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**A Collaborative Knowledge Management Tool for
Product Innovation Management**

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Abstract: Contemporary business systems are becoming increasingly competitive. Faster and smarter technology, although imperative, is not enough to survive in dynamic environments. Modern enterprises must adopt a deliberate and systematic approach to managing the drivers of innovation in order to create and deliver innovative new products and services and thus maintain competitive advantage. Managing the enterprise's knowledge base and converting intellectual capital into useful products and services is fast becoming the critical executive skill of the age. With this in mind, our research focuses on adopting a knowledge management approach to product innovation management. This paper reports on the findings of a case based research investigation. It introduces the concept of knowledge management for product innovation and presents a collaborative knowledge management tool specifically designed to help manage a portfolio of product innovation projects in a distributed environment.

Keywords: Knowledge Management, Product Innovation Management, Portfolio Management, Groupware prototype

INTRODUCTION

Effective product innovation is imperative for the survival, growth and profitability of most design and manufacturing enterprises [1]. In the current dynamic manufacturing environment companies must innovate successfully if they wish to remain competitive. Global competition, emerging technologies, and an ever-increasing need for superior products in shorter time frames are all contributing forces driving organisations to adopt new and innovative approaches to product innovation. Much research has been undertaken in this area in an attempt to enhance the product innovation process in organisations [1, 2, 3]. Despite considerable progress there is still significant room for improvement. We found that this is particularly evident in relation to communication, co-ordination and management issues. Product innovation is a complex, cross-functional and dynamic process, which is difficult to manage [3, 4, 5]. In order to operate effectively, timely, accurate and reliable information from many facets must be available to product managers to help them to make informed decisions [6, 7]. In this view, information and knowledge are key resources that must be managed if improvement efforts are to succeed and businesses are to remain competitive in global markets [6, 7, 8, 9].

As we enter this new era of business, the approach to managing product innovation is evolving rapidly. Manufacturing enterprises are paying more attention to the concept of managing their knowledge base across the entire value chain in order to increase competitive advantage [7, 10, 11, 12]. They are in the process of creating a distributed design and manufacturing environment that enables successful product innovation [11, 13]. Suppliers and customers are becoming more and more involved in the process regardless of their location [1, 4, 14]. Consequently organisation's must be able to provide the right information, to the right person, at the right time, in the right format, anywhere within the extended enterprise. In order to manage this process effectively, certain strategies and some specific structures and technologies are required to create an enabling environment [6, 7, 15]. One such strategy is finding effective structures and methods for communication, co-operation and collaboration within the manufacturing enterprise and throughout the supply chain. The technologies that support such a strategy must be able to deal with distributed environments and databases, must ensure reliability and security and must be

practical [16, 17]. With this in mind we have undertaken a field-based study in this area. This approach helped us to understand the social and cultural contexts within which people work. We then designed and developed a groupware based knowledge management prototype, based on our research, called eProduct Manager. eProduct Manager was specifically designed with the requirements of industry in mind to facilitate the sharing and integration of product related information and knowledge in a distributed environment. This paper introduces the concepts of knowledge management and identifies how this can be used to enable product innovation management. It then presents the software prototype and examines how it can facilitate product innovation management in a dynamic environment.

ENTERPRISE KNOWLEDGE MANAGEMENT

Knowledge is an elusive concept and difficult to define. The term is used in several different ways in the literature. For example, Nonaka and Takuechi [15] adopt a philosophical angle and define knowledge as “*justified true belief*”. In other words, knowledge is an opinion, idea or theory that has been verified empirically and agreed upon by a community. Wilson [18], also examines knowledge at a fundamental level and defines it as “*that which is known*”. Quinn et al [19] compare knowledge to professional intellect. Stewart [20] also considers knowledge in terms of intellectual capital. While knowledge is an ambiguous concept, enterprise knowledge management is slightly more concrete. Enterprise knowledge management focuses on the application of knowledge in an industrial setting. Many researchers and industrialists claim that enterprise knowledge management centres on the knowledge process [21, 22]. For example, Bassi [21] defines enterprise knowledge management as the process of creating, capturing and using knowledge to enhance organisational performance. Blake [22] believes it is “... *the process of capturing a company’s collective expertise wherever it resides and distributing it to wherever it can help produce the biggest payoffs*”. Taking these definitions into consideration enterprise knowledge management can be considered to be a systematic and organised attempt to use knowledge within a company to transform its ability to generate, store and use knowledge in order to improve performance. In short, the overriding purpose of enterprise knowledge management is to make knowledge accessible and reusable to the organisation.

According to Bassi [21] enterprise knowledge management is a means to an end not an end in itself. Therefore, knowledge management initiatives must be linked to strategies. Strategy influences knowledge generation and use by providing a context for the perception and interpretation of the environment and a boundary to decision-making. In this view, defining a clear purpose and strategic intent are critical to the success of knowledge management endeavours [3, 24]. Therefore, enterprises must develop, implement and improve proactive knowledge management strategies. Hansen et al [25] argue that there are two different types of knowledge management strategies. The first is called the codification strategy, which focuses on the computer. In this instance, knowledge is carefully coded and stored on database systems where it can be accessed and used by others. The second strategy they identified is called the personalisation strategy. This strategy focuses on helping people communicate knowledge as opposed to storing it. Hansen et al [25] note that the strategy chosen depends on how the company serves its clients, the economics of the business and the people it hires. The balance between what can be termed a

technical or codification strategy for knowledge management versus a social or personalisation strategy for knowledge management is illustrated in figure 1.

Insert Figure 1 Strategic Choice for Knowledge Management Initiatives

In this figure an idealised balance between both approaches is illustrated and termed minimum critical codification and team based personalisation. The centre arrow indicates a growth in knowledge management based on a balance between two possible extremes. With this in mind, it is important that the right balance be found between appropriate codification of knowledge (such as logging problems) and personalisation (such as working in teams). It is imperative to have a certain minimum critical codification of knowledge and information. In other words, it is important to represent or codify information and knowledge, which refers to the process of putting knowledge into various forms that can be accessed, leveraged and transferred [1, 2, 3]. It is also imperative to effectively connect team members to one another in order to facilitate knowledge generation and innovation [7, 11, 14, 15, 26]. Effective communication structures are essential to integrate the knowledge and skills required to design, develop and deploy successful products and services. Moreover, closely connected networks of people are lauded to generate more knowledge of a higher quality than any individual can [14, 27].

KNOWLEDGE MANAGEMENT AND PRODUCT INNOVATION

The product innovation process can be described as an information transformation process where information is gathered, processed and transferred in a creative way [28]. Vast amounts of information and knowledge are required by designers and developers to integrate customer requirements, ideas, problems and design changes [1, 2, 3, 4, 13]. In addition, the effective management of multiple projects requires the easy integration of information from many project plans [1]. In this view, the right information must be made available to the right people, at the right time, and in the right format. Without access to accurate, relevant and up to date information mistakes or misjudgements will continually be made on many aspects of the product's design, development and co-ordination [13]. Furthermore, not only are they continually acquired, created and processed but both knowledge and information must also be transferred from one activity to another and between the relevant players involved in the product innovation process [6, 7]. Therefore, knowledge sharing is a vital and basic necessity for product innovation management. Frequent communication increases the amount of information and knowledge shared. In this view, more communication and collaboration usually yields more information and knowledge.

According to Jones and Jordan [26], knowledge sharing and transfer depends on personal networks and the willingness of individuals to share. A great deal of what people learn and therefore what the organisation comes to know results from interaction among and between team members. Organisations leverage individual talents into collective achievements (i.e. new products and services) through networks of people who collaborate. Consequently, organisations are beginning to reorganise reporting lines and organisational structures not around traditional tasks or functional departments, but around communities of practice [7, 26, 27]. Communities of practice are informal networks in which experience is shared among the members. Not only are these networks a mechanism for communicating but they

also help to advance collective understanding by providing a forum for discussion and collaboration. In doing so, they create value for their individual members as well as the organisation. Communities of practice leverage knowledge through organisational pull rather than information push. They are organic networks in the sense that they evolve as a result of the informal interaction of the members over time as the knowledge base evolves as well.

Baets [29] argues that building a knowledge management tool in order to support decision-making and management should best be based on a connectionist approach. In other words, building frameworks or structures to enable closely connected networks of people. Such networks of individuals are lauded to generate more knowledge of a higher quality than any individual can. Furthermore, individual use of information technology is moving gradually to group use (i.e. group decision support systems, networks for exchange and electronic discussion). In the broadest sense, groupware refers to any computing technology that helps groups work better collaboratively over digital media [30]. Some describe it as computer-based tools that can be used by work groups to facilitate the exchange and sharing of information [31]. Others defined it as computer-based systems that support groups of people engaged in a common task (or goal) and that provide an interface to a shared environment [32, 33]. According to Dennis and Gallupe [34] groupware systems provide at least five contributions that may improve group interaction. These are:

- They enable group members to break the bonds of time and space. Group members can work on the project together without coming together in the same room at the same time.
- They enable parallel communication. By typing, rather than taking turns talking, all participants can contribute information, ideas, and opinions simultaneously (i.e., in parallel) so that information is collected and shared much more quickly.
- They allow comments to be anonymous. Anonymity may improve group work by separating personalities from the problem.
- They can impose a structure on the work. Groupware enables structures to more closely guide work and makes it more difficult for participants not to follow them.
- They provide organisational memory by electronically recording all information so that participants can immediately see information entered by others.

DESIGN GOALS FOR A KNOWLEDGE MANAGEMENT TOOL

The aim of knowledge management is to manage information in the unique context of the enterprise. In this view, context is embedded in the organisations business values, strategic direction and experiences and in the insight and expertise of the employees. Every organisation has a unique collection of knowledge assets and distinct business problems to which those assets must be applied. Therefore, every knowledge management solution is specific to the firm for which it is designed [7, 9]. However from our research we identified generic activities in the knowledge process namely; generate knowledge, represent knowledge, store knowledge, access knowledge and transfer knowledge.

- Knowledge generation includes the creation of new ideas, the recognition of new patterns, the synthesis of different disciplines and the development of new processes.

- Knowledge representation is the process of putting knowledge into various forms that can be accessed, leveraged or transferred.
- Knowledge storage refers to the mechanisms that can store and retrieve all kinds of data, information and knowledge.
- Knowledge access refers to the process of retrieving information and knowledge from a system for reuse.
- Finally, knowledge transfer is the process by which an organisation shares its knowledge and information among members in order to promote learning and produce new knowledge or understanding.

These represent the primary knowledge activities of most organisations and we found that knowledge management efforts should improve or at least enable, the activities they represent. We also found that it is imperative to design an approach to impose a structure on the work. Groupware tools are lauded to enable structures to more closely guide work and make it more difficult for participants not to follow them [33]. It is also important to provide the user with an integrated approach to better manage and control product innovation initiatives in a networked environment [5, 6, 13, 26]. The next section introduces eProduct Manager that was designed to meet these criteria.

ePRODUCT MANAGER

eProduct Manager is a web enabled collaborative knowledge management prototype developed to encourage a systematic approach to product innovation management. It was designed specifically for product managers wishing to co-ordinate a portfolio of product innovation projects in a distributed environment. The main objective of the prototype is to develop a structure to (a) enable critical information to be codified and (b) enable a participative approach to managing a portfolio of product innovation projects. In other words, the goal of the prototype is identify and integrate critical project information such as customer requirements and expectations, new product concepts and customer complaints as well as promoting communities of practice and integrating customers and suppliers in to the product innovation process. The prototype also aims to support key activities in the knowledge process (i.e. generate knowledge, represent knowledge, store knowledge, access knowledge and transfer knowledge). To this end eProduct Manager is build around an a structure that integrates four modules namely (a) Goals, (b) Actions, (c) Teams and (d) Results (see figure 2).

Insert Figure 2 Key Elements in the Prototype

Goals

Goals are the objectives of an organisation's effort. Therefore, the goals module deals with the strategic planning stage of the product innovation process. This is where the direction for the company's product innovation endeavours is identified and communicated so that all projects can be aligned with the strategic direction of the organisation. It involves creating statements such as; product innovation charter mission and vision. Customer, shareholder and conformance requirements are also defined. Strategic thrusts and agreeing strategies as well as measures of performance are also selected.

Actions

Actions are the expenditure of an organisation's effort. Therefore, this module comprises the definition of individual projects or deliverables. It involves engaging staff in problem solving and idea generation. Ideas and problems are then selected and ranked. Project portfolios and timelines are created. The company's goals are then deployed into actions. This enables all actions to be aligned with the organisation's goals.

Teams

Teams are the resources for an organisation's effort. Teams and team leaders are assigned to implement actions. This module facilitates the effective co-ordination of team activities by organising and prioritising tasks, activities and deadlines. It can use an organisation's existing e-mail system to disseminate new or updated information and regular status reports between team members so everyone has access to complete, accurate and timely information. A performance review tool is also included in this module, which incorporates skills, competencies and progress. It enables reward and appraisal systems to be linked to participation levels, which can increase motivation towards change.

Results

Results are the outcome of an organisation's effort. This module involves implementing the development plan and continuously monitoring the results of the goals and actions. More specifically, it deals with performance measurement and evaluation. It helps to ascertain whether the product development plans lead to the results envisioned. This feedback loop allows the organisation to develop a corporate conscience by learning from its experiences.

As figure 2 illustrates goals filter actions that flow into the system. In other words, goals constrain actions that enter the system. In this view, only actions that align with the organisations goals can proceed through the system. Teams also constrain the number and type of actions. In other words, organisations must have the appropriate quantity (i.e. number of individuals and teams) and quality (i.e. people equipped with the right skills and capabilities) to undertake each action. Actions that fit with these constraining factors are deemed viable and eventually progress to the planning stage where the project is prioritised, a sponsor appointed and resources assigned for implementation. Finally, results monitor the progress of goals and actions. Actions are evaluated using tailored performance indicators or scorecards and these results are used to influence the continuous development of the organisation's goals and strategies. Effective and continuous interaction between goals, actions, teams and results can help companies develop and grow.

COMPOSITE CASE STUDY

This section comprises case study material on eProduct Manager. More specifically, it demonstrates how to populate the software prototype with company specific information. In order to preserve the confidentiality of information provided by the organisations that participated in this study, a working example using a composite case study is provided. This is a best practice example that describes the operations of a company that designs and develops innovative mobile communication solutions referred to as MobileCom. eProduct Manager is populated using case study material from this organisation. A four-stage methodology for doing this is presented. This

step-by-step process provides users with a structured approach for populating and using eProduct Manager. A brief profile of MobileCom is provided from the outset in order to provide a background to the case study. The methodology is then introduced and finally a working example of eProduct Manager using MobileCom's details is provided.

Profile of MobileCom

MobileCom designs, develops and markets next generation mobile communication products. The company is part of a large global electronics corporation. The mobile communication division is a separate stand-alone unit within the corporation. MobileCom's strategic thrusts lie in the area of product innovation within the telecommunications industry. Research and development is focused on new technology together with market analysis in order to understand both state of the art technologies and emerging customer requirements. This organisation focuses on state of the art engineering in terms of product design and little emphasis is placed on co-ordination and project management. In the past, the product innovation function was small and cohesive and thus the project portfolio was easy to manage. However, today the project portfolio is significantly larger and thus more difficult to manage. Problems relating to the management of product innovation management include the following:

- The organisation also has many new product ideas in its development pipeline. However, there are not enough resources in terms of people, time, budgets and equipment available to develop them. Therefore, it seems that the organisation requires a systematic portfolio planning process to facilitate effective selection and prioritisation of projects. This process must ensure that all projects chosen for the portfolio align with the strategy of the organisation.
- MobileCom has an abundance of information regarding its product innovation projects. However, it is often difficult to locate the required pieces of information as they are often distributed across different document archives. Therefore, it seems that critical information regarding the status of each project such as start date, end date, project status, priority and exception reports (i.e. projects that are red flagged in other words those that are falling behind key milestones) is required in order to keep track of progress.
- Mobilecom concedes that the interface between the organisations key functions (i.e. marketing, design and manufacturing) and the company's customers is poorly managed. The organisation feels that they must involve both customers and suppliers in the early stages of new product innovation (at concept development stage) in order to effectively understand their needs, requirements and expectations.
- Finally, the organisation maintains that product innovation activities are not measured adequately or effectively. Key performance indicators must be developed in order to help manage the performance of the portfolio.

Methodology

This section describes how eProduct Manager functions using MobileCom's product development data. It is based on a four-stage methodology namely, (a) define goals,

(b) manage actions, (c) empower teams and (d) monitor results. Each of these stages is explored in more detail below.

Step 1. Define Goals

The Goals module facilitates MobileCom's strategic planning process. It helps managers to identify and communicate the organisation's strategic intent so that all product innovation projects in the portfolio can be aligned with this strategy. The module enables the identification, definition and communication of four key features. These are (a) requirements, (b) measures, (c) strategies and (d) statements.

- Requirements represent internal and external demands on MobileCom from key stakeholders. MobileCom's stakeholders include: their customers (*Customer*), the corporation (*Corporate*), the organisation (*Critical Internal*), and the government (*Conformance*) (see figure 3).
- Measures help to identify the measures of performance the organisation wants to achieve in terms of product innovation management. MobileCom's measures are categorised in terms of cost (e.g. reduce product cost), market share (e.g. increase market share), quality (e.g. improve product quality) and reliability (e.g. improve reliability).
- Identifying, codifying and communicating strategies clarify how the organisation intends to reach its goals for everybody involved in the product innovation process. MobileCom uses four strategic thrusts (i.e. cost, innovation, market share and supply chain optimisation). This helps MobileCom's employees to select appropriate market and technological opportunities that fit with the organisation's goals.
- Finally, statements help MobileCom to understand what they do, where they are going and what influences will affect its journey into the future. MobileCom's statements include: vision, mission, quality, environment, health and safety, values, strengths, weaknesses, opportunities and threats.

eProduct Manager uses forms to record the organisation's goals. This enables tacit knowledge to be captured and codified into explicit knowledge. By doing this, information and knowledge is made accessible to all team members involved in the product innovation process through simple web browsers.

Insert Figure 3 Screen Shot of the Prototype

Step 2. Manage Actions

MobileCom's goals are achieved through actions. Ideas and problems are the seeds of these actions. They also act as inputs into the product innovation process. eProduct Manager uses structured forms to help generate and codify both problems and ideas. It is hoped that this information will lead to potential new product concepts. The user is asked to rank the degree of strategic alignment for each new product concept. In other words, the user must ascertain whether a new product concept fits with the organisation's strategies, measures and requirements. Each new product concept is ranked according to its priority. This feature empowers

everybody in the organisation to participate in idea generation and problem solving and facilitates the cross fertilisation of ideas.

If there is a good fit between the organisation's new product concept and the organisation's goals a project form is generated. Projects are time bound actions that when implemented help MobileCom to achieve its goals. Critical knowledge captured in this module includes schedule information, ranking information and team members responsible. The projects module permits the entire team to share project information effectively. It provides easy access to schedules, resource allocation information and activity status information for all projects in the portfolio. This facility also provides the integration that enables managers throughout the firm to see how schedules and events impact the projects underway. Managers can be aware of disrupted schedules and take steps to manage their individual projects effectively in response.

Step 3. Empower Teams

The Teams module represents the human resources that are available to manage goals and execute actions. This module acts as a constraint on MobileCom's product innovation process since the availability and quality of people limits the amount and type of innovative actions that can be undertaken by the organisation. However, by providing more employees with the necessary skills, they can engage in the process and allow more actions to flow through the process. The Teams module facilitates the effective co-ordination of team activities by organising and prioritising tasks, activities and deadlines. It can use an organisation's existing e-mail system to disseminate new or updated information and regular status reports between team members so everyone has access to complete, accurate and timely information. A performance review tool can also be included in this module, which represents an individual's skills, competencies and progress. It enables reward and appraisal systems to be linked to participation levels and this can help increase motivation towards change.

Step 4. Monitor Results

This module deals with performance measurement and evaluation. Results allow the user to view the status of MobileCom's strategies, measures and projects. Each of these modules contain a special results section that allows those team members who are responsible to update the status of the activity. Critical knowledge is captured about the results of the organisation's activities such as; percentage complete, status (green meaning good, red meaning poor and amber meaning fair and finally, a check mark meaning complete). An exception report allows the product manager to focus exclusively on those activities that are performing poorly. This feedback loop allows the organisation to develop a corporate conscience by learning from its experiences.

eProduct Manager provides an instrument to enable the identification, communication and measurement of performance parameters. It also provides a common language and methodology for engineers and managers to implement a structured process for effective product innovation management. The main benefits derived from the use of eProduct Manager were identified and grouped into the following categories.

- Strategic alignment: A major challenge in distributed product development is ensuring that all projects in the portfolio strategically align with the goals of the organisation. eProduct Manager was found to provide an infrastructure that drives the organisation's strategies and their associated performance measures down the organisation to the operational level. In other words, the company's goals are deployed into each action and deliverable. This helps to focus and integrate team effort and permit delegation.
- Requirement driven design: eProduct Manager enables customer centric, requirement driven design. The system enables the product development team to establish the voice of the customer by analysing complaints, warranty and customer satisfaction rates using internet technologies. This value can then be deployed into the product concept. In addition, a better understanding of the target markets needs means that an organisation's products will be more readily acceptable by the potential customer base. This can lead to lower costs of production as well as shorter lead times to market.
- Support the knowledge process: The development process involves synthesising and reusing existing knowledge. eProduct Manager was found to support the knowledge process by helping to; (a) generate knowledge (i.e. identify, develop and acquire information and knowledge such as customer requirements and new product concepts); (b) capture knowledge (i.e. prevent knowledge from disappearing by using structured forms to capture critical information); (c) store knowledge (i.e. best practice lessons are stored electronically for future reference); (c) access knowledge (i.e. the prototype uses cross platform, open standards capabilities of the internet that allows information access from multiple sources) and finally (d) transfer knowledge (i.e. distribute policies, procedures, technical reference and project information to the appropriate points of action).
- Integrated product realisation: The software also enables integrated product realisation. This involves the continuous and highly concurrent involvement of all necessary functions and organisational elements (e.g. customer, marketing, manufacturing). eProduct Manager adopts a groupware platform to support a collaborative environment thus promoting integrated product development.
- Increased visibility: eProduct Manager was found to promote transparency and traceability. It allows issues, problems and assumptions to come to the surface where they can be examined, analysed and rectified. Managers can take quick effective action to bring projects back in line if necessary. This visibility facilitates the necessary dialogue among project managers, ensures integrity in reporting and allows everybody to see how projects are progressing.
- Supports new workforce paradigm components: The prototype was designed to address today's workforce paradigm components. It can support multiple users across the entire product innovation process regardless of location. This is illustrated in figure 4.

Insert Figure 4 Functions that Interact with the Prototype

CONCLUSION

Successful product innovation management is lauded to be crucial to the advancement of design and manufacturing enterprises. However, this process is extremely complex and involves the effective management of many different activities. The knowledge-based theory of a firm suggests that knowledge is the only remaining sustainable resource that can provide competitive advantage in hyper competitive environments. Therefore, adopting a knowledge management approach to product innovation management can increase the likelihood of success. In this view, managers can add real value to their companies by identifying, managing and leveraging the company's knowledge base. Therefore, the development of a knowledge infrastructure is central to survival in this new era of business.

Knowledge management tools and techniques can facilitate the process of generating, structuring and sharing knowledge through the use of information technology. Developing a knowledge management practice requires a well-balanced approach. Technology can help to manage knowledge assets and bring people together in dispersed organisations. At the same time, creating incentives for sharing knowledge and having focused business goals will help avoid many of the common pitfalls of knowledge management. This paper presented a groupware based knowledge management prototype called eProduct Manager specifically designed to enable effective product innovation management in a networked environment.

REFERENCES

1. Cooper, R.G., Edgett, S.J., and Klienschmidt, E.J. (1998) *Portfolio Management for New Products*, Addison-Wesley, Reading, MA.
2. Clark, K. and Wheelwright, S. (1995) *Leading Product Development*, Free Press, New York.
3. Crawford, C. M. (1996) *New Products Management*, Irwin, Chicago.
4. Mc Donagh, E.F. (2000) Investigation of Factors Contributing to the Success of Cross Functional Teams, *Journal of Product Innovation Management* 17, 3, 221-235.
5. Song, X.M.; Moytona-Weiss, M.M. and Schmidt, B. (1997) Antecedents and Consequences of Cross Functional Cooperation: A Comparison of R&D, Manufacturing and Marketing Perspectives. *Journal of Product Innovation Management*, 15, 35-47
6. Balasubramanian, R. and Tiwana, A. (1999) Supporting Collaborative Process Knowledge in New Product Development Teams, *Decision Support Systems*, 27, 1-2, 213-135.
7. Davenport, T.H. and Prusak, L. (1998) *Working Knowledge: How Organisations Manage what they Know*, Harvard Business Press, Boston.
8. Johannessen, J., Olaisen, J. and Olsen, B. (1999) Managing and Organizing Innovation in the Knowledge Economy, *European Journal of Innovation Management*, 2, 116-128.
9. Drucker, P. (1993) *Post Capitalist Society*, Harper Business, New York.
10. Sveiby, K.E. (1997) *The New Organisational Wealth: Managing and Measuring Knowledge Based Assets*, Berrett-Koehler, San Fransisco.
11. Nadler, D.A. and Tushman, M.L. (1999) Organization of the Future: Strategic Imperatives and Core Competencies for the 21st Century, *IEEE Engineering Management Review*, 27, 96-107.

12. Olin, J.G., Greis, N.P. and Kasarda, J.D. (1999) Knowledge Management Across Multi-tier Enterprises: The Promise of Intelligent Software in the Auto Industry. *European Management Journal*, 17, 4, 335-347.
13. Mc Mahon, C. and Browne, J (1998) *CAD CAM Principles, Practices and Manufacturing Management*, 2nd Edition, Addison Wesley, Harrow England.
14. Leonard-Barton, D. (1995) *Wellsprings of Knowledge: Building and Sustaining the Sources of Innovation*, Harvard Business Press, Boston.
15. Nonaka, I. and Takeuchi, H. (1995) *The Knowledge Creating Company*, Harvard Business Press, Boston.
16. Grantham, C.E., and Nichols, L.D. (1993) *The Digital Workplace: Designing Groupware Platforms*, Van Nostrand Reinhold, New York.
17. Perdergast, M. and Hayne, S., 1999 Groupware and Social Networks: Will Life Ever Be The Same Again? *Information and Software Technology* 41,6, 311-318.
18. Wilson, D.A. (1996) *Managing knowledge*. Butterworth Heinemann- Oxford.
19. Quinn, J., Anderson, P. and Finklestein (1996) Managing professional intellect: Making the most of the best, *Harvard Business Review*, 74, pp 71-80.
20. Stewart, T. A. (1997) *Intellectual Capital: The New Wealth of Organizations*, Doubleday.
21. Bassi, L. (1998), Harnessing the Power of Intellectual Capital, *The Journal of Applied Manufacturing Systems*, Summer, 29-35.
22. Blake, P. (1998) The knowledge management expansion, *Information Today*, 15, 1.
23. Ulrich, D. (1998) Intellectual Capital = Competence*Commitment, *Sloan Management Review*, Winter, 15-26.
24. Liebeskind, J.P. (1996) Knowledge Strategy and the Theory of the Firm, *Strategic Management Journal* 17, Winter, 93-109.
25. Hansen, M.T., Nohria, N. and Tierney, T. (1999), What's Your Strategy for Managing Knowledge? *Harvard Business Review*, March-April.
26. Jones, P. and Jordan, J. (1998), Knowledge Orientations and Team Effectiveness, *International Journal of Technology Management*, 16, 152-161.
27. Hildreth, P. Kimble, C. and Wright, P. (2000) Communities of Practice in the Distributed International Environment, *Journal of Knowledge Management*, 4, 1, 27-38.
28. Evbuomwan, N.F.O., Sivaloganathan, S. and Jebb, A. (1996) A Survey of Design Philosophies, Models, Methods and Systems, *Proceedings of the Institution of Mechanical Engineers*, 210.
29. Baets, W.R. (1998), *Organizational Learning and Knowledge Technologies in a Dynamic Environment*, Kluwer Academic Publishers, Boston.
30. Khoshafian, S. and Buckiewicz, M. (1995), *Introduction to Groupware, Workflow, and Workgroup Computing*, John Wiley & Sons, New York.
31. Bullen, C.V. and Bennett, J. (1990), Learning from User Experience with Groupware, *Proceedings of Conference on Computer-Supported Cooperative Work*, 291-302.
32. Ellis, C.A., Gibbs, S.J. and Rein, G.L. (1991), Groupware: some issues and experiences, *Communications of the ACM*, 34, 1, 38-58.
33. Watson, R., Bostrom, R. and Dennis, A., Fragmentation to integration in Lloyd, P. (Ed), *Groupware in the 21st Century*, Adamantine Press, Twickenham, 1994.
34. Dennis, A.R. and Gallupe, R.B. (1993) A History of Group Support Systems Empirical Research: Lessons Learned and Future Directions. In *Group Support*

Systems: New Perspectives (Jessup, L.M. and Valacich, J.S. (eds.)) Macmillan Publishing Company, New York, 59-77.

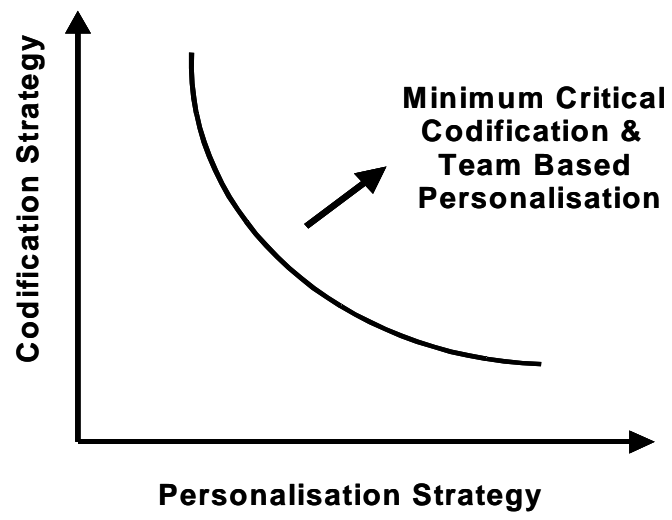


Figure 1. Strategic Choice for Knowledge Management Initiatives

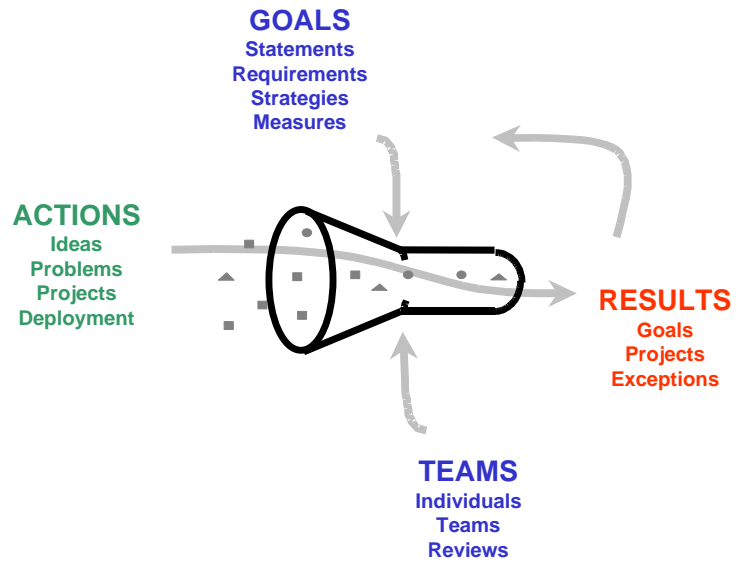


Figure 2. Key Elements in the Prototype

MobileCom Product Innovation Manager
GOALS
[Statements](#)
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Stakeholder

Title

Responsible

Updated

▼ Conformance

[Develop new technologies for phone safety.](#)
[Comply with end of life directive](#)
[Reduce Waste](#)

O'Gara, R. 02/23/2001
Clohessy, P. 02/23/2001
Shine, B. 02/23/2001

▼ Corporate

[Minimise prime costs](#)
[Develop Induction Programmes](#)
[Reduce Employee Turnover](#)
[Improve Quality of Raw Materials](#)
[Accommodate US Transfers](#)

O'Gara, R. 02/23/2001
Barthez, F. 02/23/2001
Keane, R. 02/23/2001
Merson, P. 02/23/2001
Keane, R. 02/23/2001

▼ Critical Internal

[Reduce number of iterations](#)
[Increase number of training Hours Per Employee](#)
[Launch New Products on Time.](#)

Cormican, K. 02/23/2001
Juan Pablo Angel 02/23/2001
Cormican, K. 02/23/2001

Requirement

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Title	Launch New Products on Time.		Stakeholder	Critical Internal
Responsible	Cormican, K.	Team	Clohessy, P., Fortune, Q., Giggs, R., Keane, R., Quinn, N.	
Description	In our department, keeping ahead of the competition is Vital, therefore we must ensure products are released on time or ahead of schedule.			

Figure 3. Screen Shot of the Prototype

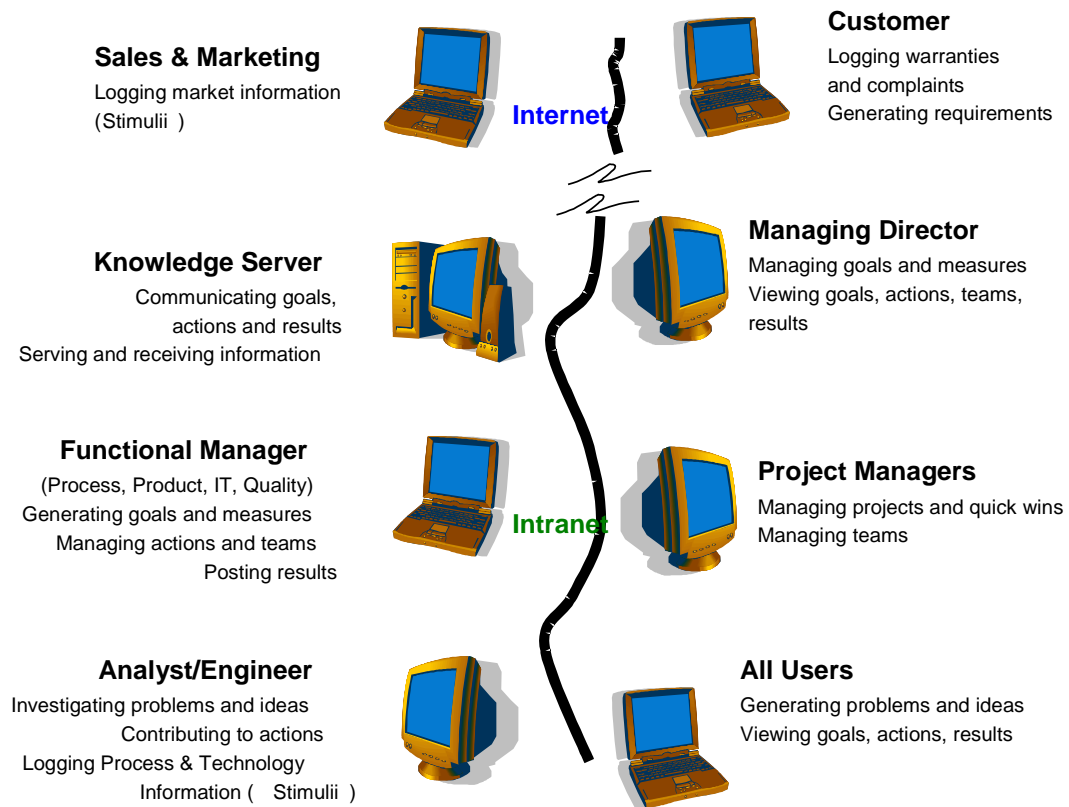


Figure 4. Functions that interact with the Prototype