

A PERSPECTIVE OF NONAKA'S SECI MODEL FROM PROGRAMME MANAGEMENT: COMBINING MANAGEMENT INFORMATION, PERFORMANCE MEASUREMENT AND INFORMATION DESIGN

Martin Wickes
(Corresponding Author)
Cranfield University
International Ecotechnology
Research Centre
Building 53
Cranfield
Bedfordshire MK43 OAL.
Tel: (01234) 754194
Fax: (01234) 750852.
E-mail:
m.wickes@cranfield.ac.uk

Annette Leslie
Cranfield University
International Ecotechnology
Research Centre
Building 37
Cranfield
Bedfordshire MK43 OAL.
Tel: (01234) 750111.
E-mail:
a.leslie@cranfield.ac.uk

Dr Fiona Lettice, Cranfield
University
International Ecotechnology
Research Centre
Building 37
Cranfield
Bedfordshire MK43 OAL.
Tel: (01234) 754966.
E-mail:
f.lettice@cranfield.ac.uk

Additional Authors: Aileen Feeney, Centrica and Paul Everson, PA Consulting

ABSTRACT

This paper presents the findings from on-going research into the implementation and maintenance of a programme management tool with knowledge transfer capabilities, which aims to monitor and improve the organisational processes and performance of large, complex portfolios of change. The findings are based on a case study conducted at a FTSE 100 corporation where poster size tools have been developed to document and disseminate performance knowledge. The tool offers a perspective on the operationalisation of Nonaka and Takeuchi's SECI model (1995). Having demonstrated the application of the tool, the findings are discussed within the context of knowledge management:

This research is interdisciplinary, drawing on work conducted in the fields of knowledge management, project/programme management, Management Information (MI)/performance management and information design. The project was developed by practitioners and academics and is funded by the EPSRC and two industrial sponsors.

1. INTRODUCTION

To sustain innovation Drucker (1993) recognised the need for the “application of knowledge to knowledge itself”. A recent analysis of Knowledge Management literature (Scarborough, Swan and Preston, 1999) identified an over emphasis on a resource based view of knowledge, leading to production of tools to leverage knowledge without learning from earlier literature based on the learning organisation which focused on people.

The power of socially constructed information should not be underestimated. Nonaka and Takeuchi (1995) and Blackler (1995) both put forward a community model of knowledge management which implies that knowledge is “embedded in and constructed from and through social relationships and interactions” and “achieved through shared understandings and attitudes” (Scarborough and Swan 1999). Sharing knowledge across organisational boundaries is seen as the key to the effective exploitation of knowledge (Gibbons et al, 1994)

This paper presents the findings from on-going research into the implementation and maintenance of a programme management tool with knowledge transfer capabilities, which aims to monitor and improve the organisational processes and performance of large, complex portfolios of change. The findings are based on a case study conducted at a FTSE 100 corporation where poster size tools have been developed to document and disseminate performance knowledge. The tool offers a perspective on the operationalisation of Nonaka and Takeuchi’s SECI model (1995). Having demonstrated the application of the tool, the findings are discussed within the context of knowledge management:

This research is interdisciplinary, drawing on work conducted in the fields of knowledge management, project/programme management, Management Information (MI)/performance management and information design. The project was developed by practitioners and academics and is funded by the EPSRC and two industrial sponsors.

2. LITERATURE REVIEW

2.1 Project and Programme Management

Project Management is defined as the management of “a temporary organisation that is needed to produce a unique and pre-defined outcome or result at a pre-specified time using predetermined resources” (CCTA, 1998). Programme Management is “the co-ordinated management of a portfolio of projects that change organisations to achieve benefits that are of strategic importance” (OGC, 1999). Programme management sits above project management and therefore operates at a higher, more strategic level. This differentiation impacts the type of information required to improve visibility and decision making. Whilst some of the programme level information can be aggregated from the project level, much of it stands alone. The main challenges of programme management are: to manifest business strategy, to yield the right balance of projects and investments, to optimise resource allocation, to communicate project priorities and to provide greater objectivity in project selection (Cooper et al., 2001).

Project and programme environments are extremely challenging. Team members are often required to work in knowledge areas they are unfamiliar with, operating as transdisciplinary, and need to be able to quickly understand new technologies, markets, people and organisations. They have to be able to respond to changing environments. Due to increasingly fast technological advancement and the forces of globalisation, the development of corporate strategy in many industries is more dynamic than ever (Mintzberg et al., 1998). Organisations will increasingly find their strategies are emergent with non-linear progression (Stacey, 2000) making the communication of that strategy to staff an ever-greater contest. Those working in a programme management capacity will increasingly find their role demands the development of more stringent Go/No-Go criteria, in order to best utilise resources. Average project cycle time is also likely to shrink to ensure that when a project delivers it remains congruent with strategy. Further, project workers in most organisations face the trials of having to satisfy a myriad of stakeholders, each with a different perspective of what constitutes a successful project or programme. This is further compounded for those working in matrix organisations, who report to functional superiors as well as project superiors.

These factors result in an environment that is increasingly difficult to co-ordinate and control, though a degree of control is achieved through the implementation of formal project management methodologies, such as PRINCE2, (the *de facto* standard in the UK). This has led to an acceptance in the academic literature that organisations are never totally in control (Streatfield, 2001). The impact of this understanding is that the need for high quality information is vitally important if the organisation is to respond in a responsive and flexible manner to meet the challenges of programme management (Cooper et al., 2001). Effective knowledge transfer techniques are also imperative if the knowledge base of the organisation is to be leveraged to communicate issues such as strategic re-alignment, project status, best practice, departmental performance, and so on. The authors' stance regarding knowledge transfer is summarised by the quote "All learning is rooted in conversation" (John Seeley Brown, quoted in Foster & Kaplan, 2001), a viewpoint which is supported by proponents of the community network model (Swan et al., 1999). It is however acknowledged that IT can play an important supporting role as a repository for the vast breadth and depth of information accumulated by the organisation. Socially constructed information then, initiates a demand for more information.

2.2 Management Information and Performance Measurement

For Programme Managers to operate effectively within their environment, the quality of information within and generated by the system is of paramount importance. Quality here comprises several elements: the integrity of the data, the focus and timeliness of the information and the presentation of the information. Information can only be transformed into knowledge when it is internalised by the individual (Nonaka, 1995; Weick, 2001).

A range of multivariate Management Information is required to reflect the current status of the programme. The following set of information does not illuminate performance; moreover it is intended to highlight critical information, around three core themes: strategy, programme planning and programme progression, including benefits management.

A key component within this programme management information system is the contribution of performance measurement; this forms the fourth theme. Performance measurement is “the process of quantifying action, where measurement is the process of quantification and action leads to performance”. (Neely et al., 1995). A Performance Measurement System (PMS) is a framework, which structures a range of performance measures.

Traditionally, PMS were financially orientated, focusing on profit, Return on Investment (ROI) and other accounting formulae. More recently, and principally as a result of Kaplan & Norton’s (1996) work, which developed The Balanced Scorecard (BSC), organisations have aimed to develop PMS which consider a number of stakeholder perspectives. In the case of the BSC, this meant viewing the performance of the organisation from four perspectives: financial, customer, internal (process) and learning and growth.

A review of the literature reveals a similar evolution of PMS within the field of project management. The debate surrounding the performance of projects informs the debate at a programme level because many of the measures are appropriate for aggregation. Historically, project success was defined by compliance with the iron triangle (Atkinson, 1999), also known as the ‘golden triangle’ (Gardiner and Stewart, 2000). That is, whether or not the project had been delivered to cost, time and quality (specification). More recently, de Witt’s research (1988) has resulted in a recognition in the difference between a successfully delivered project and a well managed one. For example, the Project Manager may have established excellent relations with a client and sold further contract work, but for internal or external reasons beyond the Project Manager’s control (e.g. organisational politics or economic disruption) the project delivered over time and budget. Using the traditional parameters of success, such a project would have been considered a failure even though the costs associated with delivering over budget and time are far outweighed by the profits that will be generated by the next contract.

State of the Art Project PMS can now be summarised by considering the performance of a project from three key perspectives: project (task oriented perspective), project management (internal and external perspectives) and project team (psycho-social perspective) (Bryde, 2002). Organisations that employ programme management techniques should also develop a more strategic perspective.

2.3 Information Design

Information design is an emerging academic discipline, in response to the modern challenges of information overload:

“increasing numbers of executive directors of KPMG client companies express concern that the information they receive neither enables them to measure performance against their chosen strategy and objectives, nor helps them in their strategic decision-making process. The common complaints are of too much data and too little analysis.” They go on to report that *“information used to monitor performance was rated poor or average by just under half of the companies contacted in terms of its relevance, accuracy, timeliness, completeness, cost-effectiveness and presentation. Dissatisfaction appeared to be most marked in the cost-effectiveness and presentation of information”*. (KPMG (1990) report (quoted in Neely et al, 1995)).

Though fast-breaking, information design has been gathering pace for over half a century and is robust in nature (Tufte, 1983). Visual language is at the forefront of information design and is defined as the “tight coupling of words, images and shapes into a unified communication unit” (Horn, 1998). “Tight coupling means that you cannot remove the words or the images or the shapes from a piece of visual language without destroying or radically diminishing the meaning the reader can obtain from it” (Horn, 1999). Research by Mayer (2001) found that by adding visuals to words, learning improved by 23%. In another group of studies, adding visuals to words improved transfer of learning by 89%. Maltz’s (2000) study of Perceived Information Quality (PIQ), based on measures of information credibility, comprehensibility, relevance and timeliness, found that communication supported with tables and graphs improves PIQ. With support from developments in information technology, visual language has the potential for increasing human ‘bandwidth’, the capacity to take in, comprehend, and more efficiently synthesize large amounts of new information. (Horn, 2001; Paivio, 1968). The number of applications are virtually unlimited but are likely to be most beneficial in environments where large amounts of information must be processed quickly, such as in interdisciplinary work (which is becoming increasingly common), or in day-to-day single discipline operations where large volumes of data must be processed in order to do the job. Project and programme environments fit both these criteria.

Other research into presentation graphics has been conducted by a range of academics from Kosslyn (1994), who provides an excellent account of chart design from a psychology perspective, Cleveland (1985) and Everitt (1978) who focus on graphing data and Bertin (1981) on a process for extracting maximum value from data sets and the presentation thereof.

In summary, within the performance measurement literature, there is an increasing reference to the need for measures to be clearly displayed (Bourne and Neely, 1998) and not just on the shop floor but also in product development, design engineering project environments and in financial reports (Johnson, 2000; Buchheim, 2000; So & Smith, 2002).

3. THE SECI MODEL

In order to provide context, the SECI model is briefly summarised with examples, which highlight the challenges that many programme management organisations face in establishing effective knowledge transfer systems.

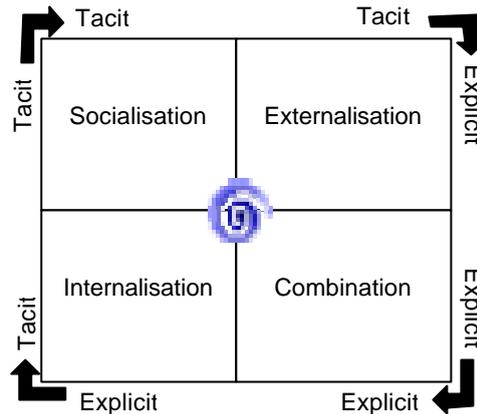


Figure 1. The SECI Process (Nonaka and Takeuchi, 1995).

Socialisation is the process of sharing tacit knowledge through shared experiences. In programme environments where knowledge transfer capabilities are low, communication tends to be intra-project team only. Communication between project teams is limited due to a highly competitive culture and a strong focus on achieving project goals over portfolio goals. Projects typically last for six months, which means that knowledge transfer is very slow because the opportunity to work with different personnel only arises approximately twice a year.

Externalisation is the process of articulating tacit knowledge into explicit knowledge. When this occurs, knowledge becomes crystallised and accessible to all. A programme management example is the documenting of project performance. Where knowledge transfer processes have had limited consideration, reporting processes are typically closed (i.e. restricted distribution), which limits externalisation. The format of such reports tends to be heavily text-biased, which limits access due to the time required to study the document. *Combination* is the process of converting explicit knowledge into more complicated and systematic sets of explicit knowledge. For example, the aggregation of project reports to form a programme report or the aggregation of programme reports in to a portfolio perspective. Access to such reports tends to be restricted to senior personnel, limiting the opportunity for many staff to gain an appreciation of programme and portfolio level issues - to see the bigger picture and their role within it.

Internalisation is the process of embodying explicit knowledge as tacit knowledge. This often occurs when explicit knowledge is practised, or given context from an individual's history or experience. In environments where knowledge transfer is low, the richness of experience with which an individual can internalise is limited.

In general, the speed of knowledge transfer (and therefore cycle speed) is low. A culture of knowledge protection prevails, which at an individual, group and organisation level is sub-optimal.

4. RESEARCH METHODOLOGY

This research has been designed around four non-discrete phases, and has adopted a data driven or grounded approach (Strauss and Corbin, 1998). This work is exploratory; the use of graphical tools in a programme management environment is under-researched. The first phase therefore involved conducting a pilot study, to gain an appreciation of the pertinent issues and to direct the subsequent phases. Phase two reviewed literature identified as salient from the pilot study. Phase three involves developing a set of research propositions, around two key themes. Firstly, the conceptual framework, which identifies MI and performance measures considered to be good practice. This framework will then be translated into a series of graphical templates. Secondly, a set of guidelines, which includes visual language techniques (including effective chart design) and organisational issues surrounding the implementation of the tool will be developed. During Phase four, the concepts and guidelines generated in Phase three will be validated to ensure their integrity and degree of generality.

The research strategy is case study-based (Yin, 1994), with one case study being conducted in each of the collaborating organisations. Specifically, the case studies triangulate data from interviews with tool stakeholders (i.e. those persons who use the tool, those involved in creating it and the sponsor(s) of the research), and from a document review. The data will be analysed using qualitative techniques, such as memoing, coding and content analysis (Miles and Huberman, 1994).

Conducted in parallel with the case study activities, a portfolio of mini-cases and expert interviews is being developed. Meeting design will vary from co-development to semi-structured interviews (Robson, 1993), depending on the nature of the organisation. To date, discussions with programme management consultancies, other FTSE 100 corporations and information designers have been conducted.

5. ESTABLISHING THE BUSINESS CONTEXT

The findings presented are from a pilot study, representing the first phase of this research. The case was conducted at a FTSE 100 company. The change portfolio, at the time of study, was valued at around £500m and principally involved complex business change and IT projects. The need for the tool arose from a lack of understanding across the change portfolio. That is, senior managers and Directors of functional business areas had little information regarding the status of the change effort. Project and Programme Managers had poor visibility over portfolio performance. Project personnel knew little about the purpose and performance of other projects in the portfolio. The format of the communication was a poster size display with several components of information. The information presented in each of these components is mainly graphical, incorporating combinations of pictures, graphics and text.

Initial research has shown that very few companies use such a tool to improve visibility across the change portfolio and as a mechanism for knowledge transfer. As such, in Figure 2, the use of such tools is included in Stages 3 and 4, and is representative of good practice. In the SECI model, movement through the four modes of knowledge conversion is a spiral, not a circle (Nonaka et al., 2001). Having progressed through several cycles, the organisation

may find that they have developed sufficiently to be able to document a new set of organisational characteristics. Figure 2 details these organisational characteristics in four stages and includes knowledge transfer techniques (as defined in the SECI model) found in programme management organisations. It should be noted that the stages are not discrete.

Originally, this research was focused on developing a tool to aid Programme Managers to gain a clearer insight into the status of the change programme. As such the management information and performance measures appropriate in programme environments were developed. The circulation of the tool was at first limited to the Directors (including the Programme Director) of the company as a way of 'playing back' their change plan (case 1, interview 1: 25/03/2002). Distribution then increased so that the tool was displayed in project area corridors and coffee areas. At this stage, issues surrounding knowledge transfer started to become apparent. The tool appears to operate on two levels. Firstly, at a strategic level, Directors can visualise the breadth of the change plan, map future scenarios, understand resource utilisation, delivery bottlenecks and the performance of other Directors' (Sponsors) projects. At a more operational level, individuals can see how their project fits into the grand scheme, projects currently in evaluation that they may be seconded to and the performance of their colleagues' projects.

Organisations should view the cycle characteristics as a set of options, rather than as one cycle being superior to another. The information presented in this paper is considered to be best practice, however, it is acknowledged that different cycles and different quadrants within each cycle may be more important during different phases of a project, or if applied to different industries.

The tool developed is one method of encouraging knowledge transfer and would be supported by other media and management theories (such as the introduction of open communications/reporting, the development of trust and a no blame culture). Other recommended techniques include the mapping of social networks. Socio-professional cliques are then discouraged through formally arranged but informally structuring 'discussion periods' where employees who would not normally discuss ideas and transfer knowledge sit in a meeting room to discuss, among other things, learning experiences and best practice. It is anticipated that other organisations, inexperienced in knowledge transfer could use these approaches to expedite their progress through the stages. These propositions are scheduled for testing in an implementation study, the results of which should be available for presentation at the conference.

Stage 1

- Intra-project discussion
- Limited internalisation potential as a result of limited experience

S	E
I	C

- Project reports, limited horizontal distribution. Text based.
- Programme / Portfolio reports. Limited vertical distribution. Text based.

Characteristics

- Slow rate of knowledge transfer
- Subjective performance measures
- Closed communications
- Low awareness of activity across the portfolio
- Culture of knowledge protection

Stage 2

S	E
I	C

Characteristics

- More focused reporting
- Increased staff access to information

Stage 3

S	E
I	C

Characteristics

- On-line system / graphically represented data supplements focused text-based reports
- Largely objective measures employed
- Enhanced visibility across the portfolio
- More collaborative working environment

Stage 4

- Inter-project and programme discussion
- Increased breadth and depth of employee knowledge
- Increased internalisation potential due to richer knowledge base
- Increased staff contribution

S	E
I	C

- Graphical project reports. Open access.
- Programme / Portfolio reports.
- Best practice documents
- Improved training schemes

Characteristics

- Faster rate of knowledge transfer
- Objective performance indicators
- Open communications, which facilitate discussion
- One message, many media (internet, poster displays, meetings, databases)
- Wide distribution / access to information
- Culture of knowledge sharing, encouraged by open communications

Slow Cycle Speed

Increasingly sophisticated knowledge transfer systems

Faster Cycle Speed

Figure 2. Four Stages of Knowledge Transfer in a Programme Management Environment

6. DECONSTRUCTING THE TOOL

Information on the tool is presented graphically and relates to a number of areas. In order to communicate strategy, a cause and effect map is displayed, linking the business drivers (Kaplan and Norton, 2001). So that the performance of the department can be monitored, there is a component displaying the status of projects currently in execution (Figure 3), a section highlighting portfolio optimisation and another monitoring general performance (Neely, 1998). A series of components deal with planning management: projects currently being evaluated to determine their financial value and strategic congruence; the capacity and demand for key resource constraints and how the current set of projects will impact the functional business areas and the project's department once they are ready for implementation. In addition, there is a section which displays the key achievements within the department, from the previous two months.

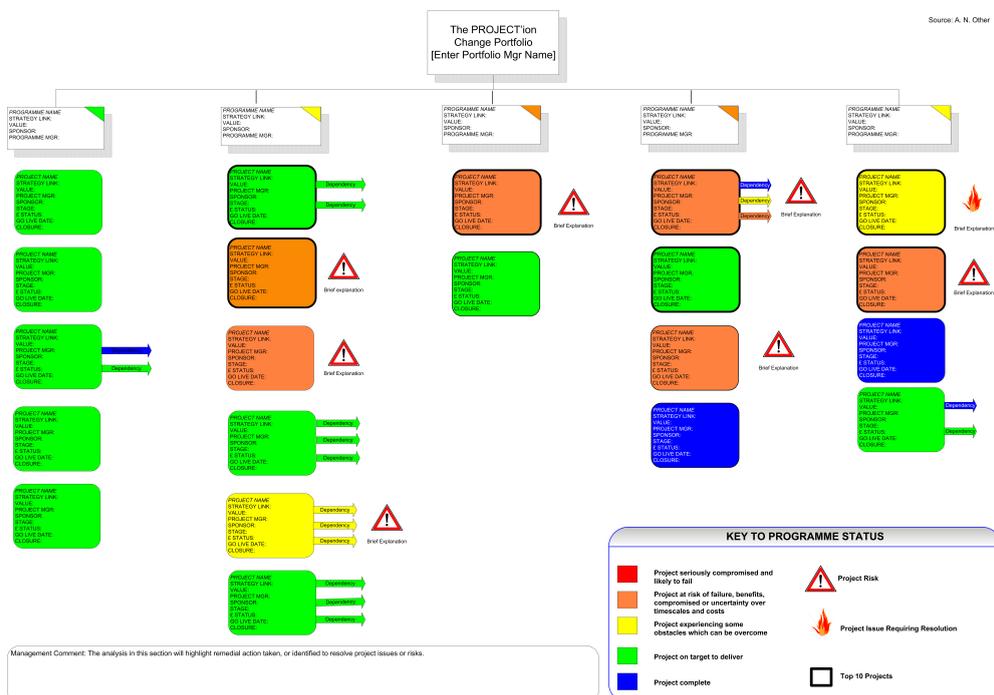


Figure 3. Example of a component of the display, illustrating the current status of the change programme, including project prioritisation, risk, issue and dependency information.

6.1 Benefits and Drawbacks of the Tool

A wide range of benefits have been identified for the tool. Firstly, there appears to be increased visibility within the programme environment. The simple presentation of unambiguous data creates increased visibility for strategic and operational users across the portfolio. This allows for the identification and correction of poor performance and the acknowledgement of excellent performance. Secondly, there is enhanced knowledge dissemination across projects and programmes. Information is not hidden in complex accounting formulae or through management jargon and

corporate language / acronyms, which means that the information is accessible to all employees, important if socialisation processes are to initiate knowledge transfer. Thirdly, organisations executing change portfolios across a number of countries may find that they encounter the additional barriers of culture and language. The tool is effective at overcoming these obstacles as it employs visual language rather than textual language, which can result in difficult reading and misinterpretation. In one of the mini-cases, the reporting processes of a multi-national car manufacturer were studied. They perceived there to be benefits in using numerical and graphical data over textual description. Fourthly, as discussed in the literature review, visual language is effective because it reduces comprehension time and increases retention rates. This allows Programme and Portfolio Managers to spend more time managing and less time reading. Penultimately, users of the tool report that one of the benefits is that all the information is reported on one page, "...the difference between having one piece and three pieces of paper may seem absolutely trivial but when you can just stand there and have no need to do anything apart from just look and understand ... then your brain ... can just take it all in." (case 1, interview 8: 02/05/2002). Finally, the tool can be used to structure meetings. Anecdotal evidence suggests that the tool is extremely effective at structuring meetings. Progress meetings have been reduced from 2 hours to an average of 40 minutes in one of the collaborating organisations. It is not possible to structure a meeting around a computer monitor. Where projector screens are used, effectiveness is likely to be diminished as a result of the information being presented on a number of different screens, without the ability to annotate.

There are inevitably some drawbacks associated with the tool and these are principally surrounding the cost of production. The collaborating organisations have invested in A0 Plotters (a type of printer which is fed by a roll of A0 width paper), which costs £5,000 - 7,000. In addition, there are on-going costs associated with printing and distribution. Secondly, there may be an issue surrounding the frequency of update. Information sourced from IT applications has the potential to be updated in real time or at intervals deemed appropriate by the organisation. The poster style display takes approximately one day per month to compile and distribute. However, this appears to be a satisfactory reporting frequency for the organisations involved in this research.

7. TOWARDS EFFECTIVE KNOWLEDGE TRANSFER

Having outlined the symptoms that commonly hinder programme management within organisations that have not considered knowledge transfer, the organisational characteristics of businesses which enable knowledge transfer will now be presented, and applied to Nonaka's SECI Model.

Socialisation: Inter-project discussion is commonplace. Discussion around project issues, potential solutions and successful outcomes occur in corridors and coffee areas where inter-project socialisation is high and prompted by the display of the tool. Socialisation is encouraged by the introduction of a 'no blame culture'. Staff are encouraged to share their learning experiences with other project staff, without fear of recrimination. Some organisations may choose to link staff performance to the number and quality of project learning publications.

Externalisation: The principle of open reporting has been embraced. Staff now have access to data across the entire portfolio and at all levels, should they want to further

research an issue or action taken in another project. Such action is typically prompted by an inter-project discussion. Another factor encouraging externalisation is the simplicity of the presentation format. Information is not hidden in complex accounting formulae or through management jargon and corporate language and acronyms. Given that most discussions are impromptu and informal, occurring sometimes during employees' break times, it is argued that the opportunity for knowledge transfer is reduced if the information presented in the display is technical and/or complex. The simplicity and graphical nature of the reports means that they are also effective at transcending barriers of language and culture. Staff can access more detailed or more focused information via traditional reporting structures and/or the knowledge repository.

Combination: Reports are aggregated from project to programme level and from programme to portfolio level. The presentation is heavily biased towards the use of graphics and are presented on one large sheet of paper for ease of reading. Employee access is not restricted, moreover it is encouraged. It is proposed that the aggregation of these discussions will lead to organisational learning, specifically: increasingly fast advancement towards the realisation of good practice, improved training and development programmes and the development of communities of practice as like-minded employees begin to develop shared mental models.

Internalisation: As a consequence of increased socialisation, employees have a much richer set of experiences from which to internalise new information. They are also aware of more potential solutions to the problems that they encounter. Junior staff can also play an active role in the resolution of project issues as a result of increased access to higher level information.

In summary, anecdotal evidence suggests that knowledge transfer is much higher and the SECI cycle time is faster, crucial in an increasingly dynamic corporate environment. By establishing open communications, employees feel empowered. They have access to information relating to all projects within the portfolio, not just the projects with which they are involved. Performance indicators are used, which are the basis for discussion, rather than an absolute measure of performance.

8. EXPLAINING KEY LEARNINGS THROUGH KNOWLEDGE MANAGEMENT THEORY

A large portfolio of project work will require many different project teams and associated disciplines to integrate their knowledge in order to continue the development of new products, services and systems. Quintas et al. (2002) identifies the challenges of sharing knowledge across disciplinary and functional boundaries 'since different communities and disciplines may have little common ground for sharing understandings'. Indeed working in programme teams competing for resources may create a competitive environment, which creates barriers and firewalls to knowledge sharing. "It is only through the process of sharing and assimilating information, often determined in large part by high levels of reciprocal trust, that organisations can move from collections of individuals to a more collective culture" (Lemon and Sahota, 2002). By promoting management theories, such as a no-blame culture and open communications, organisations can encourage a trusting environment. Organisations are cognitive enterprises that learn and develop knowledge (Argyris and Schon, 1978) such a capability could involve a tool and an organisational or cultural ethos that supported its use.

Using a matrix style to create cross functional project teams for resource and adopting a community network model of knowledge management processing encourages knowledge sharing through networking. The cross functional style of working enables an overlap of skills and previous experience, creating 'redundancy' – seen as necessary by Nonaka and Takeuchi (1994) as some knowledge is needed by all individuals, even if not used regularly, as it allows them to interact or 'sense make' (Weick 1990). The community network model, as its name indicates, requires active participation in an innovation process which is accepted as unpredictable and complex requiring continuous interaction and reiterations. The networking, through networks such as communities of practice, which may be IT based, offers the opportunity to communicate both inside and outside of the organisation to draw in information to add or amend to the shared system of meaning. The 'big picture' approach brings together many of the facets of the community network model. The SECI process can be illustrated by the use of such a diagram, offering it as a social communication process, enabling sense making and creating a common language, which in turn leads to a shared system of meaning. By displaying the diagram in coffee rooms and corridors, the organisation is encouraging the cross functional team to network within and across teams and communities of practice. It is proposed here that such discussions occur as a result of human's inherent interest in other people's performance. Though requiring further research, such discussions usually involve the use of story telling (Snowden, 1999) and metaphor to facilitate organisational understanding (Morgan, 1986).

The use of the diagram as a focus of attention, facilitates multidiscipline and cross functionality networking of the teams, generating a Mode 2 style of working, which Gibbons (1994) sees as necessary for knowledge production for innovation; this overlapping in turn generates the ability to create a 'redundant representation' (Hutchins 1990). This 'redundant representation' enables the group to envisage 'a social system of joint actions' (Swan et al 1999), literally working together through the diagram to identify potential risks and changes of approach from a kaleidoscopic range of opportunities. The graphical presentation of the organisation's key data creates a shared system of meaning and associated shared metaphors, such as the traffic light coding of red, amber and green. The community networking models emphasise developing a common language spoken by all project team members to challenge the typical problems of competitive project team knowledge silos and barriers as it highlights relationships, shared attitudes and understanding (Spender, 1996) and provides a cumulative feedback loop (Castells 1996).

Swan et al. (1999) identify an aim "to develop systems that allow experts to engage in active networking through creating environments that are media-rich enough to encourage knowledge sharing and organisational learning". The one page big picture creates a demand driven approach to knowledge processing, reducing individual overload, and encouraging sharing of knowledge through formal (project review meetings) and informal (coffee room) networking. An immediate advantage of the diagram is the opportunity to exploit previous organisational knowledge and move away from reinventing the wheel, however whilst this generates more efficiency in the organisations processes it does not necessarily lead to innovation. To explore opportunities for innovation the organisation needs to understand their 'big picture',

its interrelationships, its shared communities and language which enable them to make sense of the future they are designing and developing.

Wharton (1998) reasons that organisations must develop ways of ensuring that the culture is conducive to knowledge sharing. One way of supporting this culture is to facilitate and encourage socialisation as a platform for knowledge dissemination. Senge (1990) promotes the use of dialogue promoting mutual understanding between individuals. The individuals engaged in knowledge transfer are known as boundary spanners because they facilitate the transfer of information and bridge the communication gap created by functional areas or competitive teams, thereby reducing distortion and bias. (Wilensky 1967, Myers and Marquis, 1969, Tushman, 1977).

9. CONCLUSIONS AND SUMMARY

This paper presented findings from on-going research into the implementation and maintenance of a programme management tool with knowledge transfer capabilities, which aims to monitor and improve the organisational processes and performance of large, complex portfolios of change. The findings are based on a case study conducted at a FTSE 100 corporation where the tool has been developed to document and disseminate performance knowledge. The tool offers a perspective on the operationalisation of Nonaka and Takeuchi's SECI model (1995).

Socially constructed information can overcome difficulties in sharing knowledge. In this study, open communications have made visible the performance of other projects to a wide range of personnel. The location of the display, such as in office corridors and coffee areas has led to a high number of staff reading the display. The simplicity of the presentation and its graphical nature has generated interest in the information by making it quick and easy to read. These factors have led to discussions around problems that project teams have encountered; potential solutions to the problems and how effective those solutions have been. The next stages of this research will validate these findings in further industrial case studies.

REFERENCES

- Argyris, C. and Schon, D. (1978). *Organizational Learning: A theory of action approach*. Reading, MA: Addison Wesley.
- Atkinson, R. (1999). "Project Management: cost, time and quality, two best guesses and a phenomenom, it's time to accept other success criteria". *International Journal of Project Management*. 17 (6) 337-342.
- Bertin, J. (1981). *Graphics and Graphic-information processing*. Walter de Gruyter & Co.
- Blackler, F. (1995). "Knowledge, Knowledge Work and Organizations: An overview and Interpretation". *Organization Studies*. 16(6).
- Bourne, M and Neely, A. (1998). "Why do performance initiatives succeed and fail?" *Performance Measurement – Theory and Practice: Papers from the 1st International Conference on Performance Measurement*. July 1998, Cambridge, England.
- Bryde, D. (2002). "Aligning Project Management Key Performance Indicators of Internal Stakeholders with Definitions of Project Management Success". *British Academy of Management Annual Conference*. 9-11 September, London, England.
- Buchheim, R K. (2000). "Developing performance metrics for a Design Engineering department". *IEEE Transactions on Engineering Management*. 47 (3) 309-320.
- Castells, M. (1996). *The Rise of the Network Society*. Blackwell.
- CCTA. (1999). *Managing Successful Projects with PRINCE2*. London: The Stationary Office.
- Cleveland, W. S. (1985). *The Elements of Graphing Data*. Pacific Grove, Calif.: Wadsworth and Brooks/Cole.
- Cooper, R. G., Edgett, S. J., and Kleinschmidt, E. J. (2001). *Portfolio Management for New Products*. 2nd Ed. Perseus Publishing.
- De Witt, A. (1988). "Measurement of Project Management Success". *International Journal of Project Management*. 6 (3) 164-170.
- Drucker, P. (1993). *Post-Capitalist Society*. Oxford: Butterworth-Heinemann.
- Everitt, B. S. (1978). *Graphical Techniques for Multivariate Data*. Heinemann Educational Books.
- Foster, R. N. and Kaplan, S. (2001). *Creative Destruction*. Pearson Education Limited.

- Gardiner, P. D. and Stewart, K. (2000). "Revisiting the golden triangle of cost, time and quality: the role of NPV in project control, success and failure". *International Journal of Project Management*. 18, 251-256.
- Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P., and M. Trow (1994). *The New Production of Knowledge: the dynamics of science and research in contemporary societies*. London: Sage.
- Horn, R. E. (2001). "Visual Language and Converging Technologies in the Next 10-15 Years (and Beyond)". *National Science Foundation Conference on Converging Technologies (Nano-Bio-Info-Cogno) for Improving Human Performance*. Dec 3-4 2001.
- Horn, R. E. (1999). "What is Information Design? Information Design as an Emerging Profession", in Jacobson, R (ed.). *Information Design*. MIT Press.
- Horn, B. (1998). *Visual Language: Global Communication for the 21st Century*. MacroVU Inc.
- Hutchins, E. (1990). "The Technology of Team Navigation", in Galegher, J. Kraut, R. & Egidio, C. (Eds). *Intellectual Teamwork*. NJ: Erlbaum.
- Johnson, A S. (2000). *Building an Effective Co-Development Performance Measurement System*. PhD Thesis, Cranfield University.
- Kaplan, R. S. and Norton, D. P. (2001). *The Strategy Focused Organisation*. Boston: Harvard Business School Press.
- Kaplan, R. S., Norton, D. P. (1996). *The Balanced Scorecard*, Harvard Business School Press, Boston.
- Kosslyn, Stephen M. (1994). *Elements of Graph Design*. New York: W. H. Freeman.
- Lemon, M. and Sahota, P.S. (2002). "Organizational culture as a knowledge repository for increased innovative capacity". *Technovation*, Article in Press.
- Maltz, E. (2000). "Is all communication created equal? An investigation into the effects of communication mode on perceived information quality", *Journal of Product Innovation Management*. 17, 110-127.
- Mayer, R. E. (2001). *Multimedia Learning*. Cambridge: Cambridge University Press.
- Miles, M. B., and Huberman, A. M. (1994). *Qualitative data analysis, An expanded sourcebook* (2nd Ed.). CA: Sage.
- Mintzberg, H., Ahlstrand, B. and Lampel, J. (1998). *Strategy Safari*. Pearson Education Limited.
- Morgan, G. (1986). *Images of Organization*. Newbury Park: Sage.

- Myers, S. and Marquis D. (1969). *Successful Industrial Innovation*. Washington, DC: National Science Foundation.
- Neely, A. (1998). *Measuring Business Performance*. London: Economist.
- Neely A, Gregory M and Platts K. (1995). "Performance measurement system design: a literature review and research agenda". *International Journal of Operations and Production Management*. 15, 4, 80-116.
- Nonaka, I. and Takeuchi, H. (1995). *The Knowledge Creating Company*. Oxford: Oxford University Press.
- Nonaka, I., Toyama, R. and Konno, N. (2001). "SECI, Ba and Leadership: a Unified Model of Dynamic Knowledge Creation". In *Managing Industrial Knowledge*. Ed. Ikujiro Nonaka and David Teece. London: Sage.
- OGC. (1999). *Managing Successful Programmes*, London: The stationery Office.
- Paivio, A., Rogers, T. B., and Smythe, P.C. (1968). "Why are Pictures Easier to Recall than Words?" *Psychonomic Science*. 11, 137-138.
- Quintas, P. Little, S. & Ray, T. (2002). *Managing Knowledge: An essential reader*. Sage.
- Robson, C. (1993). *Real world research, a resource for social scientists and practitioner-researchers*. Oxford: Blackwell.
- Scarborough, H. & Swan, J. (1999). *Cases in Knowledge Management*. People Management Series. London: Institute of Personnel Development.
- Scarborough, H., Swan, J.A. and Preston, J. (1999). *Knowledge Management: a literature review*, London: The Institute of Personnel and Development.
- Senge, P. (1990). *The Fifth Discipline: the art and practice of the learning organisation*. London: Doubleday.
- Snowden, D.J. (1999). "The Paradox of Story: Simplicity and Complexity in strategy". *Journal of Strategy & Scenario Planning*. Ark Publishing
- So, S. & Smith, M. (2002). "Presentation format and information complexity in multivariate decision making". *British Academy of Management Annual Conference*. 9-11 September, London.
- Spender, J. C. (1996). "Organizational Knowledge, learning and memory: three concepts in search of a theory". *Journal of Organizational Change*. 9, 1, 63-78.
- Stacey, R. D. (2000). *Strategic Management & Organisational Dynamics*. 3rd Ed. Pearson Education Limited.

- Strauss, A., & Corbin, J. (1998). *Basics of qualitative research, Techniques and procedures for developing grounded theory*. (2nd Ed.). CA: Sage.
- Streatfield, P. D. (2001). *The Paradox of Control in Organisations*. Routledge.
- Swan, J., Newell, S., Scarborough, H., & Hislop, D. (1999). "Knowledge Management and Innovation: Networks and Networking". *Journal of Knowledge Management*. 3, 4 262-275.
- Tufte, Edward R. (1983). *The Visual Display of Quantitative Information*. Cheshire, USA: Graphics Press.
- Tushman, M. L. (1977). "Special Boundary Roles in the Innovation Process". *Administrative Science Quarterly*. 22.
- Weick, K. E. (1990). "Technology as equivoque: sense-making in new technologies". In Goodman, P. S., Sproull, L. S. and Associates (Eds), *Technology and Organisations*. Oxford: Jossey-Bass.
- Weick, K. E. (2001). *Making Sense of the Organization*. Blackwell Business.
- Wharton, A. (1998). "Common Knowledge". *Document World*. Oct/Nov.
- Wilensky, H. (1967) *Organizational Intelligence*. New York: Basic Books.
- Yin, R. K. (1994). *Case study research, Design and methods* (2nd Ed.). CA: Sage.