

Focused Knowledge Management

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Abstract

Knowledge Management has been an issue within the NWAIAG since 1993 when several problem cases were identified in organisations. These cases concerned some sort of breakdown in the organisations knowledge asset. A period of research and analysis of the problems preceded the formation of a collaborative group of companies intending to develop tools and systems which support the strategic decision making process. The project, lead by the NWAIAG aims to raise the profile of a company's Knowledge Asset, particularly during the planning and management of change.

In order to help focus the views of a broad range of opinion and experience, the team decided to create a prototype Knowledge Management Tool. This tool, although not intended to be a commercial product, helped to clarify the ideas and opinions of the group and allowed them to develop a common approach. The tool quickly emerged as a bottom up method of implementation for this particular aspect of knowledge asset management. A more complete perspective was developed by refocusing on the demand for information about the knowledge asset, starting at the board room. Furthermore, considerable interest was found in the provision of a graphical visualisation of a companies knowledge asset (or at least part of it) and the dependent relationships which existed within it.

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1. Introduction

This paper is intended to provide an overview of a collaborative Knowledge Management project. The paper describes the context within which the project developed, outlines some of the main features of the project and discusses the main findings.

1.1 The Importance of Knowledge in Industry

Knowledge is an issue in companies today because many people are beginning to recognise that mistakes are being made when knowledge is not handled correctly. Those who promote knowledge management can find receptive ears in business and industry because it is easy to show where things are going wrong.

Companies who don't provide a proper knowledge repository and an equally functional access method are likely to duplicate the production of knowledge leading to considerable inefficiency. It is not difficult to show that if certain knowledge is inaccessible, mistakes can be made, floored decisions can be taken and worst of all, these mistakes can be repeated. (Ann Macintosh) provides an

interesting summary of knowledge asset management, highlighting the key points.

Researchers now promote solutions such as Data Warehousing, Knowledge Sharing and other activities and cultures which will begin to create a knowledge rich organisation. (Karl Wigg) discusses the gathering of knowledge, its organisation and preservation, its preparation for transfer, its transfer and deployment and its use. This is the basis of a coherent knowledge management policy intended to be a blue print for individual company schemes. Block and Poynter (Block 1996) discuss a knowledge or document storing and navigation method in operation at the Swiss Bank Corporation.

These efforts intend to bring a company's knowledge asset together so that it can be managed, organised and accessed. The term 'knowledge management' is a little loose here. Knowledge seems to refer to data and information, to documents and to statistics. However, it does highlight in this key area of what has become known as knowledge management, the need for organisations to take charge of their knowledge asset in a way which has not been done before. Indeed, it has not been possible before. Advances in technology have made it possible.

1.2 Knowledge Management is Needed Now

What has made knowledge management desirable and why have mistakes been made now and not in the past? It is likely that the results of pressures on business to down size, become more efficient and to streamline have also resulted in businesses operating much closer to their critical level than before. Staff reductions mean that staff are now almost fully committed, leaving little spare staff resource to deal with the unforeseen. This has led to greater pressure on management who must now predict as much as possible leaving less to chance. Part of this need to predict the effects of change and of future activity is the need to manage the knowledge asset. It is of course, likely that knowledge related mistakes were made in the past, however they may not have had such catastrophic consequences.

2 The Problems to be Addressed

The general nature of, and need for knowledge management is very briefly discussed above. The North West Artificial Intelligence Applications Group however, have approached knowledge management from a different perspective. The approach has been directed by particular experiences and a desire to solve the resulting problem which centres around the strategic management of change in organisations.

2.1 Initial Case Studies

During the period from March 1993 to March 1994 five different companies approached the NWAIG seeking advice concerning knowledge related problems. The aim of the consultation was to attempt to find solutions to particular problems.

The essential details of these five cases are as follows.

Case 1.

A small company, partly owned by a larger organisation, was forced, through some higher directive, to reduce the size of its local work force. The responsibility for this reduction rested with the managing director who, after due consideration, selected several staff for redundancy. It emerged nine months later, during negotiations for a new contract of work, that one of the key skills necessary to carry out this contract, had been lost during the previous round of redundancy.

Case 2.

More than one large company had been through the process of the removal of layers of middle management. This was done after analysis of working practices and evaluation of future needs. However, after further analysis, it is believed that the full range of duties of middle managers was not known before the decision was taken to flatten the management hierarchy. It is now believed that middle managers used to perform some sort of knowledge management in addition to their other duties.

Case 3.

One frustrated managing director with three shop floor managers explained the problem. One of the shop floor managers was particularly able and well suited to the job, locating potential difficulties and ensuring smooth operation. The other two did not perform to this level and indeed were giving cause for concern. One solution was to remove the two less efficient managers and replace them with better ones. However, it was realised that the qualities which enabled the good manager to work effectively were not known and consequently it would not be known what qualities to seek in new recruits. Better solutions are available.

Case 4.

One large multinational company recognised a problem in their sales to delivery systems. Sales staff had to travel widely and negotiate sales on site. Once a sale was agreed, the details of the customers requirement was passed back to the technical team so that a specific product could be designed and costed and then finally agreed before production. Making more knowledge available at the point of sale could improve sales turnaround. On investigation it was realised that the source of the knowledge was not easily identified.

Case 5.

This problem has many manifestations. This particular example took place in a large UK manufacturing company, desperate to reduce staffing costs during recessionary periods. A general and global early retirement policy was introduced to reduce staff, initially without introducing compulsory redundancy. One department, which provided a much revered customer service and was staffed by older and highly experienced staff, was severely affected by this policy. The problem was that the staff in this department had skills which were in great demand internationally and the staff, because of their age, could attract a very favourable redundancy deal. Clearly the prospect of a substantial redundancy settlement, coupled with a secured future in one of a number of other organisations, lead to a mass exodus. The company, rather belatedly, recognised the existence of a serious loss of key skill; skill which it had developed and nurtured over many years.

Collectively, these cases show a problem in knowledge asset management. Particularly, there is a need to provide some sort of mechanism for managers to avoid the costly mistakes of knowledge mismanagement. If mismanagement is too harsh a term, the cases described above, at least show a lack of knowledge management.

3. Foundations of the Focused Knowledge Management Project

These cases were discussed by representatives from several leading companies in the North West of England and it was decided that further investigation was warranted. The purpose of the investigation was to determine whether the general problem of knowledge mismanagement was indeed universal or were the cases identified simply isolated and unrepresentative

3.1 The Enquiry Phase

During the period between March 1994 and March 1995 the collaborative group carried out several actions.

Developed an interview scheme to estimate the scale of the knowledge management problem.

* Carried out 20 interviews in 16 companies. There was 1 vertical study of 5 managers in one company. There were 6 interviews at Director level, 5 interviews at Senior Management level, 3 interviews at Personnel Manager level and 6 interviews at section head level.

* Developed a prototype knowledge management, computer based tool, to investigate ideas and develop strategy. This tool looked at knowledge from the staff, or ownership perspective and from the activity (project) or demand perspective. Typical ideas which were tested included the idea of a knowledge gap, knowledge risk and a general statement of health of the knowledge asset.

A more detailed report on this work is available through the NWAIG (Gordon + 1995).

As stated above, in addition to meetings to plan, carry out and analyse the interview programme, tool design meetings also took place. A very early system, based on a genetic algorithm (GA) approach, was developed by Colin Cadas of Rolls Royce & Associates. This experiment allowed the collaborative team of company representatives to clarify their ideas, discuss possibilities and assess what would be required within the setting of their own company. The GA approach allowed early speculative ideas to be expressed as functional computer code. A follow up tool, developed over successive meetings, using Multimedia Toolbook as the delivery vehicle continued this theme of expressing ideas in working code and subsequently evaluating, developing and improving ideas. Interface design issues for a specific target audience were addressed during the EMMA project (Gordon 1995).

In parallel with this process, company representatives on the team, discussed the ideas within the context of their own companies and elicited the input of other people from those organisations. This eventually lead to a sort of wish list of services and features which a computer based knowledge management tool may deliver. A more refined version of this wish list was eventually included in a general specification for the design of an experimental knowledge management tool.

3.2 The Design Phase

During the rest of 1995 and the beginning of 1996, the collaborative team concentrated on the development of a general specification for a knowledge management tool.

Notes

It should be made clear that this tool was not and is not intended to be a commercial product. It was designed to make clear, amongst a diverse range of interests, an emerging methodology for knowledge management. It has been incorrectly stated that the NWAIG project aims to develop a knowledge management tool. This is not the case. The tool was used as a vehicle to exchange and develop ideas between many individuals with different backgrounds, different interests and from different companies.

It should also be made clear that the whole project was focused on making the company knowledge asset both visible and accessible during the strategic planning and management of change. This was the focus of this project because it was intended to address the range of problems which initially lead the start of work and which was justified by the subsequent interview programme.

A subsequent programme of activity consisted of :

A small programme of field trials took place in 3 companies using the prototype Knowledge Management Tool (Toolbook version). Feedback from these trials was presented at a meeting which took place in January 1996.

A strategy meeting also took place in January 1996. This meeting developed an overall strategy for the project covering the development of an experimental Knowledge Management Tool and the development and dissemination of methodology.

An initial meeting to develop a General Specification which could be worked to was held at British Aerospace, Samlesbury site on 20th February 1996.

Several draft specifications lead finally to the internal publication of the general specification on 10th May 1996 (Gordon + 1996).

An initial promotional event was held on 9th August 1996 and a first release of the new Knowledge Management Tool was made available to team members on that date.

3.3 The Implementation Phase

By this time, it was becoming even more clear that the project would support managers (decision makers) during the strategic planning and management of change. It would do this by making the knowledge asset more visible and helping decision makers to assess the effect of change on this vital resource. It was also becoming clear that the Knowledge Management Tool was helping companies to see how practical knowledge management could be performed from the bottom up. This sort of bottom up process could provide a focus for other initiatives such as the Investors In People scheme (IIP). Regular staff interviews required by the IIP scheme could also populate and maintain information about the company knowledge asset. Following on from this work on the bottom up approach, it became vital that the project considered ways of supporting this work from the top down.

In order to allow time to concentrate on the top down view and also to provide time to evaluate the work done so far, it was decided to bring forward the release of a working (but very much prototype) version of the tool which satisfied most if not all of the general specification. This software, 'Demonstration System II' was released at the end of March 1997. It was distributed to eight organisations for testing. Complete results from this testing phase are not expected until the end of 1997.

3.3.1 Some Implementation Details

The Knowledge Management Tool followed the general specification produced by the collaborative team. It consist of three main elements.

compute the average risk of staff who know this item of knowledge and invert the result so that the highest risk represents the highest value.

$$AF1 = \frac{\sum_{p=1}^{P=Np} R_p}{Npk}$$

$$AF = 1 - AF1$$

Where:

R = Age Risk factor

p = Person n

Np = Number of people

Npk = Number of people with this knowledge

AF = Age Factor

Now the number of employees with this knowledge should be included in the computation. The function creates a linear relationship showing that if all employees have the knowledge then the risk is almost zero, to a state where if only one person has the knowledge then the risk is highest.

$$R = C - Mx$$

$$\text{Where } C = AF + AF/Np$$

$$M = - AF/Np$$

$$x = Npk$$

Giving the Risk factor:

$$R = (AF + Af/Np) - Npk * AF/Np$$

3.3.3 Visualising the Knowledge Asset

The knowledge asset map is creating some interest within the companies who have seen it applied to a portion of their own knowledge. This section of the project is already receiving special treatment and is being developed separately. The current tool works from a knowledge base of the form.

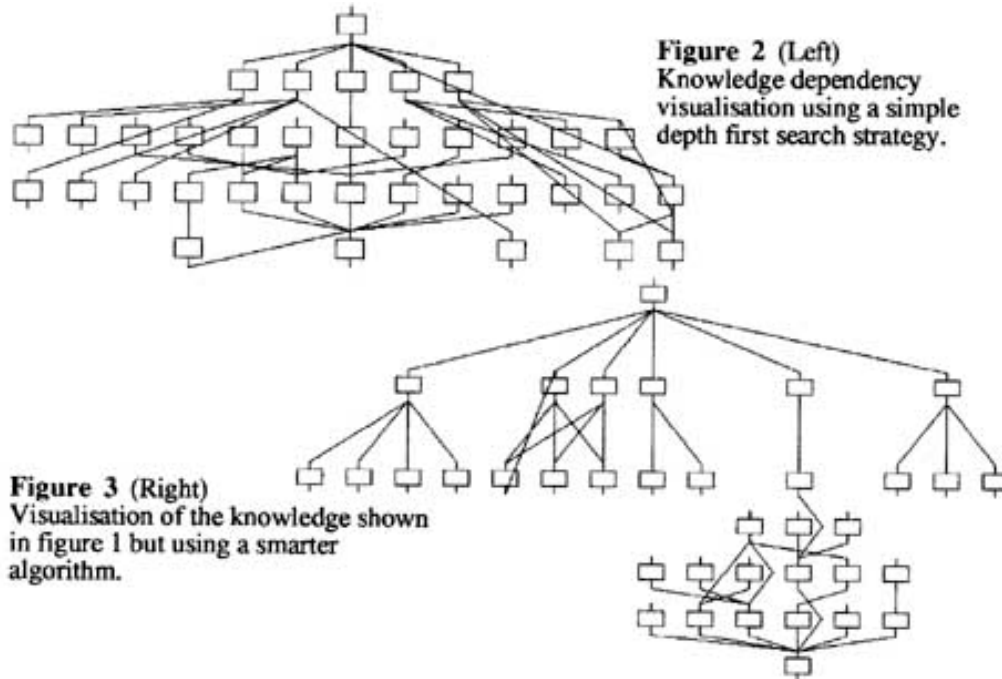
Knowledge Item 1
 Dependency
 Dependency
 Dependency
 Knowledge Item 2
 Dependency
 Dependency
 Knowledge Item 3
 Dependency
 Knowledge item 4
 Knowledge item 5
 etc.

Knowledge items may have any number of dependencies and their dependencies, other knowledge items, may also have dependencies or they may be leaf nodes. Elicitation of this structure is not too difficult but keeping track of a dependency network during elicitation would prove difficult. Computer support for this elicitation process would be desirable, it would at least introduce real time checking.

The current prototype tool, displays this information after performing a simple depth first search through the dependency network. It has been shown that this is not adequate and can lead to very complex representations and may fail to support users in the identification of structure within the knowledge asset. A range of breadth first search strategies have also been tried with varying degrees of success. The difficulty is that the aim is to produce a display format which will help the user to locate structure within the knowledge asset network. Of course, the computer cannot know what the user is experiencing when he/she views the result on the computer screen and cannot know in advance if a display structure is meaningful to the user.

More work is required in this area but a greatly improved (if rather laborious) algorithm is giving better results.

The diagrams below (figures 2 and 3) show the same knowledge network plotted using different techniques.



3.4 Early Analysis

Initial attempts to perform controlled studies of the bottom up end of this knowledge management initiative met with staff scepticism. Two large companies were approached, the management of whom were keen to participate in the trials. However union and workers groups were not so keen, seeing the effort as another analysis aimed at reducing employment. In fact, the reverse is true. The exercise is intended to make managers appreciate and value that part of their knowledge asset which resides within their staff. This point needs to be made to companies at all levels. It seems that workers are suspicious, and who can blame them, and managers may still be looking for new ways to improve efficiency by staff reductions.

Progress is now being made by allowing the companies to carry out their own trials by releasing the prototype software to them.

4. Refocusing on a Top Down Approach

The Knowledge Management Tool, developed as a research tool, is nevertheless a bottom up approach to knowledge management. Such an approach is not likely to be sustainable. Clearly, senior managers want to know how a scheme may be implemented in practice at all levels but there must be a demand for information about the knowledge asset.

Our approach is to draw an analogy with a companies financial assets and try to show that anything less than a firm demand for information about a companies knowledge asset during the planning and management of change is at best, ill advised.

4.1 The Strategic Importance of the Knowledge Asset

Would a manufacturing company sell off its manufacturing machinery to save

money? How would a company perform without any knowledge? Clearly, even if one could argue that the knowledge asset does not need to be, or cannot be managed, its importance cannot be questioned.

4.1.1 Is Knowledge Asset Information Really Needed During Planning?

It would make an interesting spectacle to witness the board of directors asking the company accountant for current financial information during a meeting which is planning major changes, if the accountant stated that such information was not available. The accountant could argue that the information was difficult to collect and the board should base its decisions on something else.

The board may be so accustomed to the lack of information about the company's knowledge asset however, that they don't even ask for it and furthermore, have no internal company structure to collect it.

In fact, the board of directors make sure that there is an internal structure to collect all financial information and keep it up to date. This may be the responsibility of the company accountant but he/she will be supported by a tried and tested mechanism within the company. Is it not then, up to the board to demand information about the knowledge asset and also to create the necessary company structure which will provide it and keep it up to date. After all, it is difficult to deny that the knowledge asset is an important part of a company and therefore should be a factor considered during the planning and management of change.

5 Summary

- Evidence collected during this project has shown that companies risk making serious and costly errors if they leave knowledge asset management to chance.
- The project has collected evidence to show that knowledge management can be a real problem during the planning and management of change.
- Interviews across all levels of management in companies have identified problems relating to knowledge management.
- Initially, companies have looked for a practical method of implementing knowledge management from the shop floor up.
- Computer support is seen as the best way to make progress.
- A Bottom up scheme to maintain information about a company's knowledge asset could also support other initiatives such as IIP.
- Once a practical implementation can be identified, a top down mechanism is required in order to produce a demand for knowledge management.
- Companies can see the logic for the creation of a mechanism to supply information about this valuable asset, where and when it is needed, during the planning and management of change.
- Making the knowledge asset more visible through graphical means can provide managers with valuable insight.

6 Future Work

The majority of, if not all companies, will need to begin to take their knowledge asset seriously in the future. However, it is likely that the way in which the knowledge asset is managed will differ from company to company depending on specific needs. This work has shown that a well designed visualisation of a company's knowledge asset can help managers to bring this abstract asset into the working problem solution space. It is not clear why this sort of visualisation is of value. It may be that it simply helps to bring the abstract concept into the foreground of the decision making process. In any case, it seems that the

development of a graphical visualisation of a text based knowledge asset will be of value. An outline proposal to extend this line of work to include information related to the type of knowledge and the preferred learning method, has been produced.

Planned development of the current project includes the incorporation and analysis of feedback from several companies who are performing internal trials using the basic knowledge management concepts outlined in this paper. It is felt that the project has advanced as far as is sensible without this next phase of feedback.

Dissemination of the current findings and the promotion of this focused version of knowledge management are the main goals for the remainder of the current project until May 1998. This work is already proceeding and making a noticeable difference in target companies.

7. Conclusions

This project has addressed the issue of knowledge management from a problem perspective. The specific problem being the negative consequences resulting from the mismanagement of knowledge during the decision making and solution implementation stages of planning and managing change. The project has considered the format and the implementation of knowledge management from the shop floor up and from the board of directors down. Both issues need to be addressed if a working strategy is to be put in place. The strategy will ensure that the problems of the past are not repeated and subsequent changes in the companies activity do not lead to new knowledge related problems.

Evidence collected during the project has confirmed the view that a company's knowledge asset should play a greater and more visible role in company forward planning and decision making. The evidence has identified some of the consequences of ignoring this issue and has shown at least one way forward in the development of a working solution. It is hoped that this work will encourage the early introduction of schemes of the type outlined. Once a demand and supply of information about the knowledge asset has been created, refinement of methodology in individual companies will lead to more effective schemes.

Clearly, knowledge is now an issue in modern company management.

One cautionary note however; we should not repeat the mistakes made during the introduction of knowledge based systems by believing that we can manage knowledge in isolation of the people, the employees, who possess it. Recent experience suggests that a management programme which introduces measures to support and develop staff along with the companies knowledge asset, will be much more likely to succeed than measures which try to capture a companies knowledge and separate it from staff so that it can be owned by the company in isolation. If this more sensible approach is adopted, knowledge management schemes must include systems which bring the knowledge asset to the foreground of decision making and provide concrete and usable information about it.

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Company Participation

British Aerospace Military Aircraft.

Rolls Royce & Associates

Harland Machine Systems

Michelin Tyre plc.

Pilkington Glass

Richard Millington & Co.Ltd.

Barco,

Dextralog Division.

TDS CAD Graphics

Borden Decorative Products

Liverpool John Moores University.

Blackburn College.

Many other companies have also contributed to the project by way of interviews etc. Not all companies wish their names to be released.