective and optimal approach leading to their success and retention of valuable capital.

2.5 Centres of competence

While similar in nature to Communities of Competence, Centres of Competence differ in one fundamental way – the members of the centre are drawn from within the organisation. As the membership is internal to the organisation, the centre approach has the benefit of increased security, stability and supportability from an organisational perspective. However, there are corresponding drawbacks, which include a reduction in the diversity of the centre members. This drawback in itself may be enough to limit the use of Centres of Competence within small organisations, but may not be a large prohibiting factor in medium to large-scale organisations. Centres of Competence are formal groups within organisations with power derived from legitimate authority. Leadership authority is associated with a formal leadership role as opposed to an individual. The focus of such groups tends to be narrow and sell stated with stated objectives to be achieved within a relatively short time period. Once the objectives of the group have been achieved, the group may be disbanded or assigned further objectives. Members maybe employees of the organisation for the duration of the task or may be temporary or consultative to the group depending upon the capability that they offer and the requirement for that capability.

Human Resource Management (HRM) has the opportunity to play a major role in HC development, and thus, act as the strategic HRD function contributing value towards competitive advantage and wealth creation (van Marrewijk and Timmers 2003). HR must adopt an HCM approach actively focusing on the development, performance and readiness of individuals. A set of strategies must be developed and implemented by HR to support and facilitate collaborative group efforts that enhance HC. An overall competency profile of individuals must be maintained and monitored for assessment and placement in groups (Smith 2005). Traditional HR records such as resumes and CVs can be made internally available through intranet-based or groupware applications (O’Sullivan 2005). KM technologies, such as expertise locators and competence management systems, can be mixed with conventional HR documents in order to furnish an accessible, accurate and real-time competence depiction of a group or an organisation. Access to this knowledge will prove invaluable to managers, sponsors and team leaders interested in talent for groups. Successful group leaders must rely on and solicit the collective competencies of their group members (Smith 2005). HR should invest in training group leaders. Leaders must keep members motivated, therefore, individuals must be presented with challenges encouraging them to tap into their full potential and recognised for positive efforts.

Increased autonomy and the ability to self-manage are critical factors in the success of groups. HR can contribute by championing the cause of groups to management and sheltering them from hindering aspects of the norms and processes while taking advantage of the positive aspects of the organisation (Lewis, Wright and Geroy 2004). Groups should be empowered with access to tangible resources, such as financial assets, and intangible resources, such as relationship capital, throughout the organisation. HR must proactively reach out to isolated talent within the organisation and find ways to align individual interests with group focus. Membership in collaborative groups must be promoted, encouraged and rewarded by means of intrinsic motivators, such as challenging work, peer recognition (Smith 2001), learning from others and belonging to a strong cohesive group (Smith 2005), as well as non-intrinsic motivators such as salary, bonuses and performance reviews. In this day and age, organisational success will depend on the speed and effectiveness of generating, capturing and disseminating knowledge and then leveraging it to develop capabilities that cannot be easily copied by rivals (Sharkie 2003). It is clear
that supportive, interactive, learning environments built on trust, openness and collective ownership definitely encourage knowledge creation and sharing (Smith 2001), and thus in high demand situations these groups will solve problems better than isolated individuals (Ulrich 1998). Building and investing in such groups that keep up with the pace of rapid change must be a long-term strategic effort and will prove to be a source of sustainable competitive advantage, because it is difficult to imitate capabilities based on unique knowledge, intellect and organisational context.

3. The technology factor

Of course, because of the nature of the groups discussed above, technological enhancements may improve their ability to achieve their stated objective, and in fact, may be a requirement. In categorising technology, there are many different approaches taken in the literature ranging from thirty seven different categories to just two. In our research we have utilised an eight category model first utilised by KPMG in 1998 (O’Sullivan and Stankosky 2004). This model categorises knowledge management technology in terms of its core basis, in other words by the fundamental way in which it is used. In Table 3, we detail these technologies with reference to the way in which they may be used to support collaborative group structures.

<table>
<thead>
<tr>
<th>KM Technology</th>
<th>Application</th>
<th>Structure Application</th>
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<tbody>
<tr>
<td>Internet Based</td>
<td>Public Access Discussion Boards</td>
<td>Community of Practice</td>
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<td></td>
<td>Search engines</td>
<td>Community of Competence</td>
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<td></td>
<td></td>
<td>SIG</td>
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<tr>
<td>Intranet Based</td>
<td>Internal Access only</td>
<td>Centre of Practice</td>
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<tr>
<td></td>
<td>Discussion Boards</td>
<td>Centre of Competence</td>
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<td></td>
<td>Knowledge Dissemination</td>
<td>SIG</td>
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<tr>
<td>Extrante Based</td>
<td>Similar features to Internet and</td>
<td>Community of Practice</td>
</tr>
<tr>
<td></td>
<td>Intranet with the added abilities for secure intra-organisational collaboration</td>
<td>Centre of Practice</td>
</tr>
<tr>
<td>Document Management</td>
<td>Document Library</td>
<td>Centre of Competence</td>
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<td></td>
<td>Version Control</td>
<td>Centre of Practice SIG</td>
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<tr>
<td>Groupware</td>
<td>E-Mail</td>
<td>Community of Practice</td>
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<tr>
<td></td>
<td>Collaborative spaces such as discussion boards and document libraries.</td>
<td>Centre of Practice SIG</td>
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<tr>
<td></td>
<td>WIKIs</td>
<td>Community of Competence</td>
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<td>BLOGS</td>
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<td></td>
<td>Instant Messaging</td>
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<td>Conference Calling</td>
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<td>Video Conferencing</td>
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<td>Knowledge Agents / Artificial Intelligence</td>
<td>Data Analysis</td>
<td>Centre of Practice SIG</td>
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<td></td>
<td>Data Retrieval</td>
<td>Centre of Competence</td>
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<td>Data Warehousing</td>
<td>Data Retrieval</td>
<td>Centre of Practice SIG</td>
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<td></td>
<td>Data Storage</td>
<td>Centre of Competence</td>
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<tr>
<td>Decision Support Systems</td>
<td>Outcomes Analysis</td>
<td>Centre of Practice SIG</td>
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<td></td>
<td>Assessment</td>
<td>Centre of Competence</td>
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</table>

Table 3: KM Technology Utilisation in Collaborative Group Structures

The selection of the appropriate technology to support the different forms of group depends upon a number of different criteria. These criteria include the nature of the group in terms of internal / external focus, security requirements, the operational form of the group in terms of operating in the same place same time, same place different time, different place same time and different place different time. The ability to archive and access knowledge developed by the group at a future time should also be a consideration.

4. Conclusion

The application of appropriate group structure is a product of several different factors. Once the appropriate structure has been selected, technological support can be applied considering environmental factors such as security and operational considerations in terms of how the group will operate. The establishment of the forms of groups outlined in this paper tends to have a positive outcome for the organisation from a
human capital perspective. Individuals benefit from involvement in collaborative groups such as CoCs and CoPs in that they become more knowledgeable, improve their self-efficacy and relationship capital. The ability to develop solutions and ideas faster may also lead to increased innovative capabilities. Essential to the selection of the correct collaborative structure is an understanding of the nature of those structures. In this paper we have demonstrated that there are significant differences in the nature and capabilities of the structures. Although the selection of a less optimal collaboration structure may be operational in achieving an organisational goal, the methodological approach taken by the group using the collaborative structure may not achieve the goal in the most effective way. Similarly, the value added benefits of using collaborative structures may not be achieved with a less optimal structure selection. Further research into the degree to which participation in such groups has upon the level of innovation is currently underway, however, based on research conducted thus far, it has become apparent that HR must play a strategic role in facilitating groups increasing human capital. The development of human capital management profiles from the HR department is key to the increased effectiveness of organisations in the selection of germane group formats and the rapid allocation of appropriate personnel to accomplish organisational objectives and increase innovation. The implications of the move towards centres of competence are significant in an ever more dynamic business environment given the need for agility in business operations and organisational structures in today’s competitive environment.

References
US Government Knowledge Management Working Group Communities of Practice Special Interest Group, [Online], KMWG, http://km.gov/QuickPlace/kmwd2/PlaceLibrary85256C6800609A0A0.nsf
Abstract: Knowledge has long ago been recognised as an important asset for sustaining competitive advantage. Recently, the use of information technologies for knowledge-sharing within an organisation is identified as an important tool for managing organisational knowledge in order to improve business performance. This paper starts with a retrospective analysis of the basic theories that during the course of the 20th century, gave birth to the Knowledge-based Theory of the Firm. Then it focuses on Knowledge Sharing within the organisation, and the Knowledge Sharing Networks that facilitate this complicated task. Through an empirical study, it evaluates the role and the level of contribution of Information Technology functions and infrastructure among knowledge-sharing groups, for their relationship and the organisation’s performance. Finally, building upon both the theoretical analysis and the empirical results, the paper concludes with guidelines that help management to overcome existing barriers and at the same time, make Knowledge Sharing Networks the backbone of their knowledge-sharing infrastructure.

Keywords: organisational knowledge, knowledge sharing networks, information technology, organisational performance

1. Introduction

It was Plato and Aristotle who first studied the nature of knowledge. Centuries later, in the 1950s, cognitive philosophers –like Polanyi and Wittgenstein, for whom knowledge was explicit, capable of being coded and stored, and easy to transfer– carried on with scientific research in the area of social and psychological sciences, and it is not long ago that business emphasis was given on the topic. In a series of recently published management books (Quinn 1992, Drucker 1993, Nonaka and Takeuchi 1995, Prusak 1997, Davenport and Prusak 2000 among them) the implications of knowledge-based work and knowledge-based competitive advantages are outlined and the role of knowledge sharing within the organisation is highlighted. What is interesting about these books is the fact that they all integrate theory with practice, in the so-called ‘knowledge-based view of the firm’, and therefore surpass the division between academic research and management practice (Grant, 1997).

On the other hand, amongst academics, the ‘knowledge-based view of the firm’ has received influences from various research lines. Based upon Polanyi’s ‘epistemology’, the ‘resource-based theory’ (von Krogh and Roos, Wernerfelt) is acknowledged as the most dominant among them. Other research lines, like ‘organisational capabilities and competences’ (Prahalad and Hamel), ‘innovation and new product development’ (Teece, Wheelwright and Clark) and ‘organisational learning’ (Argyris) have also contributed significantly. As pioneers in the emerging ‘knowledge-based view of the firm’, one can easily distinguish the work of Robert Grant, Ikujiro Nonaka, Karl-Erik Sveiby and Georg von Krogh listed in alphabetical order and without stating, at this point, their numerous articles. The aim of this paper is to draw attention to the impact of Information Technologies infrastructure in knowledge sharing within the organisation and, at the same time, bring to light the support of certain IT functions to inter-organisational cooperation. Based mainly in the work of the above mentioned authors and researchers, this paper investigates both into the theoretical framework of knowledge sharing within an organisation and the implication it has for managers. The rest of the paper is organised as follows. In the next section we present the general framework of what is lately referred to as the Knowledge-based Theory of the Firm. In section three we focus on most specific issues of Sharing Knowledge and the Information Systems supporting knowledge-based work. In section four we present the results of the empirical study, upon which our investigation is built. Finally, in section five, we provide guidelines that may encourage industrial firms to make information technology the backbone of their knowledge-sharing infrastructure.

2. A retrospective analysis

Three theories that gave birth to the Knowledge-based Theory of the Firm and, thus, influence to a great extent the sharing of knowledge within an organisation, are briefly presented here below.

2.1 The transaction cost economics

It is mainly in the management and organisational areas where knowledge research has been focused in businesses. Scientists have long ago investigated knowledge related issues mainly due to their desire to understand why serious cost-
performance differences are noticed among organisations. It was first Robert H. Coase who with his 1937 article “The Nature of the Firm” revolved the conventional microeconomic view of the theory of the firm (as viewed in orthodox textbook chapters under titles ‘Production and Cost’, ‘Competitive Supply’, ‘Monopolies’, and so forth) with his perspective of ‘transaction cost economics’ that succeeded in linking organisation with cost. Coase’s views were neglected for almost thirty years, and they were only ultimately accepted and finally honoured with the 1991 Nobel Prize in Economic Sciences. In the new economy that emerged at the end of the 20th century, even the product-based theory has been altered. The manufacturing and transportation of physical goods from suppliers, via a factory to a buyer gave us the concept of the Value Chain (Porter, 1985). If we see the organisation as creating value from transfers and conversions of knowledge together with its customers the Value Chain collapses so the concept should better be seen as a Value Network (Allee, 2000); an interaction between people in different roles and relationships who create both intangible value (knowledge, ideas, feedback, etc) and tangible revenue.

### 2.2 The resource-based theory

Coinciding with Coase’s Nobel Award, in the last decade of the 20th century the resource-based theory of the firm (Prahalad and Hamel 1990; von Krogh and Roos 1995; Wernerfelt 1984, 1995) received attention as an alternative to Coase’s transaction cost economics and the traditional product-based or competitive advantage view (primarily of Porter 1980, 1985). Under the latter perspective, research on sources of sustained competitive advantage for organisations has focused on describing a firm’s strengths and weaknesses, isolating its opportunities and threats, and analysing how these are matched to define strategies. Under the resource-based view of the firm, research emphasis has been given to the importance of alternative organisational resources, including intellectual capital, as a source of sustainable competitive advantage. Wernerfelt in his 1984 article titled “A Resource-based View of the Firm” recognises resources and products as the two sides of the same coin, and notices that: “Most products require the services of several resources and most resources can be used in several products” and he proposes that “…by specifying a resource profile for a firm, it is possible to find the optimal product-market activities”. In this pioneering article, Wernerfelt develops simple economic tools for analysing the “…relationship between profitability and resources, as well as ways to manage the firm’s resource position over time” (p. 171).

Oddly enough, Werner felt’s article has also been neglected until 1994, when it won the annual prize for the ‘best paper’ published in the Strategic Management Journal five or more years prior. On receiving the prize at the 1994 Strategic Management Society meeting, the author used the following metaphor: “[in 1984] I put a stone on the ground and left it. When I looked back, others had put stones on top of it and next to it, building part of a wall.” (Wernerfelt 1995, p. 172). Prahalad and Hamel (1990), who picked up on what Wernerfelt called the ‘stepping stone’ strategy, start their article with an ascertainment and a prediction: “During the 1980s, top executives were judged on their ability to restructure, declutter, and delay their corporations. In the 1990s, they will be judged on their ability to identify, cultivate and exploit the core competencies that make growth possible…” (p. 79). They define core competences as the “…collective learning in the organisation, especially how to coordinate diverse production skills and integrate multiple streams of technologies” (p. 82). Their contribution has been widely recognised and Wernerfelt (1995) acknowledges, “…these authors were single-handedly responsible for diffusion of the resource-based view into practice” (p. 171).

### 2.3 The knowledge-based theory

von Krogh and Roos (1995, pp. 56-57) in the introduction to their article on knowledge, competence and strategy, are further “…building on the resource-based perspective, [in order to develop] a better understanding of how competences build firms’ competitive advantage. The point of departure is knowledge, implying that the relevant unit of analysis in competence-based prospective is the individual. This is different from the unit of analysis used both within the competitive strategy perspective (the industry) and the resource-based perspective (the firm).” According to the authors “…knowledge is not seen as a resource in a traditional meaning [i.e. financial, physical, organisational, technological, intangible, and human resources]… and differs from these types of resources in many ways;”. We deem this perspective as the common link between the resource- and the knowledge-based theories and we have considered their remarks in our conclusions section.

### 2.4 The knowledge-based theory

At the turn of the 20th century Grant, in a series of articles, and Sveiby (2001) presented in a very clear way the fundamentals of a knowledge-based theory of the firm. Let us quote Grant summarising his recent work (Grant 1995 with Baden-Fuller, and 1996a, 1996b): “Based on certain premises regarding the nature of knowledge and its role within the firm, the [knowledge-based] theory explains the rationale for the firm, the delineation
of its boundaries, the nature of organisational capabilities, the distribution of decision-making authority and the determinants of strategic alliances” (Grant, 1997, p. 451). Grant has also gone one step further, by exploring the implications of the new theory for practicing managers; an important issue that we shall further built upon in our conclusion section. According to Sveiby (2001) while competitive-based and product-based strategy formulation generally makes markets and customers the starting point for the study, the resource-based approach tends to place more emphasis on the organisation’s capabilities or core competences. Thus the knowledge-based strategy formulation should start with the primary intangible resource: the competence of people. Sveiby (2001, p. 346) believes that people can use their competence to create value in two directions: by transferring and converting knowledge externally or internally to the organisation they belong to.

- When the managers of an industrial company direct the efforts of their employees internally, they create tangible goods and intangible structures such as better processes and new designs for products.

- When they direct their attention outwards, in addition to delivery of goods and money they also create intangible structures, such as customer relationships, brand awareness, reputation and new experiences for the customers.

In both these above transactions shared knowledge, within an organisation, becomes a critical factor for the organisational performance and this is exactly the way sharing knowledge is conceptualised for the purposes of our investigation. We shall refer to this issue in more detail, in the section following.

### 3. Sharing knowledge

At its first stages, knowledge management focused on sharing knowledge related to industrial world applications. The two dominant and mostly cited examples of the 1990s refer to new product design and development, and industrial innovation. The first one, by Nonaka (1991), relates to the development of new product lines (like Matshusita’s bread making machine, the Honda City car, and Canon’s revolutionary minicopier) and persuades researchers, product designers, manufacturing and sales personnel to work together across departmental boundaries. With these examples Nonaka has made Matshusita’s software developer Ikuo Tanaka with her ‘twist dough’ identical to his SECI model, Honda’s project team leader Hiroo Watanabe with his ‘Tall Boy’ concept and Canon’s task-force leader Hiroshi Tanaka with his beer can analogy, identical to terms like ‘metaphor’, ‘analogy’ or ‘model’. The analogy to the knowledge-sharing situation that our research is focused on is very strong.

The second example refers to the sharing of what Seely Brown (1991) and the researchers of the Xerox Palo Alto Research Centre (PARC) call ‘local innovation’ in the design of usable technology by sharing the knowledge end-users have of the products under consideration. PARC research is focused on new work practices, in parallel to new products, and recognises the customer as the research department’s ultimate innovation partner. In both these classic examples, the emphasis is on the way large organisations (namely Matsushita, Honda, Canon and Xerox) used brainstorming methods and software systems for co-designing and cross levelling the knowledge within the organisation. Recently, knowledge sharing emphasises more on indirect interactions between members of different groups in an organisation, or members of a community, that are not always working at the same geographic location. Davenport and Probst (2002), in their Siemens Best Practices case book, refer to a number of organisations devoted on their staff sharing ‘best practices’ using document repositories (such as reports of past successful or failed projects, employee, product and service profiles, known as Yellow Pages) and IT-based tools for inputting and extracting knowledge from the repositories. The range of such knowledge sharing systems includes from simple document management systems that help in the storage, annotation and retrieval of documents (Gibbert et al 2000, Kalpers et al 2002), to Group Support Systems and Expert Systems that help in problem solving and decision making (McNurlin and Sprague 2004).

Classical knowledge sharing models suggest that the knowledge transfer and/or sharing process involves the conversion of tacit knowledge into explicit and vice versa. At the same time, there are processes that help share tacit and explicit knowledge without conversion; although for Nonaka and Takeuchi (1995) the conversion of knowledge from tacit to explicit and finally tacit is the basis of knowledge creation. The knowledge conversion process involves close interaction between, and complete understanding amongst key employees, the so-called knowledge group of an organisation. This team includes employees and staff (from manufacturing, quality, RandD, marketing, supplies and sales) and in most cases the end-users of the products or services created by the organisation.
3.1 Knowledge sharing networks

For knowledge to be shared effectively between, within and across organisations and persons, those who possess knowledge should make it available in an accessible place and manner and with a focus on its application. Those who seek knowledge should first be aware of the knowledge locus and, second, be capable of interpreting the knowledge within their own context, prior to applying it. In recent literature, a number of scientists have successfully addressed the topic of inter-organisational networks. Based mainly in the work of von Krogh and Roos (1996), Zack (1999) and Dyer and Noboeka (2000) we consider Knowledge Sharing Networks (KSN) as those types of networks among individuals, communities, organisations (or even between groups of organisations), which have as main common characteristic the sharing of both tacit and explicit knowledge. Dyer and Noboeka (2000) consider that a KSN serves as a locus for facilitating knowledge sharing and effective knowledge work, since it makes knowledge permanent, accessible and portable to those who need it, both inside and outside organisations. Zack (1999) proposes a framework that he calls Knowledge Management Architecture, in order to manage mainly explicit knowledge, based on two KSN elements:

- Repositories of explicit knowledge, and
- Refineries for accumulating, refining, managing and distributing explicit knowledge.

He also recognises the new organisation roles needed in order to execute and manage the refining process, and the importance of IT in supporting the repositories and processes. We shall briefly explain these two KSN elements, building mainly upon Zack (1999) and Ruggles (1998).

3.1.1 Knowledge repository

Knowledge repositories capture explicit, codified information wrapped in varying levels of context. They are used to store and make accessible ‘what the organisation knows’. They include data warehouses, which are useful in knowledge management when the mining and interpretation of their content allows employees to become better informed. More sophisticated repository approaches attempt to enfold more context around information as it is captured. According to Zack (1999) the basic structural element of a repository is the Knowledge Unit, a formally defined atomic package of knowledge content (labelled, indexed, stored, retrieved and manipulated). The repository structure also includes schemes for linking and cross-referencing the different knowledge units. A Knowledge Platform may consist of several repositories, each one with a structure appropriate to a particular type of knowledge or content. The most common types of knowledge repositories are those accumulating:

- Structured internal knowledge (or knowledge embodied in documents) like memos, reports, product oriented material, etc
- Informal internal knowledge, a less structured form of accumulated knowledge, like discussion databases, containing know-how, and usually referred as ‘best practices’ or ‘lessons learned’
- External knowledge, like competitive intelligence knowledge encompassing analyst reports, trade journal articles and external market research on competitors.

Repositories may be linked to form a ‘virtual’ repository. For example, product literature, best-sales practices and competitor intelligence might be stored separately, but viewed as though contained in one repository.

3.1.2 Knowledge refinery

The refinery represents the process for creating and distributing the knowledge contained in a repository. This process includes five stages:

- Acquisition (a firm either creates or acquires knowledge)
- Refinement (value-adding process, i.e., cleansing, labelling, indexing, sorting, abstracting, standardising, integrating, and recategorising)
- Storage and Retrieval (bridges upstream repository creation and downstream knowledge distribution)
- Distribution (mechanisms used to make repository content accessible)
- Presentation (the context in which knowledge is used influences its value).

Acquisition, refinement and storage create and update the knowledge platform, whereas retrieval, distribution, and presentation derive various views of that knowledge. For KSN –and knowledge projects in general– to succeed, organisations must create a set of roles and skills to do the work of capturing, distributing and using knowledge. The majority of researchers (Earl and Scott 1999, Zack 1999, Davenport and Prusak 2000, among others) coincide with the need of a Chief Knowledge Officer (CKO), responsible for the overall organisation’s knowledge management. As Davenport and Prusac (2000) mention, many firms in the United States and a few in Europe have already appointed CKOs, although in some of them the title may vary. It may be Chief Learning Officer (CLO), Director of Intellectual
Capital, or Director of Knowledge Transfer, just to mention a few. Zack (1999) gives a more detailed scheme of the organisational roles required, including knowledge creators, finders, collectors, and more, like organisational ‘reporters’, analysts, classifiers, and integrators. Finally, a librarian, or ‘Knowledge curator’ must manage the repository. We shall emphasise here the role of Information Technology. The IT infrastructure provides a ‘pipeline’ for the flow of explicit knowledge through the five stages of the refinery process. Using IT (i.e. the World Wide Web and Groupware) an organisation can build a multimedia repository with knowledge units indexed and linked by categories. In this way, the organisation’s explicit knowledge will be displayed as flexible subsets via dynamically customisable views. Effective use of IT allows knowledge sharing via electronically mediated channels. Explicit, factual knowledge may be disseminated by means of an electronic repository. When the exchanged knowledge is less explicit, e-mail or discussion databases are more appropriate and when knowledge is primarily tacit, most interactive modes, such as videoconferencing or face-to-face conversation are the best answers.

4. The empirical study

The empirical results used in this paper stem from an investigation that aimed to evaluate the contribution of shared knowledge and information technology to manufacturing performance. For the purpose of this research, an evaluation model was developed and survey data collected from 51 medium to large size industrial companies with a total of 112 manufacturing groups, representing 5 industrial sectors (alimentation, automotive, chemical and pharmaceutical, electro-mechanical, and textile) were analysed to test the model. The key elements of the methodology deployed for that investigation are summarised here below. Two symmetrical relationship questionnaires, worded in a reverse form, were addressed to Production and Quality or RandD managers -and their assistants- and aimed at portraying the opinion and the attitude of the two collaborating groups towards each other, in reference to sharing knowledge. In addition, the role and level of contribution of Information Technology, both as a tool and/or enabler in supporting sharing knowledge among the collaborating groups, was investigated. A last, ad hoc question evaluated the use of commonly used IT infrastructure for inter-firm knowledge sharing. The third, a performance questionnaire, attempting to measure manufacturing group performance, was addressed to senior managers or their assistants. They were asked to compare the manufacturing group under question to other comparable manufacturing groups they had managed. In addition, the level of contribution of Information Technology to manufacturing group performance was investigated and again, a last ad hoc question evaluated the use of specific IT functions on four knowledge sharing issues, closely related to the group performance. Design of the indicators was carried out using two types of measures, for every variable: a general one, where each informant was asked to assess the overall level of interaction for a specific characteristic of a particular relationship; and a multiplicative or interaction measure, where each informant was asked, for example, to assess the role of manufacturing and either RandD or quality group for each characteristic separately. Using the conceptualisation of fit as interaction, proposed by Venkatraman (1989), the measurements were operationalised as ‘manufacturing role X RandD or quality role’, i.e. by multiplying the two responses. There are a number of advantages to such a measurement scheme, as indicated by Churchill (1979) and Campbell and Fiske (1959). First, the two types of measures (general and multiplicative) can be thought of as different methods; second, it provides a stronger test for the validity of the measurement scheme, and third, it balances possible threats to validity inherent in either type alone.

Figure 1. The Proposed Causal Model
Key-informant methodology was used for the selection of our research responders, and path analysis was applied for the testing of the investigation hypotheses that were found to be fully or partially supported, by the degree of significance of the relevant paths, as indicated in Figure 1. IT constructs that were measured with the relationship questionnaires, Type A and B, are marked ITsk. Those measured by the performance questionnaire, Type C, are marked ITmp. In the following two sub-sections we are presenting the specific results of our study that make obvious the impact of IT-supported sharing of knowledge within the organisation.

4.1 Information technology and sharing knowledge

By means of the relationship questionnaires (Type A, for Manufacturing and Type B, for Quality or RandD) we measured the role and level of contribution of IT in supporting shared knowledge and the use of the Information Technology (IT) infrastructure within the cooperating groups. Here are the questions relevant to our investigation:

Please characterise the general working relationship that currently exists between the [Manufacturing] group and the [Quality or RandD] group (Questionnaire Type A), or [Quality or RandD] group and the [Manufacturing] group (Questionnaire Type B).

Use the following scale to measure constructs:

1  2  3     4  5     6     7____
Extremely Weak  Moderately About
Moderately Strong Extremely
Weak    Weak Average Strong
          Strong

In every question below, titles in brackets were customised to reflect the exact names of the participating organisations and functional groups, as they are used in every firm. The results of our investigation are presented in parenthesis here below; detailed statistical analysis is given in the Appendix, under 3.1.

A.10 In general, the role and the level of contribution of Information Technology (IT) as a tool and/or enabler, in supporting shared knowledge between [Manufacturing] groups and [Manufacturing] group is: (Mean 5,19820; SD 1,10223; Range 5)

B.11 In general, the role and the level of contribution of Information Technology (IT) infrastructure in the [Manufacturing] group is: (Mean 5,21429; SD 0,90473; Range 5)

A.11 In general, the role and the level of contribution of Information Technology (IT) as a tool and/or enabler, in supporting shared knowledge between [Quality or RandD] group and the [Manufacturing] group is: (Mean 5,54128; SD 0,95774; Range 4)

The fact that all means indicate Moderately Strong to Strong opinion supports our investigation hypothesis. That means that IT has a positive impact on the knowledge-sharing process and IT infrastructures are amply used within the collaborating groups. Finally, the use of certain IT infrastructure by the company, as a whole, is evaluated by the responses to the following multiple question:

A.12/B.12. Specifically, the use of the following IT infrastructure is:

- Intranet: Extranet:
- Groupware: Workflow:
- Internet: e-mail:
- Data warehouse:
- Other ……………:

The most noteworthy findings regarding the use of IT infrastructure by managers, or their deputies, of the three collaborating groups (Manufacturing, Quality and RandD) also strongly support our investigation hypothesis, as they indicate that:

- E-mail is used by 86,6 percent of the participating companies.
- 71 percent of the participating companies use Intranets.
- Internet is used by 42,85 percent of the participating companies.
- 30 percent of the participating companies use Data Warehouse software.
- Extranets are used by 23,65 percent of the participating companies.
- Workflow software is used by 11,6 percent of the participating companies.
- Finally, SAP, investigated under Other, is used by only 2,25 percent of the participating companies.

Percentages here refer to the sum of ‘strong’ answers (Likert ratings 5, 6 and 7) between key-informants of questionnaires A and B. For simplicity purposes we have grouped ratings of the 7-points Likert scale into three categories:
Extremely Strong, Strong or Moderately Strong = Strong; About Average = Average, and Extremely Weak, Weak or Moderately Weak = Weak. It is noticeable that, in certain areas, there is room for improvement and we shall come back to that in our conclusions.

4.2 Information technology and manufacturing performance

By means of the performance questionnaire (Type C) we measured the role and level of contribution of IT in supporting the performance of the manufacturing group. Here are the questions, relevant to our investigation: The following questions ask you to compare the [Manufacturing] group to other such Manufacturing groups. In relation to other comparable groups you have observed, how does the [Manufacturing] group rate on the following:

Use the following scale to measure constructs:

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In approximately 95 per cent of the manufacturing units under investigation, the two stakeholders that completed the performance questionnaire were related one to Production and the second to Quality or RandD (in most cases Production or Quality Directors). For reasons related to our initial study, we treated the answers separately (A for Manufacturing and B for Quality or RandD stakeholders), although this does not affect results here. The interesting results of our investigation are presented in parenthesis here below; detailed statistical analysis is given in the Appendix, under 3.2.

C.A7 In general, the level of the Information Technology (IT) Contribution to the [Manufacturing] group performance is: (Mean 5,17857; SD 0,91252; Range 5)

C.B7 In general, the level of the Information Technology (IT) Contribution to the [Manufacturing] group performance is: (Mean 5,38393; SD 0,72591; Range 4)

CA/B8 In general, the use of the Information Technology (IT) infrastructure, among the three groups is: (Mean 5,22321; SD 0,94640; Range 4)

It is noticeable that no significant difference is observed between responders of questionnaires A and B, regarding question C.7. Here again, the fact that all means indicate Moderately Strong to Strong opinion supports our investigation hypothesis. That means that IT has a significant contribution to manufacturing performance and that IT infrastructures are amply used within the collaborating groups. Finally, the use of certain IT functions by the company, as a whole, is evaluated by the responses to the following multiple question:

CA/B9 Specifically, the use of the following IT function is:

- Coordinating business tasks:
  (collecting, facilitating, sharing, etc. information)
- Supporting decision-making:
  (reaching the right information at the right time)
- Facilitating member team to work together:
  (no matter where they are)
- Facilitating access of information in Data Bases:
  (no matter where they are)
- Other ………………………:
- Other ………………………:

Research findings, regarding the use of certain IT functions, do support our investigation hypothesis as they indicate that:

- Facilitating access of information in Data Bases has been reported as an IT function used by 84,4 percent of the participating companies.
- 82,6 percent of the participating companies use IT to coordinate business tasks.
- Facilitating team members to work together has been reported as an IT function used by 76,4 percent of the participating companies.
- 69,2 percent of the participating companies use IT to support decisions making.

Percentages here refer to the sum of ‘strong’ answers (Likert ratings 5, 6 and 7) given by key-informants of questionnaire C. For simplicity purposes we have grouped ratings of the 7-points Likert scale into three categories: Extremely Strong, Very Strong or Strong = Strong; About Average = Average, and Non-Existent, Very Weak or Weak = Weak.

More details on the initial study (sample, research design and instruments) and the complete analysis of the results (for all constructs, the regression equations, and the confirmatory tests) are given in the relevant sections and Appendixes of a Doctoral Thesis available in the database of the UPC (Universidad Politécnica de Catalunya, in Barcelona) at http://www.tdx.cesca.es/TDX-1019105-081507.
5. Conclusions and guidelines for management

As the 20th century drew to a close, companies, guided by a new logic of value, tended to consider knowledge and its circulation among cooperating groups as a driving force in order to gain sustainable competitive advantage (Davenport and Probst 2002; Grant 1997). This paper has identified particular aspects in the knowledge sharing process that create problems for both the Knowledge Sharing Networks and the knowledge management system in use. These are some of the most common ones:

- Discrepancies among the various versions of information stored in different locations of the KSN.
- Extensive use of personal (or group) information stores and the absence of easy-to-use indexing systems.
- Over-dependence upon sharing explicit knowledge and information, as the tacit one is more difficult to flow.
- Loss of skills developed due to collaboration, as they are not transferable through the KSN.
- Over-dependence on the KSN, and thus minimisation of face-to-face contacts.

In business environments where these situations are not overcome, they may result in inefficiencies, which may, in their turn, produce a negative influence on the performance of the organisation. Academics and economists have argued that in an environment characterised by globalisation, increasingly strong competition and the growing complexity of new products, knowledge sharing within the organisation is a key contributor (Ciborra and Patriotta 1998; Gibbert et al. 2000; Drucker 2002). Under this new shift, and by putting into practice the main findings of our study, managers should make sure that employees:

- Include in their objectives the task to share knowledge and available information with colleagues in cooperating groups;
- Are entirely aware of the information technology resources available, and especially the KSNs, within the organisation.

In doing so their companies will take maximum advantage of the positive role that IT-based knowledge sharing may play on the performance of their group and the organisation. One particular result of our study (only 20.95 percent of the managers and creative workers among the participating companies use groupware software) is a strong indication that there is room for improvement in this field. This, combined with other positive findings about information and communication technologies supporting cooperation (the e-mail with 86.6%, the Intranets with 71% and the Internet with 42.85%, all appear to be amply used), indicates that the infrastructures do exist for further improvements.

Despite the high percentages regarding the use of IT functions reported in our study and indicated below, managers should not moderate their efforts to ensure that shared knowledge and information technology are best exploited for the four IT functions they are primarily designed to assist. This will be achieved by:

- Coordinating business tasks, reported by 82.6% of the participating companies and by facilitating teamwork, reported by 76.4%. Thus, most of the factors that unfavourably affect operating efficiency among the collaborating groups may be eliminated.
- Supporting decision-making processes, reported by 69.2% of the participating companies. In their effort to make better decisions, employees have the option to search for accurate information usually possessed by their colleagues in another group. Implementing decision systems will allow them to capitalise on opportunities and to defend the group against threats already recognised in one of the cooperating groups.
- Facilitating access to information in Data Bases, reported by 84.4% of the participating companies. In this way collaborating group members may improve their intellectual skills and may use the accumulated experience to increase manufacturing performance.

To conclude, getting value out of knowledge sharing requires more than technology. Knowledge is inherently hard to control as it is ever expanding and unpredictable. Only when executives view knowledge in this light will they manage it for most effective use. It is in the hands of management to increase organisational performance, by improving the channels for knowledge to be shared among the organisation and by selecting the information technologies that best fit its innovative efforts and competitive strategy.

References

Appendix

Information technology and sharing knowledge

A.10. In general, the role and the level of contribution of Information Technology (IT) as a tool and/or enabler, to support shared knowledge between [Manufacturing] group and [Quality or RandD] group is:
### Variable: A10

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### Variable: B10

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<td>95% Confidence Interval for Sigma</td>
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<td>95% Confidence Interval for Median</td>
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</tr>
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</table>

#### B.10. In general, the role and the level of contribution of Information Technology (IT) as a tool and/or enabler, to support shared knowledge between [Quality or RandD] group and [Manufacturing] group is:

**Descriptive Statistics**

#### A.11. In general, the use of the Information Technology (IT) infrastructure in the [Manufacturing] group is:
B.11. In general, the use of the Information Technology (IT) infrastructure in the [Quality or RandD] group is:

**Descriptive Statistics**

**Variable: A11**

Anderson-Darling Normality Test
A-Squared: 7.562
P-Value: 0.000
Mean 5.21429
StDev 0.90473
Variance 0.818533
Skewness -5.9E-01
Kurtosis 0.834893
N 112
Minimum 2.00000
1st Quartile 5.00000
Median 6.00000
3rd Quartile 6.00000
Maximum 7.00000
95% Confidence Interval for Mu 5.04488 5.38369
95% Confidence Interval for Sigma 0.79976 1.04166
95% Confidence Interval for Median 5.00000 6.00000

**Variable: B11**

Anderson-Darling Normality Test
A-Squared: 5.400
P-Value: 0.000
Mean 5.54128
StDev 0.95774
Variance 0.917261
Skewness -5.1E-01
Kurtosis 0.283797
N 109
Minimum 3.00000
1st Quartile 5.00000
Median 6.00000
3rd Quartile 6.00000
Maximum 7.00000
95% Confidence Interval for Mu 5.35945 5.72312
95% Confidence Interval for Sigma 0.84527 1.04166
95% Confidence Interval for Median 5.00000 6.00000

**Information technology and manufacturing performance**

CA/B.7. In general, the level of the Information Technology (IT) contribution to the [Manufacturing] group performance is:
CA/B.8. In general, the use of the Information Technology (IT) infrastructure, between the three groups is:
Descriptive Statistics

Variable: CA8

Anderson-Darling Normality Test
A-Squared: 5.22321
P-Value: 0.000

Mean: 5.336
StdDev: 5.22321
Variance: 0.895672
Skewness: -2.6E-01
Kurtosis: -2.6E-01
N: 112

Minimum: 3.00000
1st Quartile: 5.00000
Median: 5.04601
3rd Quartile: 6.00000
Maximum: 7.00000

95% Confidence Interval for Mu
5.04601 5.40042

95% Confidence Interval for Sigma
0.83660 1.08964

95% Confidence Interval for Median
5.00000 5.00000
In Search of an Intellectual Capital Comprehensive Theory

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Abstract: The development of intellectual capital theory has been guided by the ideas and thoughts of a handful of influential practitioners, including Karl Erik Sveiby (1997), RS Kaplan (Kaplan and Norton, 1992) and Leif Edvinson (Edvinson and Malone, 1997). These pioneers established the basis of the “intellectual capital standard theory”. In the present paper the assumptions and principles that support the standard theory (the prevailing paradigm) are discussed. The paper then introduces other models and methodologies as alternatives to the standard theory—such as the “Value Explorer” (Andriessen and Tissen, 2000) and the “Intellectual Capital Benchmarking System (ICBS)” (Viedma, 2001)—and examines the foundations and principles on which the alternative new theory (the ‘new paradigm’) is based. Finally, the paper attempts to synthesise both of these theoretical approaches with other new views and contributions, and tries to develop the basis for a first general theory of intellectual capital.

Keywords: Intellectual capital; knowledge management; strategic management; models; paradigms; theory

1. Introduction

Intellectual capital issues have undergone extraordinary development since the beginning of the 1990s. The increasing difference between company market value and company book value has prompted academics and practitioners to consider the concept of “intellectual capital” as a key determinant of the process of value creation for shareholders, managers, and society as a whole. In this paper we define intellectual capital as the knowledge and other intangibles that produce or create value in the present and knowledge and other intangibles that will produce or create value in the future. The development of intellectual capital theory has primarily been guided by the ideas and thoughts of a handful of influential practitioners, including Sveiby (1997) and Edvinson (Edvinson and Malone, 1997). These pioneers established the foundations of the way in which intangible factors determine the success of companies. In the words of Andriessen (2001), the pioneers established the basis of the “intellectual capital standard theory”. Their respective models—“Intangible Assets Monitor” (IAM) (Sveiby, 1997) and “Skandia Navigator” (Edvinson and Malone, 1997)—are representative of the assumptions, principles, and foundations of the intellectual capital standard theory. However, later contributions from other academics and practitioners have developed and refined the standard theory. Today, this theory is the preeminent guide to the management of intangible assets, and has facilitated success through sustainable competitive advantage for leading companies and organisations.

The present paper is structured as follows. Following this Introduction, Section 2 notes the representative models and methodologies from the standard theory (or “prevailing paradigm”)—the IAM, the “Balanced Scorecard”, and the “Skandia Navigator”. These models and methodologies are not discussed in the present paper because it is assumed that the reader is already familiar with the main features of these models. Section 2 also contains an explanation of the assumptions and principles that support the standard theory (or prevailing paradigm). In Section 3, other models and methodologies as alternatives to the standard theory are introduced. These include the “Value Explorer” (Andriessen and Tissen, 2000), and the “Intellectual Capital Benchmarking System” (Viedma, 2001). These models and methodologies are not discussed in the present paper because it is assumed that the reader will have easy access to their main features and characteristics. These two models share similar goals and, taken together, propose some new approaches that constitute an alternative theory to the standard theory described in Section 2. Section 3 also examines, in some depth, the foundations and principles on which the new theory is based.

In Section 4, the paper attempts to synthesise both of these theoretical approaches with other new views and contributions. These new views and contributions are carefully discussed. Finally, in Section 4, the paper tries to develop the basis for a first comprehensive theory of intellectual capital. In Section 5, some of the most relevant conclusions are presented.

2. Representative models and principles underlying the standard theory (or prevailing paradigm)

2.1 Classification of intangible assets

Although intangible assets cannot be touched, they can be identified and reasonably classified.
One such simple classification is depicted in Figure 1 (Sveiby, 1997).

![Intangible Assets Monitor](image)

**Figure 1: Intangible assets monitor**

### 2.1.1 Assets of individual competence

This term refers to assets such as the employees’ education, experience, know-how, knowledge, skills, and values and attitudes. The company does not own these assets, but the use of those assets is accessed by the company’s hiring of employees. This type of asset is also known as “human capital”.

### 2.1.2 Assets of internal structure

This term refers to the company’s formal and informal organisational structure, work methods and procedures, software, databases, research and development (RandD) systems, management systems, and culture. These assets are owned by the company and some can be legally protected (patents, intellectual property, and so on). They are also known as “structural capital”.

### 2.1.3 Assets of external structure

This term refers to the company’s portfolio of customers (generally known as “goodwill”) and its relationships with suppliers, banks, and shareholders, its cooperation agreements and alliances (strategic, technological, production, and marketing), its commercial brands, and its image. These assets are owned by the company and some can be legally protected (commercial brands, and so on). They are also known as “relational capital”.

### 2.2 Representative models of prevailing paradigm

Because intellectual capital is the key source of wealth creation, it is logical that firms pay close attention to the effective management of such capital. Therefore, the ability to identify, audit, measure, renew, and increase these intellectual assets is a key factor for the success of companies in the modern environment. In this regard, significant effort has gone into the search for methodologies and models to improve the management of intellectual capital—although, it must be said, with mixed success. The main reason for this is the nature of these assets and the fact that each business has its own particular knowledge mix, specific objectives, and market environment. Three authors have been of special significance in this search for useful models of intellectual capital:

- Sveiby (1997) who designed the first intellectual capital model—the “Intangible Assets Monitor” (IAM);
- Kaplan (Kaplan and Norton, 1992, 1996a, 1996b) who devised the “Balanced Scorecard” methodology (especially with respect to effective strategy implementation); and
- Edvinson (Edvinson and Malone, 1997) who was the architect of the “Skandia Navigator” (followed by Ross et al. 1997, whose “Process Model” gave a strategic perspective to the “Skandia Navigator”).

As noted above, these models and methodologies are not discussed in the present paper because it is assumed that the reader already knows their main features or has easy access to them.

### 2.3 Assumptions and principles of prevailing paradigm

The main assumptions and principles that support the standard theory (or the prevailing paradigm) can be summarised in seven points:

- The accounting view;
- The strategy implementation view;
- Breakdown of intellectual capital;
- Cause-and-effect relationships;
- Relatively static approach to value-creation processes;
- Limitation of concept of intellectual capital;
- Use of the same models and methodologies to manage and produce reports; and
- Attempts to treat intangible assets as if they were tangible.

Each of these is discussed briefly below.
2.3.1 The accounting view

Among representative models of the standard theory there are some that try to explain the causes of the difference between the company market value and the company book value. The aim is to establish an intangible assets accounts plan that allows identification of the relevant intangible assets and their later valuation. This is an accounting approach to intellectual capital. It identifies the company’s intangible assets and enters them in the books—complementing the financial balance sheets with another kind of balance sheet (of intangibles).

2.3.2 The strategy implementation view

The majority of the representative models corresponding to the standard theory follows a strategy implementation approach. That means, that it is assumed, that in the company, where the Intellectual Capital model will be applied there is a strategy already formulated in clear and explicit terms. In this case the Intellectual Capital model takes the strategic formula as given and concentrates on successfully strategy implementation through managing intangibles in a systematic and continuous way.

2.3.3 Breakdown of intellectual capital

This is a common denominator of all models. Despite the different terminology that they each use, the three models previously mentioned all break down intellectual capital into its distinct elements. These elements can be summarised as human capital, structural capital, and relational capital. For each of these elements, the company establishes a set of indicators that is used to take account, assess, and manage each specific type of capital. That is, each type of capital is deemed independent from the rest in the model’s intrinsic processes. At the same time the set of indicators is linked with the strategic objectives through the key success factors. The actual daily operations of firms show that this division is artificial because, in the value-creation processes, all three types of intellectual capital act together, and such a division never arises. Furthermore, physical and financial assets act together with the intangible assets in the value-creation processes.

2.3.4 Cause-and-effect relationships

The models of the prevailing paradigm examine cause-and-effect relationships between each of the three types of capital (human, structural, and relational) and each of the objectives (strategic and financial). These are extremely difficult to establish—due mainly to the artificial division of the model’s intangible assets. In the value-creation processes, the human assets act together with the structural and relational assets, making it difficult for directors and managers to determine such cause-and-effect relationships.

2.3.5 Relatively static approach to value-creation processes

The artificial categorisation of intellectual capital lacked consideration of how firms actually deploy their resources through their organisational core activities. Because of this, the above-mentioned models fall short in explaining how firms effectively compete, and how they recreate the sustainable competitive advantages that give rise to value creation. Although Sullivan (2000) deemed the IAM and the “Skandia Navigator” models to be oriented towards value creation, it should be emphasised that they lack the dynamism and flexibility required in the turbulence of the modern environment. By focusing on existing intangible assets (human, structural, and relational intellectual capital), these models become prisoners of a dangerous reductionism. Indeed, the most common reason for failure in firms today is deficient strategy implementation—which actually demands paying close attention to what the firm does (rather than what it has). In short, the prevailing paradigm lacks an activity-based view (ABV).

2.3.6 Limitation of concept of intellectual capital

Existing models limit discussion of intellectual capital to ideas of means of production, and do not take proper account of other non-intellectual intangibles—such as values, organisational culture, and so on. The models described above consider intangible assets as being mainly intellectual assets or knowledge assets—that is, those that psychologists ascribe to the left side of the brain. However, other intangible assets (such as values, organisational culture, talent, motivation, and employee commitment) also exist. Even if these other affective assets cannot be labelled as “intellectual”, they are of great importance to the success of companies and organisations. However, because the emphasis is on intellectual assets, other relevant intangible assets are neglected.

2.3.7 Use of the same models and methodologies to manage intangibles and produce external reports

The above-mentioned models are too often identified with the reports of intangible assets that they generate—reports that supplement the balance sheets of the company’s tangible assets. Usually, the same models and methodologies that are used to prepare such external reports of
intangible assets are also used to manage the same intangibles—even though the requirements of management are quite different from those of preparing an external report. One exception is the “Balanced Scorecard”, which was especially conceived as a management tool. Moreover, the end users of intangibles reports are shareholders, suppliers, financial institutions, and so on—that is, external stakeholders in general. In contrast, the end users of management models and methodologies are the organisation’s internal managers.

2.4 Attempts to treat intangible assets as if they were tangible

The use of the term “intangible assets” is dangerous—in that it induces people to think of “intangibles” as assets that can be entered in the books as if they were tangibles, using the extended accounting system of double entry.

Several efforts have been made to assimilate intangible assets with tangible assets. For example, there have been attempts to establish a sort of general accounting plan in line with traditional accounting methods—including the utilisation of universal indicators that might serve to approach almost any situation. The most comprehensive list of such indicators corresponds to the “Universal Intellectual Capital Report” of Edvinson and Malone (1997). They attempted to apply to intangible assets similar procedures to those that have been universally applied to tangible assets—with the aim of generating balance sheets and earnings statements that could be used to make comparisons among any type of company, no matter its nature. Caddy (2000) followed a similar approach in his attempt to discover and assess not only intangible assets but also intangible liabilities.

3. Representative models and principles underlying the new theory (or new paradigm)

3.1 Representative models of new paradigm

In the late 1990s the problems encountered (particularly by small and medium enterprises) when trying to put into practice the prevailing intellectual capital models and methodologies led to the development of new methodologies and an alternative theoretical paradigm. Among these new methodologies, those that stand out because of the relevance of their empirical applications (especially successful among small and medium enterprises) are the “Value Explorer” (Andriessen, 2001), and the “Intellectual Capital Benchmarking System” (Viedma, 2001, 2003a, 2003b). These models and methodologies are not discussed in the present paper because it is assumed that the reader has easy access to their main features. However, the “Intellectual Capital Benchmarking System” is explored in a little detail because it represents an introductory methodology to the new theory of intellectual capital.

3.2 “Intellectual capital benchmarking system” (ICBS)

The “Intellectual Capital Benchmarking System” (ICBS) has a strategic view—as does the “Value Explorer”. Nevertheless, there is a substantial difference between ICBS and the rest of intellectual capital models, ICBS focuses mainly on strategy formulation whereas the other intellectual capital models essentially consider strategy implementation. In the following paragraphs we describe the fundamentals of ICBS.

In today’s knowledge economy the resource-based view and the activity-based view are the fundamental cornerstones that determine company competitiveness. The resource-based view (Barney, 1991, 1999; Grant 1991, 1998; Teece, D. J., Pisano G. and Shuen A. 1997) stresses that, in turbulent times and in times of rapid change in technology and in customer and industry needs, sustainable competitive advantages are mainly due to the intangible resources of a company or, more specifically, to core competencies (which are, in practice, equivalent to core knowledge). But resources perse do not create value, and because the resource-based view focuses only on what the firm has, this view does not, in isolation, adequately explain how to deploy scarce resources to create superior value. To that end, the activity-based view (Porter 1980, 1985, 1996) is a necessary complementary perspective which focuses on what the firm does, and takes into account that value creation results from the activities to which the resources are applied. If core knowledge is the key strategic asset, improving existing core knowledge and building new core knowledge are fundamental tasks. Building and improving core knowledge require organisational learning capabilities, including the appropriate learning structures and information systems. World-wide industry hyper-competition has ensured that strategic competitive benchmarking has become an essential learning tool. This valuable knowledge can be obtained only from systematic and frequent comparison with the world-class processes and core competencies of competitors in the same business segments. In fact, companies and organisations are now competing on the basis of
core knowledge and core competencies. Opportunities and threats come mainly from competitors who offer the best in the same industry segment. As a result of the above discussion, the SWOT analysis framework moves from that shown in Figure 2 to that shown in Figure 3. In effect, there is a change from simple SWOT analysis to an extended SWOT analysis.

**Figure 2: SWOT analysis**

The extended SWOT analysis gives us the main factors to consider when seeking strategies that leading to entrepreneurial excellence. The main factors of the extended SWOT analysis also determine the information system required to measure and manage those factors. In other words, the main factors produce the strategic benchmarking of intellectual capital system (ICBS) that we have defined as a knowledge-based strategic management methodology and information system framework. Nevertheless, strategy formulation in dynamic environments, even those mainly based on core capabilities, has different features when dealing with the innovation process than when dealing with the operations process. Core capabilities can be very different in the two processes. The innovation process points to new products and services through the innovation value chain in which innovation capabilities are basic and fundamental. ICBS has a specific system for the innovation process—the innovation intellectual capital benchmarking system (IICBS) (Viedma, 2002).

The operations process, which produces ordinary products and services through the systematic and repetitive operations value chain, also requires core competencies and core capabilities to be competitive. However, these competencies and capabilities will probably be of a different nature from the ones mentioned above in the discussion of the innovation process. ICBS also has a specific process for the operations value chain—the operations intellectual capital benchmarking system (OICBS). Figure 4 illustrates the business process broken down into its two constituent parts, and the specific methodologies and information systems that correspond to each of the constituent parts.
In summary, the general model of the ICBS can be divided into two partial models. The first, the IICBS, refers to innovation core activities and core knowledge, whereas the second, the OICBS, refers to operations core activities and core knowledge. The two models have a similar structure and they work in a similar way, but there is a fundamental difference. The IICBS model refers to the core activities and core knowledge of the different projects that make up the innovation process. In contrast, the OICBS model refers to the core activities and core knowledge of the different business units that make up the operations process.

Finally we would like to note that the detailed information on the ICBS systems can be found in Viedma, J.M (2003a, 2003b) and Viedma (2001).

### 3.3 Assumptions and principles of the new paradigm

The main assumptions and principles that support the new intellectual capital theory (or the new paradigm) can be summarised in seven points:

- The complete strategic view (strategy formulation as well as strategy implementation);
- Not breaking down intellectual capital into its constituent parts;
- Core competencies as the only intangible assets to manage;
- Reality and dynamism in the value-creation processes;
- Breaking down core competencies into their constituent intangible assets;
- Core competencies linked with core capabilities of professionals who work independently or in teams; and
- Evaluation and assessment of the value-creation potential of future core competencies.

Each of these is discussed below.

### 3.3.1 The complete strategic view

The models of this new paradigm support decision-making, not only in the process of strategy implementation, but also in the key process of strategy formulation. According to this approach, it is not important to determine and appraise every intangible asset—because only a few are relevant to a firm’s strategy formulation and implementation. These few relevant intangible assets are usually grouped according to the firm’s core competencies or core capabilities—which are the true intellectual capital and are therefore the key variables to manage. The theoretical background to the significance of core competencies is grounded in resources and capabilities theory (Barney, 1991, 1999; Grant, 1991, 1998; Teece, Pisano and Shuen 1997). In short, this view focuses on the fact that, in turbulent and changing environments, competitive sustainable advantages are due mainly to resources and capabilities—in particular, the core competencies or capabilities that Andriessen (2001) describes in terms of a “coordinated bundle” of intangible assets that constitute the roots of the firm’s competitive sustainable advantage.

### 3.3.2 Not breaking down intellectual capital into its constituent parts

The new theory—freed from production of annual reports and statements, and accounting principles and rules conditionings—focuses on a strategic view in achieving the firm’s mission and objectives.
and in surpassing its “best in class” competitors. Thus, the artificial division of intellectual capital into human, structural, and relational capital is of little use because the products and services that result from a specific strategy have no relationship at all with these three types of capital considered independently. Rather, these products and services are associated with an integrated bundle of such assets as reflected in core competencies and capabilities.

3.3.3 Core competencies as the only intangible assets to manage

From the above discussion, it can be concluded that, for each business unit in the operations value chain, and for each project in the innovation value chain, the only assets to manage are those grouped in the core competencies. A firm’s specific core competencies are not usually very numerous. Moreover, because a relationship between products and services and the core competencies that enable them is easily established, an appraisal of core competencies can be made by estimating the expected returns from the products in which they participate.

3.3.4 Reality and dynamism in the value-creation processes

One of the main questions that has always been at the core of the strategy theory is how firms compete in their industries or, more broadly, in the global markets. This leads to another question: “How do firms create and exploit value?”. This leads to an examination of what is deemed to be the essence of the entrepreneurial success—good strategy formulation and implementation. Seeking answers to these sorts of questions leads back to both the resource-based view and the activity-based view (because implementation is mainly about activities) to try to explain how firms deploy resources in order to create sustainable competitive advantages and to achieve superior performance.

From a knowledge perspective, this is possible only if the models pertain to the new emerging paradigm of intellectual capital—the ICBS and the Value Explorer. The focus of these new models on a firm’s core competencies allows considerations not only of which intangible resources are crucial to achieving success, but also which core activities must be acted upon (if it is accepted that value creation and exploitation are both intrinsically resource-oriented and activity-oriented). As Haanes and Fjeldstad (2000) have stated, it is not only what the firm has, but also what the firm does, that matters in value creation.

The concept of sustainable competitive advantages that underlies the processes of value creation and exploitation presupposes a certain dynamism that is extremely difficult to capture if attention is paid only to resources, and if an assessment tool based on a false division of intellectual capital into three artificial categories is used in the analysis. As Man et al. (2002, p. 128) have stated, “… the dynamic nature [of the concept of competitiveness] involves the dynamic transformation of competitive potentials through the competitive process into outcomes”. Both resources (tangible and intangible) and activities exist in competitive and non-competitive processes, and this makes it impossible to appraise the firm’s intangible forces if only a resource-based view is taken—a view that requires the creation of competitive advantages for attaining superior performance and market value, but fails to take adequate consideration of the non-competitive processes.

3.3.5 Breaking down core competencies into their constituent intangible assets

Once the principle that core competencies constitute the firm’s authentic intellectual capital has been accepted, the improvement, strengthening, and enrichment of the intangibles “bundle” is enhanced if they are broken down into their constituent parts. This should be undertaken in a broader sense, including not only intangibles that are intellectually based but also intangibles that are affective in origin. To analyse and manage those intangible components the core competencies classification included in the “Value Explorer” is of assistance.

3.3.6 Core competencies linked with core capabilities of professionals who work independently or in teams.

Core competencies are the result of aggregating intangible assets of different types. But each asset is made up of knowledge and skills, and skills are always generated by human beings—working either independently or in teams. Thus, core competencies management is essentially dependent upon the effective management of the core competencies of professionals who work either individually or in coordinated teams.

3.3.7 Evaluation and assessment of the value-creation potential of future core competencies

Finally, the strong relationship between future products and services and the competencies that support them allows an assessment of the future potential of each core competency or core capability. The “Value Explorer” appraises the
strength of each core competency by means of the following four criteria: (i) value-added to customers; (ii) future potential; (iii) sustainability; and (iv) robustness.

4. A comprehensive theory of intellectual capital

4.1 Other new views and contributions

Following the above discussion, the present paper attempts to synthesise both of these theoretical approaches with other new views and contributions. The new views and contributions considered in this context are:
- The essential role of commitment and action;
- Intellectual capital as the difference between intangible assets and intangible liabilities;
- Intellectual capital as a dynamic concept;
- Intellectual capital identified with the concept of a ‘business recipe’ in action;
- Benchmarking as a strategic tool.

Each of these is discussed below.

4.1.1 The essential role of commitment and action

Commitment and action have an essential role in the process of wealth or intellectual capital creation. Firm competencies are the ultimate creators of intellectual wealth or intellectual capital. As such, they are a necessary but not sufficient condition for wealth creation. However, firm competencies must be established with the incorporation of certain personality characteristics and attitudes that reflect a strong commitment to convert competencies into competitive and profitable products and services. This positive emotionality embedded in the concept of commitment, together with an appropriate bundle of competencies, is what ultimately accounts for differences in human and organisational behaviour. Commitment is the ‘copper wire’ that leads human competencies through to superior organisational performance. It is the element that enables these competencies, purposefully aligned with the firm’s strategy and objectives, to find their way to market considerations.

Furthermore, commitment accounts for the sustainability of the firm’s competitive advantages. The challenge of consistently delivering superior performance requires extraordinary effort and sustained commitment on the part of the key people in an organisation. The demands for innovation that the knowledge economy has exerted on firms has, in turn, emphasised talent as the main value-driver of capital creation (both wealth and intellectual capital). Given that talent is acknowledged as a key source of competitive advantage, the ability of a firm to manage this intangible also becomes a core competence that adds to the firm’s value. In such an environment, commitment needs to be managed as well as competencies (Mayo, 2001; Gubman, 1998).

This view of commitment and action draws upon Jericó’s (2001) conceptualisation of talent as being the result of:

\[
\text{competencies} \times \text{commitment} \times \text{action}
\]

It also draws upon Ulrich’s (1998) definition of intellectual capital as being:

\[
\text{competencies} \times \text{commitment}
\]

This view is also in accordance with the work of Man et al. (2002) and Mayo (2002) whose contributions emphasise that competencies alone cannot deliver superior performance in isolation from a more complex bundle of human capabilities (including personal values and attitudes).

It is therefore apparent that intellectual capital theory needs to develop new ways of systematically including commitment in its appraisals. It has long been recognised by theorists in organisational behaviour that commitment is a basic driver of a firm’s performance, and its explicative power has been clearly demonstrated in entrepreneurship research (Beattie, 1999; Hood and Young, 1993). In particular, the concept of ‘utility’, as adopted in the economic views of entrepreneurship theory (Douglas and Shepherd, 2000), is important in this. Perhaps what is missing, as Hitt et al. (2001) called for, is an integration of entrepreneurial and strategic thinking.

4.1.2 Intellectual capital as the difference between intangible assets and intangible liabilities

Practically all models (both those of the prevailing theory and those of the new paradigm) make reference only to intangible assets. Caddy (2000), in his article “Intellectual Capital: recognising both assets and liabilities”, was the first to consider the existence of both intangible assets and liabilities in organisations. Whereas intangible assets are oriented towards wealth creation, intangible liabilities are oriented towards its destruction. The systematic application of the available intellectual capital measurement tools should provide hints as to what is going wrong in a given organisation, and should thus point to the presence of certain flaws (or intellectual liabilities) that are undermining the firm’s potential for intellectual
value creation. According to Powell (2001), any assessment of a sustainable competitive advantage should consider competitive advantages and competitive disadvantages simultaneously. It is apparent that intellectual capital should be defined as the difference between intangible assets and intangible liabilities, such that positive and negative drivers of value creation are both considered—thus allowing effective intellectual capital management. Given that managing intangible assets is a difficult task, identifying and measuring intangible liabilities would appear to be an even more difficult task. However, intellectual capital theory is mature enough to undertake this exercise.

4.1.3 Intellectual capital as a dynamic concept

Most models approach intellectual capital only in terms of a static concept, without reference as to how intangible categories create and destroy wealth. They fail to consider wealth creation and destruction as taking place through virtuous circles (Knight, 1999) and vicious circles. A virtuous circle can be said to be in place when there is a good alignment of the personal and professional objectives of key people with those of the organisation, thus leading to an environment of creativity and positivity. In contrast, vicious circles reflect a malalignment of the objectives of employees and those of the organisation. It is possible to identify and manage these circles only through a dynamic approach to intellectual capital assets and liabilities. This identification of virtuous circles and vicious circles must be combined with the identification of intellectual assets and liabilities (as noted above).

Vicious circles and virtuous ones can take a long time to become apparent and, once they are identified, it can take time for an organisation to reverse their effects. This is significant in a competitive global environment. Once the market starts giving signals of a misfit between its value parameters and the firm's value offer, time for adjustment can be very short. The presence of strong competition, together with the time required to adjust internal vicious circles and intellectual liabilities, can mean that firms are simply unable to adjust in a timely fashion. All of this emphasises the need to include activity-based views (ABVs) within the new general theory of intellectual capital.

4.1.4 Intellectual capital identified with the concept of 'business recipe' in action

Core knowledge and core competencies are brought to bear in creating value through a successful 'business recipe' (BR). The difference between a successful business formula and a successful business recipe is the same as that between a successful formulated strategy and a successful implemented strategy. Superior performance that ends in value creation is a natural consequence of a firm's success in bringing a superior business formula into the market.

This emphasis on implementation is thus significant for any new general theory of intellectual capital—especially in view of the comments already made (above) about the importance of activity-based views in identifying intellectual liabilities and vicious circles.

4.1.5 Benchmarking as a strategic tool

Recognising the importance of benchmarking as a strategic tool allows early identification of virtuous and vicious circles, and facilitates the management of intellectual capital in accordance with the new views and contributions outlined thus far. The only intellectual capital measurement tools that introduce benchmarking techniques in their appraisals are those of the Innovation Intellectual Capital Benchmarking System (IICBS) (Viedma 2003a) and the Operations Intellectual Capital Benchmarking System (OICBS) (Viedma 2003b). The objective of both the IICBS and the OICBS is to determine whether the firm possesses superior core competencies in relation to the world's best competitor. This can be used to account for sustainable competitive advantages that might lead to superior performance and wealth creation. In terms of assessing world competitiveness, IICBS and OICBS benchmark a firm's business recipe against that of its world's best competitor. A firm will be able to create value in the long run as long as its BR has proven to be superior to the world's best. A detailed and thorough process of benchmarking will enable the identification of superiority (or inferiority)—signalling the presence of virtuous (or vicious) circles that will have to be subsequently managed.

Markets are changing with increasing rapidity, making it very difficult for firms to keep track of the innovations and performance of competitors. In this context, strategic benchmarking, if applied systematically, becomes an effective and efficient tool to track the firm's value-creation processes in creating sustainable competitive advantages. Benchmarking is effective because it focuses on what is strictly relevant to value creation: a superior BR and core competencies. It is efficient because it fosters a better assignment of organisational resources as long as the unit of analysis is essentially the firm's BR. Benchmarking the firm's BR with the best competitor's BR informs its key people about how
well they have been doing and whether an in-depth analysis is required. However, a firm’s intellectual assets and liabilities, together with its virtuous and vicious circles, remain a matter for the firm’s internal management. The effectiveness of management will obviously influence performance—either transforming the firm’s BR to reach the point of being a superior BR that creates value, or never reaching that point and failing to create extra value.

4.2 The formulation of a comprehensive theory of intellectual capital

As a result of the above discussion, the main ideas of a general theory of intellectual capital can be depicted in simplified form (see Figure 5). The principles on which this new theory rests are as follows.

- A firm’s success is always the result of both well-formulated and well-implemented strategies (Grant, 1998).
- Successful strategy formulation and execution crystallises in a successful business recipe (SBR) that offers customers competitive and good-quality products and services. Ultimately, an SBR is the market’s validation of the firm’s competitive quality offer.
- Strategy formulation and execution is always a human task. It is in the hands of the top management team (TMT) and the firm’s most important technicians and managers—its key professional people (KPP).
- The TMT and the KPP start from a business formula (that is, a formulated strategy), work through the innovations and operations value chains, and finally accomplish an SBR (as an implemented strategy). Those activities can be performed in a superior way due to the core knowledge and core competencies of the KPP.
- Apart from the core knowledge and competencies of the TMT and KPP, the process also requires commitment from the TMT and KPP to convert the business formula into an SBR, and thus carry the firm to success. Such a commitment fosters a climate of positivity and trust that is essential for knowledge sharing, organisational learning, and value creation. In short, this is an extended version of one of the most relevant principles of leadership effectiveness—that of “engaging people” (Ulrich et al., 1999).
- A firm’s BR can only be judged as being successful (that is, an SBR) when it has been proven to be clearly superior to those of the best international competitors as a consequence of a complete and detailed process of benchmarking.
- For analytical purposes, core knowledge and core competencies can be broken down into their constituent parts of human assets, structural assets, and relational assets.
- The engine of the process leading to an SBR are the core knowledge, core competencies, and strong commitment of the TMT and KPP who strategically manage value-chain activities in a motivating and knowledge-
sharing environment. This is dynamics of intellectual capital creation through virtuous circles. An effective SBR must constantly transform itself to fit the demands of an ever-changing environment.

- It should not be assumed that the TMT always develops certain activities and actions that are perfectly aligned with the firm’s strategy and objectives. Frequently these top managers coexist with others whose professional and personal strategies are not aligned with those of the organisation—thus producing vicious circles.
- The engine of the process leading to wealth destruction (BR deterioration) starts in the TMT—in those managers whose personal objectives prevail against the organisation’s strategic objectives. These managers put their core knowledge, core competencies, and commitment into effect in a way that does not produce value creation. Rather, they foster internal fights for power, intrigues, and a culture that is negative in its effects in terms of the firm’s requirements for innovation and competitiveness.
- The above description of virtuous and vicious circles represents two extremes in a continuum of typologies. For a given firm, it is to be expected that several circles of both types might coexist, each of them more or less important, thus placing the firm in an intermediary position between the two extremes of ‘virtuous’ and ‘vicious’. These configurations evolve through time. They change, expand, and contract—depending on the firm’s abilities to manage them effectively. It is worth noting that the negative effects of vicious circle are generally more pervasive than the positive effects of virtuous circles—causing a given firm’s performance to shift to the left (thus invading the virtuous positive zone). Figure 6 depicts these ideas.

![Firms' performance](image)

**Figure 6: The coexistence of virtuous and vicious circles**

5. Conclusions

An analysis of representative models of the prevailing theory, together with those of the alternative new theory, followed by a synthesis of the two and the integration of new views and contributions, has enabled the present paper to advance a first comprehensive theory of intellectual capital. By conceptualising intellectual capital as the difference of intellectual assets and liabilities, this new general theory attempts to unravel and tackle the fundamentals of the value-creation process in firms. At the inner core of such an analysis is the concept of the management of virtuous and vicious circles and the importance of personal objectives of top management and key personnel being aligned with objectives of the organisation in a spirit of strong commitment.

The general theory of intellectual capital introduces a new concept of superior business recipe (SBR) to emphasise the importance of successful implementation in a context of a dynamic understanding of intellectual capital. Finally, in the search for new methodologies to manage intellectual capital in accordance with the principles of the new general theory, the OICBS and IICBS methodologies have been emphasised in the belief that strategic benchmarking is the best available tool to keep track of the innovations and value-creation processes of competitors.

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