There is Knowledge Management in Process Improvement

Pat Halloran
Griffith University
e-mail pat@cit.gu.edu.au

Abstract

Process improvement can be utilised as a business strategy for best practice transfer, to develop personal learning and to provide contextual basis for the dissemination of "right information to the right decision maker at the right time", thus creating the right conditions for new knowledge to be created and managed. In a quest for organisational improvement, an implicit assumption is that it is essential to have new ideas that motivate organisational improvement. Such new ideas will not by themselves create a new learning organisation. Without accompanying changes in the way work is performed, only the potential for improvement exists.

Keywords

Process Improvement, Knowledge Management

INTRODUCTION

The impact of Information Technology, Telecommunications and e-commerce in the new "knowledge economy" requires many organisations to overhaul their existing strategies for acquiring and developing their human capital strengths, particularly in developing the required skills of future knowledge workers. This paper explores current research in progress, of the use of a (software) process improvement program in an Australian SME. The goals were directed towards improving specific business outcomes in the development group that could also transfer benefits across other business divisions in the organisation and consequently, and be utilised within a knowledge management framework.

It was initially through discussion with the software development group that an objective of 'realising better quality management and process improvement" was instigated. Central to the process improvement strategy was the realisation that the organisation's business plan incorporating the development of new wireless technologies, together with the existing revenue stream and proposed investment goals, suggested that within two years the size of the company would increase from 25 – 150 (software development group could grow substantially larger from 5 to 25 members). This was considered to have obvious implications for maintaining their "competitive knowledge advantage" and being able to institutionalise and manage defined software development practices within the organisation, that were seen as the inherent core value to the business. Also inherent in this was the ability to capture and reuse the intellectual capital that had been created in the transformation of ideas into products and the application of those ideas into different domains. Korac-Kakabadse and Kouzmin, (1999) refer to these as vertical and horizontal knowledge transfers which are seen as long, expensive and difficult processes that require technological, physical and intellectual infrastructures. The intention of using a software process improvement model was that, "it could lead to the identification and selection of key activities for improvement and provide an ongoing approach for the continuous application of improvements/knowledge to match current business needs". Although in many cases this approach is related to incremental and cumulative improvements that contribute to the organisation's ability to produce and deliver quality software (within time and budget constraints etc.), considered improvements would not just become part of the task but would become part of an appropriate knowledge management infrastructure to support the changes at an organisational level.

The research organisation have a young in-house software development team that provide solutions for many internal and external business requirements, using an "Agile" approach to development. Evolving from a 2 person team, their initial intention was to have a minimal set of formal development processes that allowed them to produce working software and not be locked into levels of onerous documentation. Their safety measure was to build in high levels of customer collaboration to alleviate any changes in requirements, so that any response to specification changes were a little more predictable and managed. However, this meant that many practices were informal, difficult to recall and even more difficult to cost. It was also becoming essential that their business infrastructure allow for certain knowledge to be created, shared across functional boundaries (processes and groups), and stored in such a way that it facilitated access and communication for departmental divisions and members of the organisation. For example, the IT Support group were becoming heavily dependant on the development group for updates and product release information regarding a range of minor defects that were requiring attention. Discussion with management saw this study to be an opportunity to not only differentiate their quality improvement strategy and to improve overall performance, but to further understand the

Halloran (Paper #288)

implications of initiating knowledge management support within the improvement framework. Sharing implicit knowledge between developers is considered to be a socialisation process – externalisation or knowledge transfer as the individual or group of individuals share knowledge or "know-how" with each other within the group (Kakabadse et al, 2001; Nonaka and Takeuchi, 1995).

Software process improvement initiatives through 'optimal' reengineering of specific processes could facilitate the organisation achieving improvements in quality, performance and productivity and help establish management of associated knowledge for those processes. Alignment with business process improvement could then be utilised as a business strategy for best practice transfer, to develop personal learning and to provide contextual basis for the dissemination of "right information to the right decision maker at the right time", thus creating the right conditions for new knowledge to be created and managed across the organisation. Utilising the creative and innovative capacity of actors within the processes, information systems could then also be used to realise the alignment of an organisational infrastructure for a framework of knowledge management. Essentially, it requires process oriented initiatives to be (re)designed to provide employees with task-related knowledge in the organisation's operative business processes (Maier & Remus, 2002).

Examination using process improvement practices can be used to identify key processes of knowledge production and accumulation in the organisation, where, there may also exist a "duality of learning", with knowledge management practices facilitating continuous and ongoing routines of learning and unlearning within those specific business processes. Markus et al. (2002) refer to these as "emergent knowledge processes" - those processes that exhibit three characteristics in combination: deliberations with no best structure or sequence; highly unpredictable potential users and work contexts; and information requirements that include general, specific, and tacit knowledge distributed across experts and non-experts. Kakabadse et al (2001) suggest there are various conceptualisations of knowledge, and thus, confusion as to what constitutes knowledge management; and that there is often no coherent framework for implementing the management of knowledge in the organisation. In order to effectively manage knowledge one has to understand the meaning and significance of knowledge, understand one's own ability and limitations of knowledge and its potential meaning for organisational endeavours.

Furthermore, this fundamental rethinking doesn't appear in the form of top-down reshuffling of organisational processes, people and structures. It is ingrained in the day-to-day operations of the business at the operational level and driven by the people who interact within the formative context of the organisation. The achievement of such objectives relies on aspects of communication and technology, and the organisation's infrastructure (Malhotra, 1998). This infrastructure becomes part of a formative context of the organisation that influences the 'learning' process, and in doing so, is also structured by its result (Orlikowski, 1992, Giddens, 1976). However, knowledge management encompasses broader issues, and in particular, creation of processes and behaviours that allow people to transform information into the organisation and create and share knowledge. Thus, knowledge management needs to encompass people, process, technology and culture (Kakabadse et al, 2001).

The framework used to examine the progress of the [software] process improvement program within the organisation has included the performance of periodic software process assessments and a range of focused project group and individual interviews. This is embraced within the observation of developers and other organisational members at work, particularly in relation to observed cultural characteristics i.e. norms and values, routines, assumptions, practices and behaviours etc. and examination of documentation, workflows, pre-existing systems seen within the organisation . The research strategy is discussed in the next section.

A model employed to assist identify evidence of learning and where knowledge resides within the organisation (the Organisational Learning Evaluation Cycle - OLEC) is discussed later. The model builds on three constructs: Ciborra et al's (1995) "Learning Audit Methodology"; Huber's (1991) "Constructs and Processes of Organisational Learning"; and Garvin's (1993) three overlapping "Phases of Organisational Learning". These are viewed within the context of the focus employed that may range from a single process to a number of inter-relating processes, defined through the orientation required to satisfy specific business requirements within the organisation (Maier and Remus, 2002).

Firstly the model examines the flows and systems, actions and events, and objects and artifacts (Ciborra et al, 1995) to identify where knowledge is currently situated within the organisation in relation to the specific software process under review. Identification of how the organisation acquires knowledge, disseminates and interprets information for that process and stores it into organisational memory (Huber, 1991; Garvin, 1993) is the second task of OLEC. The third task in OLEC is to examine the organisation's movement through Garvin's (1993) three organisational learning phases i.e. Cognitive, Behavioural and Performance Improvement and identify changes relevant to the re-assessment of that process over a period of time. The final aspect to be considered is the knowledge management infrastructure required to fulfil the intention of the improvement strategy.

RESEARCH METHOD

A case study has been used to provide the organisational context for the study of software process improvement activities and its role in knowledge management. An appropriate means of advancing theory through collaboration with practice is by taking an interpretivist case study approach to the research study. Using interpretative research methods allows the researcher to explore the social processes surrounding the implementation and execution of software development processes within organisations. The study, therefore, lends itself to a non-deterministic research approach which contextualises the phenomenon within an organisation, and studies it historically (Gasston and Halloran, 1999). The case organisation will be addressed as RAPTA, in accordance with the confidentiality agreement with the company.

The identification of knowledge intensive software processes is strongly related to selection of promising candidates for process oriented knowledge management initiatives. The relevance of having an integrated view on a process-orientation and knowledge management strategy is underlined by strong dependencies between the two approaches on the operational level. Knowledge is created within the operative business processes and can be shared with other business processes (Maier and Remus, 2002). "It can be argued that knowledge management is core to software process improvement models, for example, these models advocate that information about processes be defined, standardised, and used by the entire organisation", (Meehan & Richardson, 2002). Software process improvement strategies can support the flow of knowledge between business processes and possibly between business units as well as supporting the creation and collection of knowledge that can be characterised by the type of knowledge activities or processes it (primarily) focuses on.

Research Site

RAPTA was founded in 1998 when a need for professional-standard services within the Internet/eCommerce domain, particularly through hosting services and as an application services provider was recognised. As the Internet became more accepted as a business tool, RAPTA established new business solutions that provided innovative and unique opportunities for both themselves and their clients, particularly in being able to provide broadband data services, network management capabilities, and data storage and security services. With industry experience in professional services, banking, insurance, manufacturing, retail and Information Technology industries, etc. RAPTA began to provide specific services in Internet Access and Delivery; Data Centre and Communication Services; Software Development and Interactive Multimedia Design; and Business Technology Consulting that includes Security Systems Design, Customer Relationship Management and Application Integration.

RAPTA has stated that like many other recently formed organisations, they are yet to realise benefits from initiatives that concentrate on their core assets - intellectual capital, creativity, innovation and management of that corporate knowledge. The creation of organisational knowledge, or intellectual capital, is needed to meet product or customer needs, and is driven through the relationship of human capital (employee knowledge and skills), structural capital (organisational capability to respond to market demands) and customer capital (Kakabadse et al, 2001).

As RAPTA's service offering had grown constantly since inception and as new market opportunities continually arose, one of their objectives was to initiate formal quality assurance activities within the Professional Services division and specifically within the Software Development group as a response to customer needs. Senior management support was given to a process improvement program and the initiative was largely driven by the head of Professional Services and the software development manager. It was thought that the information provided from process improvement activities and assessments would provide valuable insights in identifying opportunities for improvement of not those specific processes, but across other business processes in the organisation as well. The process improvement initiative was also supported by the fact that although their approach to innovation had seen their technical infrastructure being realised as among the most advanced in the Australia in mobile wireless service provision, there were definite opportunities for a far more formalised approach to management of their software development and IT support activities. RAPTA saw participation in this software process improvement program as integral to developing broader organisational awareness and a "cultural" change process for improvement with a desire to improve not just software development practices but many other internal business processes.

Data Collection

The methods used to examine the progress of the Software Assessment and Improvement Program within the organisation in terms of its contribution to organisational learning have included the performance of software process assessments, the use of focused, project group and individual interviews, observations carried out as part of the program, and examination of documentation within the organisation. Data gathering was guided by the theoretical model for examining aspects of organisational learning and knowledge management.

Halloran (Paper #288)

Structured interviews were conducted with divisional managers and project team members who held different roles within the organisation (e.g. head of professional services, the software development manager and application developers). Interviewees other than project team members included the CEO, General Manager, Business Account Executives (Sales & Marketing) and the Financial and Accounting Manager. Focus interviews were held with development team and related practitioner groups to explore specific issues under question. During these interviews a set of open-ended questions, which allowed participants to formulate answers in their own terms, were utilised by the researcher. Prior to holding the interviews the researcher conducted documentation reviews, particularly of the organisation's existing quality management system, as a means of gaining familiarisation with the organisation's particular procedures, methods, and terminology so as meaningful discussions were possible both from the researchers' point of view, and particularly from the view of the participants. During these interviews participants were encouraged to identify important events of an historical, cultural or political nature which had or were still influencing the current situation.

In order to evaluate the software processes under review and provide a "snapshot of current process maturity", assessments have been conducted using the SQI (Software Quality Institute) developed Rapid Assessment model (Rout et al, 2000) based on Part 5 Version 1.06 of the SPICE Project (ISO/IEC 15504), the embedded model within the International Standard for Software Process Assessment (ISO/IEC 15504-1, 1996). This model utilises a 1 day assessment approach for the eight selected software development processes. The assessments will be performed again in 6 to 12 month intervals to monitor and assess the level of performance improvement achieved. The three main sources of gathering data within the assessment process were: open-ended and structured interviews, and documentation reviews. The assessment was conducted on a current development project that relates to both internal and external clients: consisting of a major update to an existing internal ERP system, that allows external clients to access this internal system within an "extranet" to request support or maintenance requirements on their application.

Data Analysis

Data gathered during the process assessments was analysed in terms of identifying process strengths and weaknesses and opportunities for improvement. The results of the assessments conducted during the research period will be compared to identify the extent to which recommendations for improvement had or had not been adopted over predetermined periods of time. That is, whether changes to processes had in fact occurred and whether those changes had been embedded into the organisation's infrastructure and formative context. The data analysis is being guided by the OLEC model discussed in the next section. The aim in using the model is to "observe the knowledge attributes and knowledge dependant processes" under review and identify where knowledge is located within the organisation. Further examination of the results of the process assessments will be conducted with the aim of identifying the mode of learning and exploring whether learning within the organisation is moving through Garvin's three overlapping phases of Organisational Learning: Cognitive, Behavioural and Performance Improvement.

SOFTWARE PROCESS IMPROVEMENT

Senior management support was given to a process improvement program and the initiative was largely driven by the head of professional services and the software development manager. It was thought that the information provided from software process improvement activities would provide valuable insights in identifying opportunities for improvement of not just those specific software development processes, but be enabled across other internal business processes as well. RAPTA saw participation in this software process improvement program as integral to developing broader organisational awareness and of engineering a "cultural" change process for continuous quality improvement within the organisation.

In order to evaluate existing software processes and provide a "snapshot of current process maturity", assessments were conducted using the Software Quality Institute (SQI) developed Rapid Assessment model (2000) based on Part 5 Version 1.06 of the SPICE standard (ISO 15504), the embedded model within the International Standard for Software Process Assessment (ISO/IEC 15504-1, 1996). This model utilises a 1 day assessment approach for eight selected processes. The intention is to understand the capability of the software development group and determine suitable improvement activities to progress the maturity of the development processes in the organisation.

A key issue for many small and medium size companies, in particular, is the ability to obtain meaningful and reliable evaluations of capability with minimal investment of time and resource. A Rapid Assessment method has been developed by the Software Quality Institute (SQI) at Griffith University to address this need. A Rapid Assessment process model has been designed to support this approach to assessment and contains a limited set of indicators of process performance and capability, designed to support the restricted approach to data collection and validation contained in the method. The general principle of the model is that the capability of a

process can be evaluated by establishing evidence for the performance of specified practices in the organisation being assessed. The model is a proper sub-set of the process reference model defined in ISO 15504-2, containing eight processes, each defined identically to that definition in ISO 15504-2. The eight processes examined in this assessment included: Requirements Elicitation; Software Development; Configuration Management; Quality Assurance; Problem Resolution; Project Management; Risk Management and the Process Establishment Process. Table 1 shows some examples of situated knowledge, within each process category, within RAPTA.

The main sources of gathering data within the assessment process are: open-ended and structured interviews, observation and documentation reviews. Data gathered during the process assessments is analysed in terms of identifying process strengths and weaknesses and opportunities for improvement, based on the organisations considered business objectives. The results of the 'secondary assessments conducted during the research period will be compared to identify the extent to which recommendations for improvement had or had not been implemented.

Process	Flows & Systems	Actions & Events	Objects & Artifacts	Notes	Assessment Level 0- 5
Requirements Elicitation	Marketing Dept. info to development group, workflow norms,	Consultant experience, meetings, informal communication,	Templates, Engagement doc.	Informal estimation practices performed, no established process	1
Software Development	Open source software, ticket tracking system for development	Reviews, team meetings, open communication,	Tools, Agile environment,	Very experienced dev. Manager, using Agile practices,	1
Configuration management	Configuration management system,			All items on CVS system,	1
Quality Assurance	Web based system of procedures,	Reviews, developers experience,	Templates,	Informal practices,	0
Problem Resolution	Web based support system	Triggered by system notification, failures,	Tracker tickets,	Disparate practices,	1
Project management	Informal, sub-set of RUP methodology	Meetings,	Templates,	Experienced manager,	0
Risk management	Informal, sub-set of RUP methodology	Weekly reviews at team meeting		Informal practices,	0
Process Establishment	Incomplete system of defined procedures, practices etc.			Informal practices,	0

Table 1. Examples of situated knowledge in selected processes.

Secondary assessment of the selected processes will be performed at approx. 6 monthly intervals to monitor and assess the level of performance improvement achieved, and to determine adjustments if required.

THE ORGANISATIONAL LEARNING EVALUATION CYCLE

The application of a psychological metaphor of "learning" to organisations is based on the notion that learning in individuals can be transformed into more general improvements that will lead to success and prosperity for organisations (Rhodes, 1996; Robey et al, 1995). A learning organisation, is one with a well developed capacity for what Argyris and Schon refer to double loop learning (Argyris and Schon, 1978) ; where there is ongoing attention to learning how to learn and where key aspects of organisational functioning support learning (Field and Ford, 1995). Learning at the organisational level involves creating systems which put in place long term capacities to capture knowledge, to support knowledge creation, and empower continuous transformation (Watkins and Golembiewski, 1995). Knowledge management is then seen as a combination of disciplines and

technologies, structures and people all undertaking to manage knowledge through business process reengineering, workflow processing and human resource management (Kakabadse et al, 2001).

The Organisational Learning Evaluation Cycle (OLEC), Figure 1 was developed from the work carried out in previous studies (Halloran, 1998, and Halloran, 1999) and will be used in order to analyse the case study data. The objectives in this study are to:

- Identify where the constructs and processes of organisational learning are exhibited within the organisation – in relation to the specific software processes under review. This in turn involves identifying knowledge dependant processes and enhancing them through knowledge management initiatives.

- Identify whether the software process assessment and improvement program within RAPTA has enhanced or inhibited knowledge management opportunities.

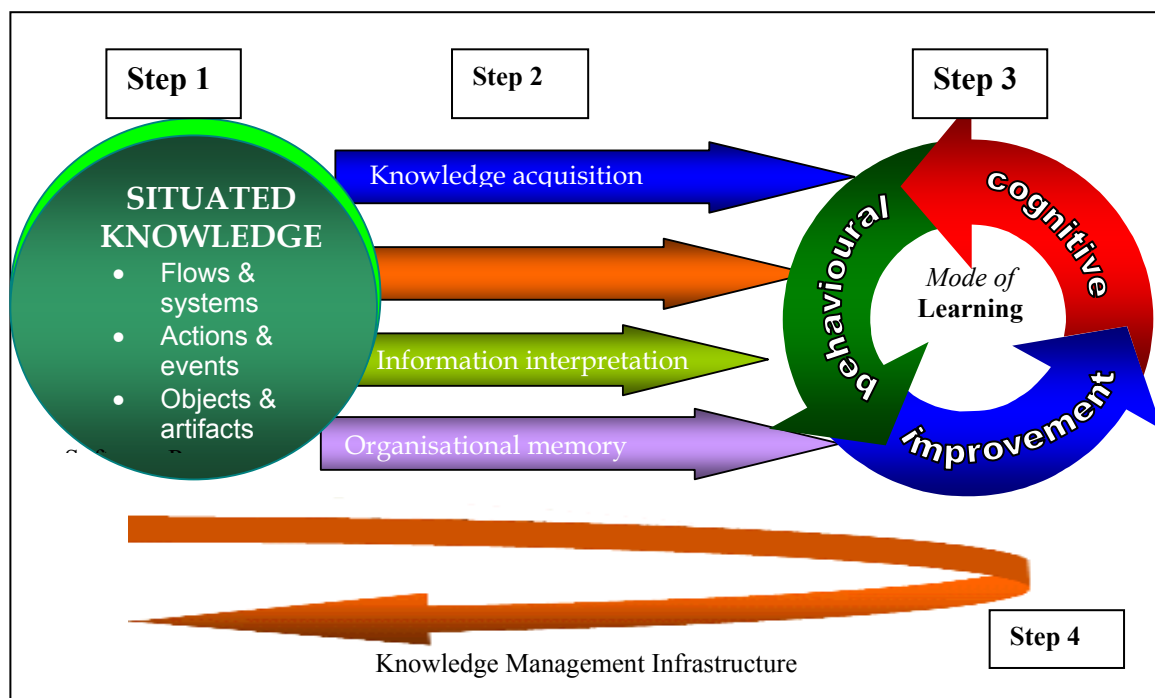These are discussed in more detail in the following sections.

Figure 1: The Organisational Learning and Evaluation Cycle

A model employed to assist identify evidence of learning and where knowledge resides within the organisation - the Organisational Learning Evaluation Cycle – OLEC (Gasston & Halloran, 2000) builds on three constructs: Ciborra et al's (1995) "Learning Audit Methodology"; Huber's (1991) "Constructs and Processes of Organisational Learning"; and Garvin's (1993) three overlapping "Phases of Organisational Learning". The purpose of using the OLEC methodology is that it enables the observation of visible behaviours and artefacts, the "theories of use" (Argyris and Schon, 1978) and the "interpretive schemes" informing them (Orlikowski, 1992), together with the organisational routines and contexts that shape them. Utilising the process assessment and improvement practices, we may be able to identify key processes of knowledge production and accumulation in the organisation. Expert knowledge is often seen as a significant factor in software development activities requiring production of new products (Bhattacharya, 1998), and because new product development knowledge evolves dynamically (Cougar, 1996), it is critical to identify within a software development organisation, the ways in which information is created and disseminated.

Firstly the model examines the flows and systems, actions and events, and objects and artifacts to identify where knowledge is currently situated within the organisation in relation to the specific process under review. These are viewed within the context of the "process focus" employed that may range from a single process to a number of inter-relating processes that satisfy specific business requirements and defined through the process orientation required within the organisation Identification of how an organisation acquires knowledge, disseminates and interprets information for that process and stores it into organisational memory is the second task of OLEC. This second stage can be further understood by articulating Nonaka and Takeuchi's (1994) "spiral of knowledge

creation processes – socialisation, externalisation, combination and internalisation", as the means for how the individual "externalizes" or converts the tacit knowledge into explicit form, or as Cook and Seely Brown refer to as "epistemology of practice" (1999). The conversion is an interactive social process that takes place between individuals, groups and organisational units (Kautz and Thaysen, 2001). The final task in OLEC is to examine the organisation's movement through Garvin's three organisational learning phases relevant to that process: i.e. Cognitive, Behavioural and Performance Improvement during the period of study. Using the process assessment mechanisms, in conjunction with direct observation and interviews, this phase explores performance improvements in the actual process itself, or on outcomes of the process, such as policies, procedures, routines and norms.

The exploration of performance improvement within RAPTA is limited to discussion of the assessment results of the Rapid software process assessment program. The study did not include an evaluation of the quality of the products produced by the processes. The last step of the OLEC model may recognise not just improvements in performance, but also changes to organisational processes, which would be reflected by changes in the formative context and situated knowledge. We refer here to the management of knowledge in the environment. Organisational knowledge may be processed information embedded in routines and processes which enable action. It could also be knowledge captured by the organisations systems, processes, products, rules and culture. Knowledge that is created within the operative business processes may be shared with other business processes; on the other hand knowledge also plays a crucial role when an organisation decides to implement the concept of process management. The development and distribution of process knowledge in improvement or change processes is a key factor for successful continuous process improvement which contributes to the adaptation of an organization to environmental change.

MAPPING OF SOFTWARE PROCESS ATTRIBUTES TO KNOWLEDGE MANAGEMENT

Fundamental to this assertion is that an organisations' knowledge and learning environments can be made explicit and managed explicitly. The basic components of a well managed knowledge/learning environment therefore, consist of expressed organisational knowledge (and knowledge structures), the knowledge processes by which they come about and through the people that are implicated. Where explicit knowledge is treated as knowledge that can 'provide evidence' or be formalised, tacit knowledge is deeply embedded personal beliefs, attitudes, values and experiences that give knowledge its meaning. As such it is at best difficult and at worst impossible to articulate as it is highly situated in the context and to abstract it from its context of application is to lose much if it's intrinsic meaning and value, as Markus et al, (2002) suggest, knowledge intensive emergent processes have challenging information requirements. The framework used to examine the progress of a [software] process improvement program within the organisation in terms of its contribution to organisational learning and knowledge management, included the performance of software process assessments, the use of focused project group and individual interviews, observation of developers and other organisational members at work, and examination of documentation within the organisation. Examination using process improvement practices can be used to identify key processes of knowledge production and accumulation in the organisation, where, there may also exist a "duality of learning", with knowledge management practices facilitating continuous and ongoing routines of learning and unlearning within those specific business processes. This "formative context" of the organisation influences the 'learning' process, and in doing so, is also structured by its result (Orlikowski, 1992), further, if the process improvement/knowledge management activities can be made explicit, they may help improve software process maturity in the organisation (Meehan and Richardson, 2002). Furthermore, this fundamental rethinking doesn't appear in the form of top-down reshuffling of organisational processes, people and structures. It is ingrained in the day-to-day operations of the business at the operational level and driven by the people who interact within the formative context of the organisation. However, knowledge management encompasses broader issues, and in particular, creation of processes and behaviours that allow people to transform information into the organisation and create and share knowledge should be leveraged.

Agarwal et al. (1997), contend that the inability of organisations to cope with uncertainties can often be attributed to a non-existent but essential social and organisational infrastructure for individual and collective learning. The success and continuous improvement of RAPTA will be seen as dependant on their ability to see things in new ways, gain new understandings, and produce new patterns of behaviour, on a continuing basis and in a way that engages the organisation as a whole. In a quest for organisational improvement, an implicit assumption is that it is essential to have new ideas that motivate organisational improvement. But such new ideas will not by themselves create a new learning organisation. Without accompanying changes in the way work is performed, only the potential for improvement exists. Continuous improvement not only requires a commitment to learning on the part of the organisation, but an explicit strategy of managing and sharing their knowledge. While reengineering implies one-shot radical change in organisational processes to achieve maximum increases in efficiency, knowledge management implies continuous and ongoing renewal of

organisational schemas to anticipate the future opportunities and threats. Knowledge management can then be seen as a framework within which RAPTA can view all its processes as knowledge processes. In this view, all business processes involve creation, dissemination, renewal, and application of knowledge toward organisational sustenance and survival. Knowledge management through process improvement facilitates continuous and ongoing processes of learning and unlearning. This can be knowledge processes supporting the collection, processing and storing of information as an outcome of conventional business processes.

CONCLUSION

RAPTA, like many other organisations are yet to realise benefits from initiatives that require attention in intellectual capital, creativity, innovation and the management of knowledge. The creation of organisational knowledge, or intellectual capital, is needed to meet product or customer needs, and is driven through the relationship of human capital (employee knowledge and skills), structural capital (organisational capability to respond to market demands) and customer capital (Kakabadse et al, 2001).

A software process assessment and improvement program can not only lead to the identification and selection of key activities for improvement but may also be a mechanism, together with the OLEC model, through which the organisation might evaluate its knowledge management capability. In order to effectively assess an organisation's capability to continuously improve its processes, human actors engage in an active process of sense making to continuously assess the effectiveness of those 'best practices.' In this view, 'best practices' are not implemented without active inquiry by the human actors. More importantly, they should have the capability of judging if the organization's 'best practices' are aligned with the dynamics of the business environment. Such knowledge workers are the critical elements of the "*double loop*" learning and unlearning cycle that should be designed within the organisational business processes. Of course, such creativity and inquiry-driven learning may be difficult to achieve within traditional command-and-control paradigm. The knowledge workers would also need to have an overall understanding of the business of their organisation and how their work contexts fit within it. Such understanding is necessary for their active involvement in the organizational unlearning and relearning processes. Only if they understand the implications of changes in their work contexts for the business enterprise, they can be instrumental in synchronising the organizational 'best practices' with the external reality of the business environment. Given the need for autonomy in learning and decision making, such knowledge workers would also need to be comfortable with self-control and self-learning. In other words, they would need to act in an entrepreneurial mode that involves a higher degree of responsibility and authority *as well as* capability and intelligence for handling both.

RAPTA has undergone pressure to become more adaptive to new development environments, particularly with respect to managing their web-based applications, in order to compete in a constantly changing environment. Adherence to standard and effective processes in software development is more critical in such circumstances. The formative context of the organisation influences the management of knowledge, and in doing so, is also structured by its result. Changes to the formative context can come about as a result of performing software process improvements. Organisations must be aware that individual members will acquire, disseminate and interpret information from various sources of situated knowledge within the organisation and as a result lead to behavioural change and performance improvement. But it is important therefore that organisations identify these potential sources, so as to obtain optimal benefits from software process assessment and improvement programs through knowledge management. Starting with a single business process may have some advantages concerning the acceptance of the knowledge management activities to other business processes; however, preliminary findings showed that significant improvements of the handling of knowledge in one business process became important success factors for the implementation of organisational knowledge management benefits. Identified knowledge processes could provide support for the flow of knowledge between business processes and business units as well as the (business process independent) creation and collection of knowledge. There are various conceptualisations of knowledge, and thus, confusion as to what constitutes knowledge management; and that there is often no coherent framework for implementing the management of knowledge in the organisation. In order to effectively manage "process" knowledge, one has to understand the meaning and significance of the process oriented knowledge, understand one's own ability and limitations of identifying and using that knowledge and its potential meaning for broader organisational endeavours.

REFERENCES

Agarwal, R., Krudys, G. and Tanniru, M. (1997) Infusing learning into the information system organisation, European Journal of Information Systems, 6:25-40

Argyris, C. and Schon, D. A. (1978) Organisational Learning: A theory of action perspective, Addison-Wesley, Reading, MA.

Bhattacharya. S., Krishnan. V., and Mahajan. V. (1998) "Managing new Product Definition in Highly Dynamic Environments" . Management Science (44:11), pp 50-64

Ciborra, C.U., Patriotta, G. and Erlicher, L. (1995) Disassembling Frames on the Assembly Line: The Theory and Practice of the New Division of Learning in Advanced Manufacturing, in Proceedings of the IPIF WG8.2 working conference on information technology and changes in organisational work, December.

Cougar. J.D. Creativity and Innovation In Information Systems Organisations, International Thompson Publishing, New York, 1996.

Field, L. and Ford, B. (1995) Managing Learning Organisations, Longman, Melbourne.

Garvin, D.A. (1993) Building a Learning Organisation, Harvard Business Review, July-August pp78-91.

Gasston. J. and Halloran. P., (2000) Continuous Software Process Improvement Requires Organisational Learning: An Australian Case Study, Software Quality Management Journal.

Giddens, A. (1976) New Rules of Sociological Method, Basic Books, New York.

Halloran, P. J. (1998) Using a Software Process Assessment Model to examine Organisational Learning in Proceedings of Australian Conference of Information Systems Sept 29-Oct 2, 1998, Sydney Australia, 1998; pp. 253-265

Halloran, P. J. (1999) Organisational Learning from the Perspective of a Software Process Assessment & Improvement Program, in Proceedings of the 32nd Hawaii International Conference on System Sciences, 5 - 8 January.

Huber, G. P. (1991) Organisational Learning: The Contributing Processes and Literatures, Organisational Sciences, February 2(1)

ISO/IEC 15504-1: (1996) Information Technology – Software Process Assessment , ISO/IEC JTC1/SC7 N1592.

Kakabadse. N.K., Kouzmin. A. and Kakabadse. A. (2001) From Tacit Knowledge to Knowledge Management: Leveraging Invisible Assets. Journal of Knowledge and Process Management. Vol 8. No 3. pp. 137-154.

Kautz. K, and Thaysen. K., (2001) Knowledge, learning and IT support in a small software company. Journal of Knowledge Management. Vol. 5, No 4. pp. 349-357.

Korac-Kakabadse. N. Kouzmin. A. (1999). Designing for cultural diversity in an IT and globalized milieu: some real leadership dilemmas for the new millennium. Journal of Management Development 18: No 3, October, 291-319.

Maier. R. Remus. U., (2002) Defining Process-oriented Knowledge Management Strategies. Knowledge and Process management. Vol 9. No 2. pp 103 – 118.

Malhotra, Y. (1998). Knowledge Management, Knowledge Organizations & Knowledge Workers: A View from the Front Lines [WWW document]. URL: http://www.brint.com/interview/maeil.htm - January 30, 1998

Markus. L., Majchrzak. A., and Glasser. L., (2002) "A Design Theory for Systems that Support Emergent Knowledge Processes". MIS Quarterly, Vol. 26. No. 3. pp 179-212.

Meehan. B., and Richardson. 2002. I. "Identification of Software Process Management". Software process Improvement and Practice. 7: 47-55.

Nonaka. I, and Takeuchi. H., (1995) The Knowledge Creating Company. Oxford University Press. New York.

Orlikowski, W. (1992) The Duality of Technology: Rethinking the Concept of Technology in Organisations, Organisational Science, 1992; 3(3): 398-427

Rhodes, C. (1996) Researching Organisational Change and Learning: A Narrative Approach. The Qualitative Report, December 1996; 2 (4). http://www.nova.edu/sss/QR/QR2-4/rhodes.html

Robey. D, Wishart. N.A, and Rodriguez-Diaz. A.G., (1995) Merging the Metaphors for Organisational Improvement: Business Process Reengineering as a Component of organisational learning. Accting., Mgmt & Info Tech. Vol 5, No 1. pp. 23-39..

Rout T.P., Tuffley. A., Cahill. B, and Hodgen. B., (2000) "The Rapid Assessment of Software Process Capability"(http://www.sqi.gu.edu.au/~terryr/RAPID_SPICE2000.pdf) , SPICE 2000 - the First International Conference on Software Process Improvement and Capability dEtermination, Limerick.

Watkins, E. and Golembiewski, R. (1995) Rethinking Organisational Development for Learning Organisations, The Journal of Organisational Analysis, January 1995; 3(1): 86-101

COPYRIGHT