A framework for the introduction of knowledge management within an engineering environment

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A Framework for the Introduction of Knowledge Management Within an Engineering Environment

By

Hardev Ubhi

A Doctorial Thesis
Submitted in partial fulfilment of the requirements for the award of Doctor of Philosophy of Loughborough University 31st May 2008

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TEXT BOUND CLOSE TO THE SPINE IN THE ORIGINAL THESIS
This research is based on real issues that have been recognised within the global organisation, Rolls-Royce. The first aim concerned an issue that many companies face, the difficulty that employees face in locating the knowledge and information they require, especially in larger organisations.

The developed solution of an Information Map proved to be a success in providing people within the Submarines business with the location of Configuration Management information. The concept of the Information Map is one that can be adopted by any business as the stages in the tools development have been well documented within Chapters Four, Five and Six. Analysis of the success of the Information Map led to the derivation of 10 lessons learned. These were then verified in a second case study of an intranet development.

The second aim of the research was to create a Knowledge Management framework that could be adapted by companies looking to invest in Knowledge Management and provide them with a guide to use. This framework was built from the lessons learned from the Information Map and from other best practice derived from available literature and within Rolls-Royce. The work conducted within the Support business tries to fill in gaps in current research by offering companies a new approach to Knowledge Management, which was based upon the way that industries work today. The creation of the Knowledge Management framework simplifies the work conducted and offers practitioners an easy, high-level approach to the adoption of Knowledge Management by grouping the process into ten steps. This is presented in a fashion that is easy to follow and ultimately offers a guide to make the best use of the resources and budget available to Knowledge Management practitioners.

Overall the research addresses the 'real' issues faced by Knowledge Management practitioners. The main contributions to the Knowledge Management domain are the Information Map, action research approach, implementation of Knowledge Management tools for the users needs and a Framework as a guide for industry.
1. Knowledge Management
2. Rolls-Royce
3. Information Map
4. Configuration Management
5. Framework
6. Intranet
7. Knowledge Management Tools
8. Information Overload
ACKNOWLEDGEMENTS

I would like to thank Rolls-Royce for giving me this exceptional opportunity to be able to experience real issues within a large, successful and dynamic organisation though offering to host the PhD. Rolls-Royce have continued to support me in my career and I am truly grateful for this. I would like to give my warmest gratitude to my supervisors Ray Dawson and Dr Tom Jackson, without whom, this PhD would not have been possible. I cannot thank them enough for their support, encouragement and guidance during the course of this research project. I really appreciate the importance of having good supervisors and I am grateful for the time, effort and care they put in to support my work. I couldn’t have asked for better supervisors for my research, so thank you!

Whilst spending just over three years at Rolls-Royce I had the opportunity of meeting so many supportive and friendly people. I appreciate the ‘realism’ of my research is accredited to those individuals who supported my research. It would be unfair to try and list them all as there are so many names, but I would just like to say thank you. My friends… well, what can I say, after all those times I heard the same question ‘have you finished yet?’ I can finally say ‘Yes’. It would be really difficult to list you all, but you know who you are. Thank you for putting up with my continuous complaining.

I would like to thank my siblings; Arjinder Rayet, Tajinder Ubhi, Javinder Roopai, and their partners Jaswinder Rayet and Jagtar Rooprai for their continued support and encouragement. I would also like to thank my nephews and nieces for keeping a smile on my face Riece, Jass, Sonam, Dharam, Rohan and Keirat. My final Thank you goes to my parents; Malkiat Singh Ubhi and Charanjit Kaur Ubhi. They have offered me nothing but support, love and encouragement and I am eternally grateful to them. I would like to take this opportunity to express the gratitude I have for them and thank them for the opportunities they have encouraged me to pursue. I would like to dedicate this PhD to my parents without whom, none of this would have been possible, so thank you.
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CHAPTER 1

INTRODUCTION

I. Chapter Preface

This chapter puts the work of this thesis into an overall context. It begins by introducing Rolls-Royce, the sponsoring company for the PhD and explains their motivation for doing so. The overall project has two aims and the first aim establishes whether a knowledge location tool for Configuration Management (CM) data could be implemented in a way that was functionally effective, cost effective and satisfies the user needs. The second aim is to create a generic KM (KM) framework. The research objectives to accomplish the aims are then listed. The chapter ends with an overview of the thesis structure and a brief chapter summary.

1.1 Rolls-Royce – The Company

Rolls-Royce aims to be 'trusted to deliver excellence' in everything they do (Rolls-Royce Plc, 2007). Their reputation for producing high quality products is one of the world's greatest, and they aim to transfer their reputation for providing world-class products to service solutions. They have sites in 50 countries around the world. The customer base comprises of 600 airlines, 4,000 corporate and utility aircraft helicopter operators, energy customers in nearly 120 countries, 160 armed forces and more then 2,000 marine customers exist within four operational business units; Civil Aerospace, Marine, Defence Aerospace and Energy.

Rolls Royce currently employs 38,000 people and 40% of these are based outside of the U.K. The order book, as of October 2007, stood at £26.1 billion, with annual sales totalling £7.4 billion. The four main operational business units tend to work in isolation from each other, due to the diversity and sheer size of this global company. The Civil Aerospace business has been established as the world’s number two, engine maker and presently has 11,900 jet engines in service. It holds the number one position in modern, large turbofans and business jets. Annual sales were £3.7 billion
in 2006, with 59% coming from services. There are 600 airlines and 4,000 corporate and utility operators, which rely on Rolls-Royce Civil Aerospace.

KM has been established within the Civil Aerospace business since 1996 with the introduction of the Capability Intranet. The Capability Intranet is a useful information tool very similar to the Internet or World Wide Web. It is based on the same technology, but unlike the Internet it is confined to the Rolls-Royce network, making it unavailable to the general public. It encourages the online, global sharing of process, technology and best practice. The Civil Aerospace business has developed a suit of KM tools and techniques that were actively publicised across the rest of Rolls-Royce, in an attempt to get them adopted within the different businesses.

Defence Aerospace is currently powering 25% of the world’s military fleet. They are, in the year 2007, the number one military aero engine manufacturer in Europe. The Defence sales in 2004 were £1,374 million, and this comprised of work from the following sectors:

- Transport
- Helicopters
- Combat
- Trainer

The defence industry, like Civil Aerospace, is actively engaging in KM practices, but at a lower level of investment.

The Energy division is segregated into many markets, which are:

- Oil and gas
- Power generation
- Customer service
- Produce history
- Environmental impact
Chapter 1

Introduction

The product range includes gas turbines, which have served the oil and gas industry since the 1960s. The Energy business is yet to invest in KM.

The Rolls-Royce Marine business is a global leader in marine propulsion. The products range from vessel design and gas turbine engines to water jets and deck handling equipment. Marine currently employs 7000 people worldwide and offers sales and services to 2000 customers in 34 countries.

The Royal Navy has commissioned the propulsion system development for all of their UK platforms including Type 45 Destroyer and the Future Attack Submarine. Rolls-Royce was selected to design and supply the reactor plants for the next generation of nuclear submarine known as the Astute class. The offshore sectors have supplied over 450 UT-700 series service support vessels. The Marine products/equipment equals 80% of RR Marine sales.
1.2 Submarines Business

The Submarines business within Marine hosted the initial part of the PhD project and the Support business, also within Marine, hosted the latter. Due to the nature of Submarines' work, RR has had to uphold its reputation for excellence, as it is the only nuclear flotilla never to have had a serious accident. It is a commitment to quality and security that has upheld this record. The Infrastructure Operational Support business department, within Submarines, set the scene for the PhD. Offering real-time product support, the department relied heavily on its CM tools and processes to ensure that validity of information.

Configuration Management (CM) becomes difficult to employ when, like the Submarines business, a company has thousands of employees and product data spanning back 50 years. RR believed they had a problem in locating the right knowledge within the extensive knowledge held in the company databases, documents and minds of employees. This led to less efficient working as employees (1) spent a lot of time searching for information (2) often failed to find what they needed and had to “reinvent the wheel” (3) made errors through not having identified the knowledge that they needed.

The first part of this research project was to, firstly, identify the extent of the problem, and secondly, to implement a KM tool to address this particular problem. The lessons learned from this pilot project would feed into the research on the second aim of this thesis.
1.3 Support Business

The latter part of the PhD was based within the Total Care Solutions department in the Support business. Traditionally, organisations' after-sales support consisted of product support e.g. new parts, current product support. Many organisations have now recognised the customers requirements within the 'after-care market'. Rolls-Royce is no different and is now focusing its services to offer through-life total care support solutions such as the support of the Olympus and Tyne gas turbines. Total Care Solutions work by offering the customer an integrated menu of services that can be tailored to their individual needs. The equipment, system or item is managed and maintained to ensure that its performance is to the same original specification.

The nature of this new type of business requires a dynamic, innovative and highly customer focused culture as each total care solution tailors itself to its individual customer needs. The employees within this department work from different sites and on different computer networks, making the process of sharing knowledge and information difficult. The contracts produced for its customers have to be precise in the detail, and this involves collecting information from different areas within the business. KM was seen as a way forward to develop the services business, helping Support to:

- Lead the effective use of KM.
- Encourage an innovative knowledge-sharing environment.
- Utilise knowledge both within Support and in the rest of the business.
- Achieve better decision-making.
- Gain a competitive advantage.
- Become an efficient business.
- Implement a process excellence program.

Having the opportunity to work within both the Submarines and Support businesses enabled the author to gain an understanding of the cultural extremes that exist within the same organisation and therefore realise the different employee needs.
The culture of the business reflects the products that are provided. The design time for an average submarine nuclear steam-raising plant can be up to 10 years. Everything has to be meticulously checked and any changes have to be rigorously justified with numerous safety cases being raised. The culture is therefore very reluctant to accept change. Many of the employees are ex-submariners and have hands-on experience in using the products and services provided, they therefore hold vast amounts of experience and knowledge based on their time within the business and at sea.

The Support business has a very different culture to the Submarines business as they have to adapt to changing customer requirements. Many have similar backgrounds to those within the Submarines business, but to succeed within business they have had to be more adaptable to change. This type of business relies heavily on ‘who knows what’ due to a lack of established documentation.
1.4 Aims

The first aim of the research is to establish whether a knowledge location tool for CM information can be implemented in a way that is functionally effective, cost effective and satisfies the user needs. An important aspect of this will be the acceptability to the users of the tool, as it is of no use unless the users are willing to use it in practice.

The second aim of the research is then to broaden the scope to consider the formulation of a generic KM framework for the introduction of KM tools in an industrial environment.

1.5 Objectives

The aims of this thesis will be satisfied through the following objectives:

1. To determine what guidelines exist for the implementation of KM tools through the examination of current literature and through interviews with consultants who give guidance to KM practitioners.
2. To establish through questionnaires the extent of the problem of locating information in the Submarines business.
3. To determine the information needs of the users in the Submarines business through interviews and questionnaires.
4. To implement a tool to satisfy the information needs captured in objective three.
5. To establish the longer-term success by questionnaires.
6. To establish the lessons learnt from the first aim of the thesis to form the basis for the development of the KM framework for the second aim of the thesis.
7. To establish the content that will form the KM framework by undertaking the following activities in parallel:
   a) A second case study of the implementation of a KM tool using the lessons learnt from the first aim of the thesis.
   b) Focus groups to establish the knowledge needs of employees.
   c) A survey of KM tools across the Aerospace business to discover their perceived usefulness.
d) A benchmark of the current state of use of KM tools and techniques within the company to establish a baseline for the measurement of future KM use.

e) A construction of a business case template for the introduction of a programme of KM tools.

8. To derive a full KM framework for the introduction of KM tools based on the findings of the above.

9. To test the KM framework though feedback from internal company managers.

1.6 Thesis Outline

The thesis will comprise of 13 Chapters. A summary of each Chapter is provided below:

Chapter 2 - Literature Review

This chapter meets objective one by containing the literature review for the nine main research areas within this thesis, which are:

- What is KM?
- Understanding current organisational issues;
- Producing a successful intranet;
- Reasons for an unsuccessful intranet;
- KM tools within industry;
- Implementing KM tools;
- Establishing KM needs;
- Analysis of other companies’ successful use of KM tools and KM activity;
- A KM business case;
- KM frameworks.

The aim of this review was to analyse the nine different areas that would create a full KM framework and establish any gaps that would make KM deployment difficult.
Chapter 3 - Methodology
This chapter details the research approach that will be taken to meet the objectives specified in Chapter One. The overall project philosophy will be from the anti-positivist school of thought as recommendations for a KM framework will be produced based on gaining an insight into the company's current KM activities. As the thesis has two aims, it was established that each required a different research approach.

Chapter 4 - Establishing a Need for an Information Map
The literature review in Chapter 2 established that many companies are struggling to deal with the vast amount of information acquired. Chapter Four fulfils objective two and three though the use of interviews and questionnaires to determine the extent of the problem of locating information and the informational needs of employees in the Submarines business.

The chapter includes extracts from the paper “What are the Fundamental Differences Between Software CM and Engineering CM?” presented at the SQM Conference 2003 (Ubhi et al., 2003).

Chapter 5 - The Development of the Information Map
The chapter is based upon the paper “A Pilot System for Locating and Sharing Knowledge” presented at the ECKM 2004 conference (Ubhi et al., 2004).

This chapter details the work conducted to fulfil the fourth objective, which was to implement a tool to satisfy the information needs of the employees in the Submarines business. This chapter describes the development of a system, called the Information Map (IM), to provide “signposts” to information and knowledge. By identifying owners and experts of information, the IM encourages users to make contact with the people that can provide knowledge and expertise in their area of interest.
Chapter 6 - Evaluation of the Information Map
Chapter Six covers the evaluation of the IM. It fulfils objectives five and six stated in Section 1.5. Firstly this chapter establishes the longer-term success by interviews and questionnaires. Secondly, it establishes the lessons that can be learnt from the development and use of this KM tool.

Chapter 7 - Getting the Best Value from the Intranet: A Case Study
The chapter is based upon the paper "Getting the Best Value from the Intranet: A Case Study" presented at the IRMA 2005 conference (Ubhi et al., 2005).

To validate the lessons learnt from the IM, they were applied to a new project (meeting objective 7a). A similar issue to the one that the IM resolved was discovered within another part of Rolls-Royce. In the newly identified area, the user requirements of the team differed due to their size and infancy. The issues of the team were explored and the use of the intranet was chosen as the solution as the team could not justify an Information Mapping tool due to their smaller size. Chapter Seven explores whether the principles established on the IM project could be transferred and used to develop other KM tools.

Chapter 8 - Establishing the Appropriate KM Tools to Satisfy the Knowledge Needs
Chapter Eight fulfils objective 7b, by exploring the knowledge needs of employees to try and establish guidelines for companies looking to implement KM tools. The research within this Chapter uses focus groups to establish if, within the same business, employees' knowledge needs differ.

Chapter 9 - Assessment of Knowledge Management Tools
Chapter Nine fulfils objective 7c by reporting the results of a survey of KM tools across the Aerospace business to discover their perceived usefulness. By distributing a questionnaire to establish the successfuless of KM tools within Aerospace business, lessons were learnt into how these tools have been embedded into working practices and how they have been successful in providing what the users required. The results proved an indication to why some KM tools might be more successful than others.
Chapter 10 - Benchmarking KM Activity
Chapter Ten shows that by gaining the KM activity level of the Marine business it is possible to identify areas for improvement and by capturing a baseline, future improvements can be measured. A benchmarking tool currently used within the Civil Aerospace business to analyse the current KM activity and to provide a baseline of the Marine business was used to achieve objective 7d.

This Chapter also covers the work undertaken to establish a method to implement KM tools with Marine by applying a similar method that was deployed within Rolls-Royce Aerospace.

Chapter 11 - Knowledge Management Business Case
Within most businesses, the approval of resources has to be sought from business manager(s) before a new initiative is explored. To do this a business case is usually produced. This Chapter explores the creation of a KM business case to justify the benefits that can be gained by investing in KM and in doing so fulfils objective 7e.

Chapter 12 - Knowledge Management Framework
The previous chapters have drawn on different areas of KM and tried to provide solutions to current issues being faced by KM practitioners. The aim of Chapter 12 is to draw upon these findings and create a KM framework for organisations to follow when embarking upon a KM initiative (objective 8 and 9). The framework is flexible enough so it can be used within other organisations.

Chapter 13 - Conclusions
This Chapter summarises the whole thesis, relating the work to the aims and objectives set out in Chapter One. Conclusions and recommendations for further work are included to provide direction for future research work by Rolls-Royce and / or other interested persons.
1.7 Summary

As the research approach is action research, it is based on real issues that have been recognised within the global organisation, Rolls Royce. There are four main contributions from this research to the domain of KM, displayed in Figure 1.1. Firstly, aim one concerns itself with an issue that many companies face. It can become difficult for employees to locate the knowledge and information they require especially in larger organisations. This research leads to the creation and implementation of an Information Map tool that helps employees locate the information they require.

The second contribution is the research approach itself. By focusing on the issues faced within industry the research has provided solutions to problems faced by KM practitioners such as how to create a business case and know which KM tools to implement. Thirdly, the research focuses on understanding employees’ KM need and assessing which KM tools will best suit those needs (Chapters Eight and Nine). The final contribution is covered by aim two of the research project and deals with the concern for a more generic need for KM within a diverse and versatile team. The requirement to create a KM programme for the department that had no previous KM experience required the creation of a framework that they and others could work to.

Figure 1.1 - Diagramatical view of research contribution
CHAPTER 2

LITERATURE REVIEW

"Knowledge itself is Power"
(Davenport – 1998)

Chapter Preface

The main aim of this chapter is to review the available literature and fulfil objective one from Chapter One. By reviewing the work that has been conducted to date a comprehensive understanding of the current status of work can be gained and, if any gaps exist, these can be assessed. By studying the application of any new or existing methods of Knowledge Management implementation in industry, an understanding of the viability of these methods will be obtained. The structure of the chapter is split within two major sections. The first section will be an introduction into Knowledge Management and the company hosting the PhD. The second part will report on the literature in relation to each of the research objectives as stated within Chapter One.

2.1 What is Knowledge Management?

2.1.1 Definitions of Knowledge Management

For the purpose of this thesis the defined of Knowledge Management (KM) has been taken from Davenport & Prusak (1998);

‘Knowledge is a fluid mix of framed expertise, values, contextual information and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates from and is allied in the minds of knowers. In organisations it often becomes embedded not only in documents or repositories but also in organisational routines, processes, practices and norms’

This particular definition was selected because of its relevance to industry. It emphasised
the origins of knowledge as being held by the expert and how organisations capture this knowledge and make it available via processes, etc. The use of the word ‘fluid’ portrays the image that knowledge is not static and is therefore moving continuously. This is a very important concept as an organisation will never have a comprehensive knowledge base due to new knowledge being created and emerging daily. Organisations therefore need to use KM in a way that will continually capture new knowledge and build upon that already captured and stored.

Companies can capture knowledge based on experiences within the organisation and reuse this to assess new ideas. Building upon the existing knowledge, for example adding to the knowledge base the reason why an idea was or was not implemented is an example of knowledge continually changing. With the rise of competition, companies need to be showing they are actively learning from their mistakes and making use of knowledge available, else their customers will leave and go to suppliers who are.

Embedding knowledge is what improves an organisation. For example, learning from past mistakes and building them into current practices should minimise the risk of the same mistake occurring twice. Knowledge is held within the mind of the knower but a small percentage of it can be gathered, shared and learnt. This is what companies try and achieve when they embark on KM. Companies that have embarked on KM, such as Rolls-Royce, often define it within corporate strategies so that they can confirm their understanding and communicate it coherently. The Rolls-Royce definition for KM is;

"A business process that formalises management and leverage of a firm's intellectual assets. KM promotes a collaborative and integrative approach to the creation, capture, organisation, access and use of information assets, including the tacit, uncaptured knowledge of people"

Roll-Royce focuses on formalising knowledge and capturing it within business processes. This is understandable as knowledge would have to be assessed and approved before it was accessible for people to use. The use of KM within the organisation should be collaborative and consistent, ensuring a unified and approved approach. Section 2.1.2 explores organisational knowledge further and communicates the key areas organisations need to focus on.
2.1.2 What is Organisational Knowledge?

The use of knowledge within any organisation is vital as it allows decision-makers to be equipped with information that reflects the current state of a business. The process of transforming data to making a decision is shown within Figure 2.1 from the European Industrial Research Management Association (EIRMA, 1999).

![Figure 2.1 - The Knowledge Pyramid (EIRMA, 1999)](image)

EIRMA reported in 1999 that the use of data within an organisation (e.g., data, facts and observations) is processed to produce information (collation of data), which is then understood and used to create knowledge. This knowledge can be asserted to make a company decision. In the simplest form, organisations looking to embark on KM require three main components as shown in Figure 2.2 (EIRMA, 1999).

![Figure 2.2 - Achieving balance for KM (EIRMA, 1999)](image)
According to EIRMA, Figure 2.2 displays three key ‘ingredients’ crucial to successful KM. An organisation will need adequate technology so that the processes can be supported and knowledge can be captured and shared efficiently. KM is dependant on people, as they hold knowledge gained from past experiences. This knowledge is key, as it has to be shared with others to support a knowledge-sharing environment. The process is used to embed KM into everyday employee tasks.

The first stage of this process is to capture the Knowledge available within the organisation. The KM practitioner would therefore need to understand knowledge; starting with the basic forms of tacit and explicit as defined in section 2.1.3.

2.1.3 Tacit and Explicit Knowledge

Desouza (2003) defines explicit knowledge as:

‘...words and numbers shared in the form of data, scientific formulae, product specifications, manuals, and universal principles’.

A working example of explicit knowledge within an organisation is the use of processes as they determine the stages within a task. They are classed as being explicit because they have been documented and are updated when an improvement is noted.

Tacit knowledge was described by Nokaka & Takeuchi (1995) as being:

‘...highly personal and hard to formulise, thus making it difficult to communicate or share with others’

Tacit knowledge is based on personal experiences and has evolved through years of understanding and learning. Tacit knowledge is difficult to capture, as people often ‘...don't know what they know’. Nonaka and Takeuchi (1995) founded the theory of explicit and tacit knowledge and have explored the relationship between the two as displayed within Figure 2.3.
Nonaka and Takeuchi said that tacit knowledge is passed through people via the medium of teamwork and coaching, known as socialisation. Tacit knowledge, if captured, can be externalised into explicit knowledge, which is very useful to organisations as captured knowledge can be shared.

Within the Combination phase, explicit knowledge is systemised and classified so that it can be internalised by understanding or learning from it. The early development of KM focused on the capture, storage and access of explicit knowledge, following which, the importance of tacit knowledge emerged.

Polanyi (1867) describes how tacit knowledge is difficult to formalise and communicate, whereas explicit knowledge can be transmitted in a formal language. Many have tried to transform tacit to explicit using techniques, such as Cognitive Mapping explored by Rodhain in 1999, but these techniques have been found to be time consuming and difficult to disseminate over a wide range of employees. Therefore, the problem of capturing tacit knowledge has not yet been resolved so other techniques to promote the sharing of knowledge have been favoured. One approach is through the use of IT systems, online discussions forums, communities of practice, etc. Another approach is to encourage face-to-face interaction.
Tacit knowledge sharing is not just about improving employee facilities to allow them to share knowledge more easily as Desouza (2003) described. He reported on a study that was carried out at Beta Corporation in Chicago that tried to capture tacit knowledge by creating two games rooms within the company premises. Difficulties arose in trying to get people to use the rooms due to the change in culture. The cultural change is a very big hurdle to overcome but when looking at the larger picture, even when employees started to use these social areas, the knowledge was not being formally captured and therefore not made accessible across the organisation.

Williams (2005) concluded that there is still a lot of research to be conducted in relation to the best ways of capturing, disseminating and sharing tacit and explicit knowledge and for a best practice guide to be produced. It is understood that different types of knowledge exist and that these are shared and communicated in different ways. The founding work by Nonaka and Takeuchi (1995) has provided a clear understanding of tacit and explicit knowledge and highlighted some of the techniques that could be adapted to share information between the different types.

2.1.4 Knowledge Management Evolution

Figallo & Rhine (2002) stated that the first example of knowledge sharing was displayed thirty-five thousand years ago, when nomadic hunting tribes used wax clay to draw images on cliff walls. By drawing the images of animals they found dangerous, e.g., lions, leopards and bears, the hunting tribes were communicating knowledge to others within the same group. KM progressed from the primitive form of the caveman and has developed over time as depicted in Figure 2.4.
Knowledge Centres hold a place in history evolving from ancient Greek philosophers. Wigg (1999) and Figallo & Rhine (2002) describe how Plato, Socrates and Aristotle all played a key part in trying to understand knowledge. Socrates required his students to question what had previously been unquestioned. Plato highlighted this by creating the school of Athens, which emphasised the capturing and elaborate thinking of his mentor Socrates, and allowed the following generations to capture, share and add new insight and creativity to existing knowledge.

Figallo & Rhine (2002) tell how Petrarch then exceeded the progression of knowledge by reviving classical learning after the Dark Ages. Boccaccio, a contemporary of Petrarch, was the first to study and write about the arts, science and philosophy. He actively collected and shared the knowledge he had. Figallo & Rhine (2002) go on to describe how the introduction of paper and the printing press by Gutenberg in 1450, allowed for the progression of explicit knowledge to be shared efficiently. Figallo & Rhine (2002) then go on to describe how, within the twentieth century, Taylor (introduced ‘management science’, aimed at increasing organisation productivity, by studying performance and creating best practice. One of his most famous studies involved timing people performing the same job to discover if those who were paid more were more productive. Mayo contradicted Taylor and highlighted the social factors that contribute to an individuals
working performance, as 'change within the working environment was likely to stimulate productive working processes'. Figallo & Rhine (2002)

Morris et al. (1996) documented how Drucker, in the 1970s, built on the work by Mayo by upholding the power of knowledge by stating that 'Knowledge now has become the capital of a developed economy'. Nonaka and Takeuchi (knowledge-portal, 2006) then went on to introduce the idea of knowledge companies in the 1990s.

The knowledge-portal in 2006 reported on the demand for KM within organisations and documented how it has continuously increased:

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"The BSI report that 80% of large UK organisations already engage in Knowledge Management and 96% predict that they will do in the next 5 years"

"In their report, 'Easing into Knowledge Management', Price Waterhouse Coopers state that 75% of a company's worth may soon reside in its intellectual property"
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The knowledgeboard (2006) concludes that the demand from the market as well as increased competition has directed companies from being product driven to focusing towards their knowledge. They go on with an example from product orientated organisations like Chaparral Steel, which is widely quoted in the field of business stating that knowledge is becoming an essential ingredient for success in the different levels within the organisation. Competition is one of the reasons for KM adoption by organisation but it was felt that there maybe other 'needs' for KM, which are explored within section 2.1.5.
2.1.5 The Need for Knowledge Management

Macintosh (2005) stated that the competitiveness of an organisation depended critically on the quality of the knowledge that is applied to the key business processes. The success of businesses within an increasingly competitive marketplace depends on the quality of knowledge that those organisations apply to their key business processes. For example the supply chain depends on knowledge of diverse areas including raw materials, planning, manufacturing and distribution. Likewise product development requires knowledge of consumer requirements, new science, new technology, and marketing etc. (Macintosh 2005).

The challenge of deploying the knowledge assets of an organisation to create competitive advantage becomes more crucial as Macintosh (2005) highlights within the following points:

- The marketplace is increasingly competitive and the rate of innovation is rising, therefore knowledge must evolve and be assimilated at an ever-faster rate.
- Corporations are organising their businesses to be focused on creating customer value. Staff functions are being reduced as are management structures. There is a need to replace the informal KM of the staff function with formal methods in customer aligned business processes.
- Competitive pressures are reducing the size of the workforce, which holds this knowledge.
- Knowledge takes time to acquire. Employees have less and less time for this.
- A rise in early retirement amongst employees as well as increasing mobility, leads to a loss of an organisation’s knowledge.
- There is a need to manage increasing complexity as small operating companies are trans-national sourcing operations.
- A change in strategic direction may result in the loss of knowledge in a specific area. A subsequent reversal in policy may then lead to a renewed requirement for this knowledge, but the employees with that knowledge may no longer be there.

Figure 2.5, taken from the OVUM Reports (1998/99) showed that investment in KM increased significantly. It rose to $8.8 billion US dollars in 1999 (not including the companies that are investing in KM internally and developing their own KM tools and
This high investment into KM is clearly shown by the high revenues generated by KM sales organisations that have undertaken KM have reported substantial cost savings that should not be ignored by others. Leavitt (2002) documented an example of a cost saving by Shell who established a global community of practice (CoP) to help create a global company. With the aim of transferring knowledge across the company, they found a $200 million per year saving using fewer wells, increasing their facility uptime and reducing their planning and design errors. BP's KM activities have reported savings of $700 million dollars due to their knowledge sharing activities (Leavitt, 2002).

Kelleher & Levene (2001) confirmed the commitment of BP in relation to KM as they reported Sir John Browne, the CEO of BP, stating that:

"Anyone in the organisation who is not directly accountable for making a profit should be involved in creating and distributing knowledge that the company can use to make a profit".

With companies like BP committing that every activity not directly accountable for creating profit should be accountable for creating and distributing knowledge, their competitors will find that they begin to learn from their mistakes and pass these benefits on...
to their customers.

Arthur. C. Clarke quoted that;
"Cave dwellers froze to death on beds of coal. It was all around them, but they could not see it or use it. Today, we are in danger of making the same mistakes"
(Kelleher & Levene, 2001).

This has, therefore, highlighted a risk that companies that do not make the best use of their knowledge could fall foul of and loose their customer base to their competitors that have made use of their knowledge. In the process of documenting knowledge companies may find that they have vast amounts of information and knowing issues associated with this and how to deal with it is explored within section 2.2.1.

2.2 Understanding current organisational issues

After understanding the origins of KM and how it has been adopted by industry (Collinson & Parcell 2004) the next sub-sections of this literature review examine the current KM issues faced by organisations and how far KM research/application has got in resolving these issues.

2.2.1 Information Overload

LaPlante (1997) highlighted that many companies find it hard to keep track of the knowledge they acquire, produce and maintain, and therefore they feel that they are dealing with ‘information overload’ as shown in a survey conducted on 1,300 managers in Hong Kong, the UK and US. The study found that while managers needed information to perform effectively, 25% of them also suffered from ill health, ranging from headaches to depression. It was discovered that this ill health was due to the enormous amount of information they had to absorb. Worst still, 94% did not expect the situation to improve and 56% expected it to get worse (cited by Farhoomand & Drury, 2002).

‘Information overload’ is a real issue affecting the health of managers across the world. Garai (1997) said that managing information successfully is:
"...getting the right information, in the right form, to the right person at the right time to add value to their role".

One possible solution has been the use of intranets. These have been used to manage information by giving employees the power to access information from anywhere on their own internal network. Pdmic (2006) stated that the power of intranets has been utilised by many companies and its use has grown beyond that of the Internet. Spending on intranets has been projected to be ten times greater than that spent on the Internet by the turn of the century (Pdmic, 2006). Many companies now have the framework on which to build their explicit knowledge store, but there is still a need to establish how it should work. Some companies try to store all of their sources of information within one place, e.g., a master database, which according to Nathan (a senior researcher at The Foundation, a UK research charity) is not appropriate (Dudman, 2006). Nathan believes that the solution is to create systems that link people to the information. Dudman (2006) states that this has been found to be successful by some UK organisations, such as the central Government departments. A master database may be inappropriate because many companies deal with different forms of information that are not inter-related, and therefore, the combination of these sources into one central hub cannot be successful.

Churchman's (Malhotra, 2000) pioneering work of the 'design of inquiring systems' noted the connection between information and knowledge as:

'Knowledge resides in the user and not in the collection of information...it is how the user reacts to a collection of information that matters' (cited by Malhotra, 2000).

This concept coincides with that of Nathan (Dudman, 2006), both agreeing that companies should strive to create a link between information and people in order to enable others to share in this knowledge. Within large established companies this is difficult because the accumulation of information is so vast. A possible solution could be one created by Bourke (2006), who established product data management systems within the Aerospace and Defence industry. Product data management systems are based on managing product data within engineering work groups, where a company has a structured data format. This solution is catered towards product data and therefore would not tackle the overall issue of
vast amounts of information whether that is product or more general organisational information.

Lui and Xu (2001) highlighted a number of additional issues with the traditional product data management systems. Due to an increased demand for product data management systems, many vendors have produced different systems with very different user interfaces. The complexity of these interfaces is a distraction from the task in hand and can eliminate any noticeable benefits. Lui and Xu (2001) believe this is mainly because it is now more 'complicated, broader in scope and more rapidly changing then ever before'.

Any integrated system needs to be more than just a database and needs to have the ability to deal with information that is held within different document format types such as databases, spreadsheets, hard documents, etc. The question therefore arises to how this information could be collated into a valuable knowledge base. The key may be within the word 'knowledge'. People within organisations acquire information and the knowledge is gained when others use that information to contribute to work they are undertaking.

By developing the conclusions made by Lui and Xu (2001) and trying to overcome the issues that they highlighted with product data management, Whittaker et al. (2004) developed ContactMap. The purpose of the tool was to make people the primary unit of interaction by providing a social desktop representation of users' important contacts. The relationships between these contacts were shown in colour, which determined if they were social, affiliate or a project based contact. Emails are represented through ContactMap and shown through each contact. The tool makes it easier to see how people relate to each other and to projects but it would not be possible to search other peoples' maps or search for areas that you may have little knowledge about. It is this type of search, which is more essential within organisations as people are usually aware of the networks they communicate in.

Another proposed solution by McGarrity (2000) aimed at improving the efficiency of a help desk at Duquesne University, Pittsburgh. They built upon Whittaker et al.’s work by capturing information relating to a specific job role rather then just the contact details. The main source of information for the employees was the policy and procedure manual, but due to its length, the employees tended to ask each other for help. Unlike Whittaker et al.
(2004), who tried to increase human interaction, McGarrity chose to implement a software tool called Knowlix by Peregrine Systems. The tool logged all of the current documents and access was given to all of the employees to search for the information they required. There was no formal analysis of the tools success, but McGarrity did document some lessons that were learnt from the project: -

- Involve line staff from an early stage.
- Spend time mapping knowledge structures.
- Make technology the last step.

In developing a tool to help manage information, McGarrity found that the employees/staff are key and that understanding the structure of the knowledge is very important. The implementation of IT seems to be the last resort and that any IT system implemented is more to support the access to information rather then a store, as suggested with the product data management system. Berkman (2006) supports the conclusions made by McGarrity by highlighting the importance of knowledge and encouraging management to find a way of capturing and sharing the information:

'One of the most valuable corporate assets is the experience and expertise floating around inside employees' heads. In order to manage this intellectual capital, executives must devise a way to capture and share that knowledge with co-workers'.

Encouraging social networks seems to be supported within the current literature. Swan et al (2000) agree that it is a more productive route as it has been found to be more effective than a linear information flow. They believe that knowledge sharing through social networks, including occupational groups and teams, will encourage a more productive KM environment. Weenig and Midden (1991) also agree that 'friendship and personal contacts heavily influence communication between individuals; when these exist, the likelihood of information sharing is increased'.

Any solution to the information overload issue would need to be people focused but would also require the knowledge structure to be well documented according to McGarrity (2004). The literature review within this section leads to the conclusion that a knowledge management system must focus on people and, therefore, they must be encouraged to
communicate. The information itself cannot be simply resolved by implementing a product data management system, according to Whittaker et al. (2004), and as the current software market does not provide a suitable tool, any software developed would have to be in-house.

The complexity faced when managing information needs to be understood. Kolekofski et al (2003) concluded that information within companies is a valid resource that is not being utilised to its full potential. Research they conducted highlighted three factors, which encourage knowledge sharing - ownership attitudes, instrumentality and value for feelings. 'Ownership attitude' is the importance of making people's feelings valued for the information they are responsible for. 'Instrumentality' looks into the size and amount of information requested, the power represented and the value given to the sharer. 'Value for feeling', is dependent on the owner and how their attitudes may reflect the user, based on past experiences.

This review has indicated that the importance of creating a solution to the current information overload issue that many companies are facing is critical and urgent. The solution would need to make use of the vast tacit knowledge available and formalise the explicit knowledge so that it can be searchable and validated. The tool would also need to meet user requirements and be catered to user needs to ensure that it is not viewed as another information management system.

Current research has concluded that there has been work conducted in the field of trying to help resolve the information overload issue but that methods deployed, such as those of McGarrity (2004) with the software tool Knowlrix, have not been well documented and have concluded with three areas that he suggests should be explored to develop a successful system. Therefore, the first research aim is to develop McGarrity's work further and establish whether a knowledge location tool for Configuration Management data can be implemented in a way that is functionally effective, cost effective and satisfies the user needs. An important aspect of this will be the acceptability to the users, as a tool is of no use unless the users are willing to use it in practice.
2.3 Knowledge Management Tools within Industry

'The mid-1990’s saw a surge of publications, conferences and consultancy activity in Knowledge Management and many organisations woke up to the challenges of managing their knowledge' (Quintas & Ray, 2002).

2.3.1 The Range of Available Knowledge Management Tools

There are many different approaches that companies have taken in KM. Carillo (2004) has tried to segregate the approaches into three types:

1. IT perspective – focus around delivering KM tools.
2. Human resources perspective – reliant on people to deliver the solution.
3. Combination – a combined approach that focuses on both IT and the human aspects of KM.

The IT perspective has been greatly favoured by software vendors that have tried to sell companies all-in-one KM solutions, but this is not always the favoured option.

'The big mistake is to falling prey to vendors’ claim that if you just buy the right search engine, portal or intranet, violà, you have KM' Berkman (2006).

Prusak, executive director of IBM’s institute for KM said that about half of 2,020 observed KM implementations failed Berkman (2006). An example given by Berkman of this was a global financial services company that spent six years and nearly $1 billion on a KM project to improve the productivity of its financial planners. The company gained nearly no return on its investment as they treated it as a technology exercise. Any company embarking on KM needs to learn the lessons from other companies, one of which may be to avoid KM software vendors and the IT perspective to KM.

Rolls-Royce Aerospace opted for a combined approach with the majority of the work to date focusing on the implementation of KM tools. The introduction of the first KM tool was the Capability Intranet in 1996. The development of the KM programme at Rolls-Royce has been recognised and voted one of the top 20 of the MAKE (Most Admired Knowledge Enterprise) list (Meskill, 2004). The MAKE list (KNOW network, 2005) rates
companies KM progression based on eight areas: -

1. Creating an enterprise knowledge-driven culture.
2. Developing knowledge workers through senior management leadership.
3. Delivering superior knowledge-based products/services/solutions.
4. Maximizing enterprise intellectual capital.
5. Creating an environment for collaborative knowledge sharing.
6. Creating a learning organization.
7. Delivering value based on customer knowledge.
8. Transforming enterprise knowledge into shareholder value.

The achievements of Rolls-Royce and its approach to KM support the combination approach to KM. The approached taken by the other companies within the MAKE list are not well understood but based on the criteria listed it seems that the criteria favours a combination approach as it focuses on an organisation’s culture and the adoption of KM tools. Whilst reviewing KM tools, it is assumed that the combined approach is best practice based on the MAKE list criteria.

A study conducted by Wong and Aspinwall (2005) established the types of KM initiative implemented as shown in Table 2.1, in the order of importance.

Table 2.1 - Types of KM initiative (Wong & Aspinwall, 2005)

<table>
<thead>
<tr>
<th>Initiative</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capturing knowledge electronically in a repository</td>
<td>26</td>
</tr>
<tr>
<td>Using information technology to share and transfer knowledge</td>
<td>25</td>
</tr>
<tr>
<td>Using the intranet to publish and access information</td>
<td>21</td>
</tr>
<tr>
<td>Building and maintaining employees’ expertise and skills</td>
<td>19</td>
</tr>
<tr>
<td>Identifying internal and external best practices</td>
<td>18</td>
</tr>
<tr>
<td>Creating a supportive environment for knowledge sharing</td>
<td>17</td>
</tr>
<tr>
<td>Developing strategies for KM</td>
<td>14</td>
</tr>
<tr>
<td>Appointing KM leaders and teams</td>
<td>10</td>
</tr>
<tr>
<td>Rewarding employees who contribute and share knowledge</td>
<td>10</td>
</tr>
<tr>
<td>Measuring the value of intellectual capital</td>
<td>5</td>
</tr>
</tbody>
</table>
The KM initiatives that were established from Wong and Aspinwall's study are in line with the general thinking of KM tools as illustrated by Carillo (2004), who conducted a similar study with 11 Canadian gas and oil companies. Interviews were conducted and a list of KM tools used was derived. The tools were segregated into 'create knowledge and share knowledge' and 'non-IT tools and IT tools'. Most of the tools highlighted from the study can be categorised into the initiatives documented by Wong and Aspinwall except those that spawn from a different heading such as a CRM (Customer Relationship Management) within the company.

It is interesting to see (Wong and Asinwall 2005, Carillo 2004) that companies successfully implementing KM have opted to develop tools in-house and the range of tools used seem to focus on the same areas as the tools used by Rolls-Royce Aerospace. A list of the tools used by Rolls-Royce Aerospace along with a description can be found in Table 2.2.

Rolls-Royce has a well developed suite of KM tools which are also similar to those used within other industries. Collinson & Parcell (2004) gives the examples of BP (on their Tackling AIDS in Cities project), the BBC (on their relocation project), Teerfund, and De Beers. Reported tools include benchmarking, peer assist, learning lessons, after reviews, people/expert pages, communities of practice and knowledge capture techniques.

Some companies have used KM consultancy firms such as KMx (Knowledge Management Solutions, 2005), KPS (Knowledge Powered Solutions, 2005) and Right Now Technologies (Rightnow, 2005) to provide them with the KM tools they required. Other companies, such as Rolls-Royce and BP, have chosen to develop and implement their own suite of KM tools (Collison & Parcell, 2004). Gamble & Blackwell (2001) estimate that there are between 200 to 300 KM related technologies available. It is evident that many companies have developed their own suite of KM tools (Skyrme, 1998; Collinson & Parcell 2004; Gamble & Blackwell, 2001) but the extent to which companies are using these tools successfully has not yet been explored.
Table 2.2 - List of Rolls-Royce KM tools in 2006

<table>
<thead>
<tr>
<th>Tool</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lessons Learnt Logs</td>
<td>A database established to capture lessons by enabling people to share their experience and contribute new knowledge.</td>
</tr>
<tr>
<td>Structured Knowledge Audits</td>
<td>An audit conducted on the level of knowledge available to support a process. This allows managers to understand their knowledge needs and assets, the risks to them and what they should do to manage those risks.</td>
</tr>
<tr>
<td>Capability Intranets</td>
<td>A specific part of the company intranet encouraging the online, global sharing of process, technology and best practices etc.</td>
</tr>
<tr>
<td>Benchmarking</td>
<td>A method that establishes strengths and weaknesses across a wide range of KM issues and capabilities. It also establishes improvement targets and measurements.</td>
</tr>
<tr>
<td>TRIZ</td>
<td>Used by the design team, TRIZ is a collection of tools that has been developed from an analysis of over 2 million of the world’s best patents.</td>
</tr>
<tr>
<td>Lessons Learnt Reviews</td>
<td>A facilitated discussion session held at the end of a key phase in a project. Lessons are captured within these sessions and then placed within the lessons log.</td>
</tr>
<tr>
<td>Hazard Identification Prompt Lists (HIPLs)</td>
<td>Lists of 'things to think about' when tackling a new problem or project. HIPLs can be used as triggers for use in risk identification sessions, or used as a reference tool as early as possible during a package of work.</td>
</tr>
<tr>
<td>People Pages</td>
<td>A collection of employee profiles including what they do and their experiences.</td>
</tr>
<tr>
<td>Communities of Practice</td>
<td>A facilitated network of people sharing knowledge and expertise across organisational and geographical boundaries.</td>
</tr>
<tr>
<td>Telephone conferencing</td>
<td>A method of global communication via the telephone often involving groups of people. Widely available to global employees, a more economical alternative to travel.</td>
</tr>
<tr>
<td>Peer assist</td>
<td>A meeting to get new project teams to learn from similar previous experience from across the organisation.</td>
</tr>
<tr>
<td>Story Telling</td>
<td>A reworking of an old KM technique based on indigenous cultures. Used to encourage individuals to share their experiences.</td>
</tr>
<tr>
<td>Design Rational Editor (DRED)</td>
<td>Helps structure, present and review decision processes and captures the decision rationale for future use.</td>
</tr>
<tr>
<td>Knowledge Acquisition Modelling Process</td>
<td>A comprehensive method for capturing and publishing knowledge. Suitable for staff that are not experts in knowledge management.</td>
</tr>
<tr>
<td>Email</td>
<td>A means or system for transmitting messages electronically between computers on a network.</td>
</tr>
<tr>
<td>Company Intranet</td>
<td>Online Information made available globally to all employees.</td>
</tr>
</tbody>
</table>
Outsourcing KM tools is not favoured by experts like Berkman (2006), who argue for the in-house development of KM tools as the preferred option. These tools can be more specific and tailored to the organisations specific needs. The lack of current research regarding in-house KM tool development verses buying a KM tool and the successful use of tools poses a problem. Those who have documented their KM tool progression, like Collinson & Parcell (2004), have developed their own suite of internal KM tools. Therefore any tool selection that a KM practitioner would have to undertake would be based on restrictions that are on themselves, for example budget restraints, software development resources, etc. This highlights a current gap in the literature to explain the usefulness of KM tools that have been used within industries and a lack of understanding into whether tools developed in-house can be successful.

There are many research papers that describe KM tools. For example, Seidman (2006) describes a digital coaching technology that accommodates the human aspects of sharing knowledge by using storytelling and ContactMap is a tool developed by Whittaker et al. (2004) to visually represent people’s social networks, etc. It seems that companies are using KM tools, however, those who are new to the area could be easily misled and consider using tools that have not yet been tested or applied within industry. It is evident that many companies are falling into the latter category with Lucier & Torsiliera (1997) estimating that 84% of KM programmes are found to exert no significant impact on the organisations. Companies therefore need to ensure that the KM tools they choose to deploy have been well researched and meet the requirements of their employees. There is no current method for establishing which KM tools to deploy to satisfy employees’ needs.

Therefore Objective 7c is to conduct a survey of KM tools available across the Aerospace business to discover their perceived usefulness.

2.4 Implementing Knowledge Management Tools

If a company chooses to develop its own suite of KM tools it would need to make sure that the implementation method for these tools ensured successful adoption and use. The issue is not as straight forward as understanding and using software implementation best practice as some KM tools, such as lessons learnt reviews, do not include IT.
KM involves more than just technology.

'The problem is, in many cases KM devolved into purely technical process, resulting in expensive software implementations sitting unused by oblivious, fearful or resentful employees' Berkman (2006).

Coakes (2003) also agrees with Berkman (2006) and analysed the implementation of Customer Relationship Management (CRM) in an organisation to illustrate some of the challenges that may emerge for KM. The case illustrated that a technology driven approach did not work, and a successful CRM implementation would involve the development of an overall strategy followed by consideration of the system.

Coakes’ (2003) case study also agreed with Skyrme (1998) who found that successful implementation techniques included the following characteristics:

- Clear vision and leadership
- Multidisciplinary teams
- A user and business centric approach
- Well-designed processes that engage humans where they are best, and allow them to interact with computers where the computers perform best
- Active learning and experimentation
- A knowledge sharing culture

Offering good grounding, Skyrme (1998) also noted that successful implementation should give focus to non-technical factors including human factors, organisational processes and culture. However, the overall approach lacks substance and could not be used by anyone as a guide to implement a KM tool.

Ngai and Chan (2005) offer AHP (Analytical Hierarchy Process) as a solution to selecting the correct knowledge management tool. AHP is a powerful and flexible decision-making process that is more vigorous in depth than the guide proposed by Skyrme. AHP measures the successfulness of a tool against three essential evaluation criteria identified: cost, functionality and vendors. They analysed the tools suitability for a given company against the three evaluation criteria. As this tool is directed towards software that is offered by
vendors, it may be difficult to adapt it to tools that companies are considering developing in-house. The method is also very analytical as it does not relate to the needs of the users and establish which tool best suits those users' specific needs. This approach would be useful to a company buying in a tool from a software vendor but if a company had developed its own tool, it would not offer any guidance to the method of implementation.

This literature review on the implementation of KM tools has established that there is no comprehensive guide that a KM practitioner could follow to help in the successful implementation of KM tools. Therefore this area will be investigated within Rolls-Royce to see if any firmer conclusions can be drawn, as detailed in objective one of this thesis.

2.5 Establishing Knowledge Management Needs

With a vast amount of KM research currently available, it is still surprising to see that an

'Estimated, 84% of KM programmes exerted no significant impact on the adopting organisation' (Lucier & Torsiliera, 1997).

To try and establish why KM projects have failed, many researchers, such as Lin et al. (2005) and Chua & Lam (2005) have analysed case studies and highlighted common failings.

Lin et al. (2005) created a list of six KM gaps that may occur in KM projects causing them to fail. Gap 4 stated that 'limited employee involvement during initial documentation review resulting from difficulty in attracting participants, results in an incomplete knowledge repository'. Involving the employees and focusing KM to their needs is therefore important in making sure that a KM initiative does not fail. This method also supports the importance that should be placed on a company's most important asset and skill base, its employees, who give a firm its competitive advantage (1000 ventures, 2005).

Nokaka & Takeuchi (1995) established the importance of both tacit and explicit knowledge within KM research, but in practice the deployment of KM is based on the creation of a KM strategy and aligning this strategy to the current business goals. Sunassee and Sewry (2003) conducted a detailed literature survey into KM strategies and stated that,
Chapter 2

‘A KM implementation strategy must be a function of the business strategy, or else the KM initiative will fail to accomplish goals that are tangible to the organisation’.

Rubenstein-Montano et al. (2000) cited in Sunassee and Sewry (2003), stated that there are three categories for classifying KM frameworks: descriptive, prescriptive and hybrid. The descriptive approach identifies attributes of KM that can influence the success or failure of the initiative. The prescriptive approach provides details of different approaches with no real direction, whereas the hybrid approach is a mix of both. The importance of aligning a KM strategy to the business goals is recognised, but the importance of aligning a KM strategy to the knowledge needs of the employees is arguably important, as stated by Lin et al. (2005), as it is one of the four reasons why KM initiatives fail. Establishing the needs of employees is an area that is not covered by current literature. Objective 7b will therefore aim to gain a better understanding of employees knowledge needs.

2.6 Analysis into the Successful Use of KM Tools

The research into the general measurement of KM is vast (see Section 2.7) but the analysis into individual tools and their usefulness is lacking. The measurement of KM tools may be approached in the same way as IT tools, however, this would not be appropriate for the non-IT KM tools (lessons learnt review, story telling, peer assist, etc) that are essential for KM to be successfully implemented.

The National Electronic Library for Health (2006) cite O’Dell and Grayson (1998) who recommend a two-pronged approach that seeks to measure both outcomes and activities. The outcomes are the overall improvements that have been recognised, such as an improved process and reduction in time to do something. The activities part of the measurement relates to KM tools and looks into individual activities and the effect. These can be both quantitative, in terms of the number of hits a tool may have, and qualitative measurements, such as asking people about the attitudes and behaviours behind their activities.

The quantitative measurements are well documented and easy to attain. Some can be used on both IT KM tools and non-IT tools. Haghi (2004) agrees, as one of their measurement goals was to ‘measure active and passive participation at KM program in terms of
Chapter 2

**Knowledge creation, capture and reuse.**

Examples they use include the number of user/visitors and the number of submitted documents, postings and downloads. Collecting these measurements on a monthly basis would allow practitioners to monitor any fluctuations in the tools use.

The qualitative measurement can be deployed via a survey (National Electronic Library for Health, 2006). Surveys can be used to assess aspects of the culture including people’s opinions, attitudes and behaviours. A presentation given by Valasquez (2005) included a survey that had been filled out by the members of a community. The respondents had to respond to comments or questions with ‘positive’, ‘neutral’ or ‘negative’. Examples are given in Table 2.3.

**Table 2.3 - Community users survey questions (Valasquez, 2005)**

<table>
<thead>
<tr>
<th>Question</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>I have gained valuable knowledge. I can apply to my job by going to the collaboration tool on the community portals.</td>
<td></td>
</tr>
<tr>
<td>I feel that those around me have benefited from the knowledge. I have gained from the collaboration within the community.</td>
<td></td>
</tr>
<tr>
<td>When I experience a problem at work, I can count on the community for help.</td>
<td></td>
</tr>
<tr>
<td>I have improved access to the knowledge and experience of experts through the community.</td>
<td></td>
</tr>
<tr>
<td>KM communities give Halliburton (the company) a competitive advantage.</td>
<td></td>
</tr>
</tbody>
</table>

Other questions that could provide a quantitative measurement included, ‘how many hours per week do you estimate the community portals save you?’ Companies could use the hours saved per week to justify the cost of the tool. This approach also included a visual mapping device that showed the community increased its collaboration and was less dependent on key people. By combining the use of both quantitative and qualitative measurement techniques, Valasquez (2005) was able to justify his KM programme in one year with the following improvements: -

- Customer satisfaction improved by 24%
- COPQ (Cost of poor quality) reduced by 66%
• New product revenue increased by 22%
• Virtual capacity created: 4.1 hours/person/week or 45 full-time equivalents in a group of 450 people. This is equivalent to 10% productivity improvement.

The development of a survey that could be used for any KM tool is needed so that KM practitioners can gain activity based metrics that can be used to help build up the measurement portfolio for KM. The survey would need to be geared towards the employees, as they would have the best basis on the usefulness of a tool within real working situations.

As the review of the literature in this area is not conclusive, the use of a questionnaire will be explored within Roll-Royce as stated in objective 7c.

2.7 Measuring Knowledge Management Success

Traditionally financial metrics focus on the value of physical assets. They do not report the value of intangible assets that have often been attributed to the growing discrepancy between valuations of companies on the stock market compared to their actual book value. 'Unreported' assets are on average 5-10 times those of the tangible assets' as reported by Skyrme (2005). This is due to the value of intellectual capital such as brand names, patents, trademarks and knowledge.

In realisation of this, Rolls-Royce Aerospace (King et al. 2001) developed a KM strategy that seeks to develop a better-informed and more knowledgeable workforce (trying to focus on there intangible assets) that will be able to: -

• Produce improved products and services at lower cost;
• Achieve more 'right first time' products reducing warranty costs and timescales;
• Introduce best practices and innovations more widely and more rapidly; and
• Encourage and support innovation through better understanding of the risks.

Companies need to measure the success of an investment regardless of its form, whether implementing a new piece of software or the building of a new factory. It is the measurement of intangible assets that most companies struggle with, as they are difficult to quantify. Skyrme (1998) has tried to classify the motivation for measurements of
intangibles and knowledge assets into three main groups: -

1. It provides a basis for company valuation (asset focused) - Valuation is important for trading assets or properly valuing the company in the marketplace and earning a proper return for shareholders.

2. It stimulates management focus on what is important (action focus) - By developing appropriate performance metrics and making managers accountable, the right things get their attention and focus.

3. It gives a baseline for justifying investment in KM activities (benefit focus) - In many companies, proponents of KM agonise over what measurements they can use to convince top management of its value.

The justification for measurement use is well documented. Different practitioners hold slightly different views, for example Haghi (2004) differs from Skyrme (1998) in suggesting measurements are to improve total customer quality, but the importance of measurements within industry is undisputable.

Knowledge, because of its intangible nature is hard to quantify. Malhotra (2003) conducted an extensive analysis into the different frameworks available for measuring knowledge assets and the strengths and weaknesses of each one. As the measurement selected would be used within Rolls-Royce, it would have to be a framework easily accessible and well documented. Therefore the four main frameworks used to measure and evaluate the value of intangibles are analysed: -

- Balanced Score Card (Currently used by the Aerospace business within Rolls-Royce)
- Intellectual Capital Index (Malhotra, 2003)
- Intangible Assets Monitor (Malhotra, 2003)
- Skandia Navigator (Malhotra, 2003)

2.7.1 Balanced Score Card

The balanced score card approach is about clearly choosing a market position and aligning your internal business processes to reach this position. Financial targets are first, then the relevant customer segments, then appropriate internal process, followed by relevant learning and growth (Mouritsen et al, 2005). Rohm (2002), the vice-president of the
Balanced Scorecard Institute, has created a guide to using the balanced score card. He raised the issue that it can be difficult for managers to identify the measures and the considerations for the selection of the measures is often not well thought out.

Gautreau and Kleiner (2001) agree with Mouritsen (2001) and highlight the importance of management in selecting the best measures and strategy. The balanced score card does not focus on the importance of the company employees and how they could be brought in to support the creation of the scorecard. Mouritsen (2001) recognised that the balanced score card is difficult to implement, with a typical one taking 5 or 6 months. Nevertheless he still reported that 60% of the fortune 1000 companies either have a balanced score card or are considering having one. Skyrme (1999) also noted that the balanced score card, unlike the intellectual capital index, does not include the following:

- The strategic impact of changes in intellectual capital.
- Identification of which categories of intellectual capital are more important.
- Cross-comparisons over different business units and companies.

**2.7.2 Intellectual Capital Index**

According to the Electronic Library for Health (2006), the index identifies four categories of intellectual capital, which are: human, innovation, relationship and infrastructure. It works by looking at the importance of each and the impact of changes in intellectual capital. The intellectual capital index also allows organisations to compare across sections, which the balanced score card cannot. The result of the intellectual capital index is not a number that can be a value of intellectual capital as it is a non-linear dimensionless number (Skyrme, 1998). The application of tools like the intellectual capital index is still proving to be a real challenge as reported by Coakes (2003).

**2.7.3 Intangible Assets Monitor**

This describes three types of intangible assets that account for the discrepancy between a company's book value and its market value. This 'gap' is made up of employee competencies and internal and external structures (Malhotra, 2003). According to Sveiby (1998), people are shown to be the only true measurement of intangible assets as it is through there own capabilities that they know how to deal with different situations. These skills are gained through education, experience, values and social skills.
The intangible assets monitor does not include members of the support staff, including those in accounting, administration and reception, as they are part of the internal structure that supports the company and should be already accounted for (Bosman, 2001).

Figure 2.6 - Examples of KPIs for the category ‘Competence of people’ (Bosman, 2001).

2.7.4 Skandia Navigator

The Navigator is a tool that measures soft assets within an organisation. Each business has to create intellectual capital indicators that are critical to future development. The intellectual capital is measured by analysing 164 metric measures covering five areas: financial, customer, process, renewal and development (Bose, 2004). These techniques are relevant when trying to monitor, control and measure intangible assets but when a KM project is in place it often requires more detailed measurements based on a specific tool or technique (Skandia Navigator, 2006).
2.7.5 Evaluation of these and other measurement approaches

Each of the above techniques is useful, but would take months to deploy and if funds were constrained then they may not be viable solutions. The use of the balanced score card in Rolls-Royce is well known as a business measurement tool. It may confuse people to bring in a second balanced scorecard to be used for KM. The approaches also lack a visual representation of the 'now situation', and as with most KM perspectives, they are produced by the managers and do not include or account for the employees that will be aiming to attain these goals. It can be concluded, therefore, that a more simplistic approach is needed that will be quick, easy, low cost and includes the employees perspectives.

A possible solution could be knowledge-based benchmarking, which is a technique that allows an organisation to assess its current view on KM by carrying out self-assessment on specific areas. According to Collinson & Parcell (2004) the tool is good for visually displaying the current state of KM in areas such as communication and managing contract staff, but it does not pinpoint the effectiveness of each KM tool. By producing graphical images that represent the current state of KM they can be useful in both measurement and capturing awareness for KM (Collinson & Parcell, 2004).
KM projects need to be continuously assessed to ensure that the required actions and changes are being made, and redefined as necessary. Skyrme (1998) reports that because of this, many companies have started to invest in researching their measurement techniques.

There are a number of problems associated with measuring knowledge that make these metrics sub-optimal (Skyrme, 1998), these factors are:

- Difficult to assess the stock of knowledge.
- No standard accounting definitions for knowledge measurement.
- No reliable way to price knowledge.

Skyrme (1998) also documents some of these ‘other’ methods have made companies revert back to more traditional measurement methods including: -

- Surveys
- Questionnaires
- Interviews
- Workshops
- Meetings with key stakeholders
- System measures (e.g., pages viewed on an intranet site)

Once collated the measures need to be incorporated into an overall KM framework and therefore allow the identification of factors that may have had a direct or indirect impact upon the KM initiative (Skyrme 1998).

There are a number of metrics available for measuring the impact of a KM initiative as detailed within the literature but it is important to consider the steps involved in deciding which metrics to use. As this is not covered within current literature, possible options to explore could include understanding the requirements of stakeholders and allowing the tailoring of metrics to answer these requirements and can show that a KM project is succeeding by demonstrating the economic value created. Metrics play a pivotal role in leading the strategic direction of the business. Measuring allows a better understanding of KM projects when trying to meet strategic objectives.

To fulfil objective 7d, a benchmarking tool used within Rolls-Royce Aerospace will be
deployed within the Support business of Rolls-Royce to measure the current state of use of KM tools and techniques within the business and establish a baseline for the measurement of KM. The results could then be developed to help quantify if a KM programme has been successful, by comparing the before and after benchmarking results.

2.8 Knowledge Management Business Case

As with any new business investment, companies have to make justifications to senior managers, usually in the form of a business case to justify that a return will be gained from the investment. This will also apply to a company looking to embark on KM. The following sections will review the literature associated with creating a KM business case.

2.8.1 Creating a Knowledge Management Business Case

Skyrme (2006) suggested that creating a business case for KM is 'as simple as ABC'. Skyrme believes that there are three main planks that justify KM:

- **Asset value** - including market value e.g. the value of specific knowledge assets on the open market; costs e.g., training costs of new employees, replacement cost of getting to where you are now, if everything was lost, and liability cost. Most companies have a hold on the value of their physical assets yet ignore those assets which are worth 5-10 times the recorded balance sheet.

- **Benefits potential** - By tracing a company within the same field as your own, it should be possible to gain these potential benefits from their own KM activities. Listed below are some of the potential benefits:
  - Information and knowledge benefits, e.g., retrieving information faster;
  - Intermediate benefits, e.g., minimising duplication, sharing knowledge;
  - Organisational benefits, e.g., reducing costs, increasing productivity; customer and stakeholder benefits equalling better products and services.

- **Cost effectiveness** - people working more efficiently; decreased facility costs (office design/health & safety) from sharing best practice; e-business opportunity; better services for customers getting as solutions such as CRM systems are more focused.
Skyrme (2006) himself has highlighted a list of stumbling blocks with the proposed ‘ABC’ method:

- Lack of a baseline
- Lack of sharing management vision
- Too heavily focused on financial measures rather than broader outcomes
- Complex link between cause and effect
- Possible unanticipated benefits

Each of the planks within the ABC framework suggested by Skyrme (2006) contains justifications that would be difficult to quantify e.g., the ‘value of specific knowledge assets on the open market’ includes an example of a ‘group of experts’. The author believes it would be very difficult to attain the worth of experts on an open market, as the method has not been documented so it is suggested that it would incur a substantial amount of time trying to create a guide. The ‘benefits potential and cost effectiveness’ suggest that the business case creator ascertains information from a similar company and reads across benefits that they have gained from implementing KM. Current research has found that companies embarking on KM very rarely publicise their KM findings, therefore making this stage of the framework by Skyrme difficult to accomplish.

Neef (1999) in a paper entitled ‘Making the case for knowledge management: the big picture’, targeted company managers and provided an understanding of the importance of KM. The paper justified a case for KM by covering the following:

- Knowledge based strategy - ‘It was this combination of global expansion and new communications technologies which led to the current focus on one of the most valuable tenets of knowledge management - mobilising organisational knowledge in such a way as to encourage sharing of lessons learned and to prevent the recurrence of costly mistakes’.

- A knowledge sharing culture - ‘what knowledge is needed by whom and when, on a global basis. Knowledge workers are being encouraged to share; leading practices, new techniques, and lessons learnt with colleagues worldwide’.

- A technical support infrastructure - ‘dedicated resources for knowledge; including a chief knowledge officer, and clear methods for submitting, organising and retrieving information electronically’.
• Business research and analysis - 'More then ever before, employees at all levels or organisations need to know more, with more certainty more quickly. The need for customised business research and analysis will grow with the complexities of the global marketplace'.

Within the paper, Neef describes his work as ‘a critical set of polices and practices that will boost an organisations competitive position in a new knowledge based economy’. This description of the paper was exact as it is more focused towards an organisation that has already agreed to a KM program and set aside the required resources, as shown by the ‘Knowledge based strategy’ section that details different organisational KM strategies. The business case proposed by Neef included some qualitative measures (‘corporate agility, learning lessons, etc.’) but it did not describe how these could be used within a business case or how to justify qualitative KM benefits.

By reviewing case study literature, Mootanah (2004) offered evidence of a KM business case. Mootanah conducted a study and found that six out of the 14 organisations reported prepared a business case, but only one company compiled a quantified business case. The quantified business case included the following points:

- Employee time-savings would equate to financial savings.
- Investment could be made on the basis that KM supported their core business objectives.
- Top management support was important.
- Pressure from clients was common (questions asked on continuous improvement, sharing best practice).

Mootanah found that there are 'few practical tools available for KM, even less on making a business case', so they proposed a number of measurements that could be used within a business case:

- Better corporate reputation.
- Increased client satisfaction.
- Staff learning, better morale leading to staff retention/recruitment.
- Overall efficiency savings including: time, money etc.
- Improved quality assurance and speed of technical decisions.
• Increased innovation due to knowledge sharing, quicker and wider access to knowledge.
• Improved risk management, etc.

Mootanah's measurements are useful but require baselines and therefore have the same issues as Neef (1999) when used within a business case.

Owen (1999) stated that creating a business case for KM involves the following steps:

1. Get your story straight - Create a white paper that starts to create your business case, using examples from similar industries. Propose a simple model that incorporates the key factors for successful KM implementation. Finally outline opportunities for quick payoffs.
2. Go visit - Meet with senior managers and discuss ideas.
3. Rally supporters - Try to congregate those interested in knowledge creation and transfer. Establish a 'strategic KM council' to discuss KM issues and identify high pay-off initiatives.
4. Use technology - Internal websites to promote KM through articles, interviews and announcements, etc.
5. Take action - Set a good example by tackling KM issues in your own area first. Get involved in the company wide projects such as revision of a KM intranet site.
6. Get Passionate - Use any opportunity to get your message across.

Owen successfully outlines the method of approaching KM within a company, but for a large company like Rolls-Royce a detailed business case would have to be produced and presented as within companies 'several such initiatives end up competing for the same resources at a corporate level' (Skyrme, 1998). KM could not be introduced at Rolls-Royce based on the opinion of others, as a return on investment would have to be justified to management and the risks associated reviewed.

Overall, the current literature on KM did not include a comprehensive step-by-step guide to creating a generic KM business case. The next logical step was to look into generic business case literature.
2.8.2 Generic Business Cases

Wu (2006) created a list of components that he believed should be incorporated within a generic business case:

- Executive Summary
- Background
- Issue/Need
- Proposed Solution
- Industry Perspective
- Cost Justification
- Qualitative Benefits
- Conclusion and Reasoning
- Summary

Wu provides a comprehensive content list that should serve to answer any initial queries a manager may ask. The basis of a KM business case could take this generic structure with related KM content.

By investigating current literature into KM business cases (Skyrme, 1998; Owen, 1999; Neef, 1999; Mootanah, 2004) it was found that no formal structure existed for both quantitative (cost) and qualitative justifications. According to Owens (1999), the best way forward in KM is to 'outline opportunities for quick pay-offs'. This will place managers at ease about the investment and should allow other employees to start viewing the advantages of KM and how it can work to help them. While easy in theory, in practice it may not be possible as organisations will not allow employees to start a project unless it has been brought-off by management and they have allocated sufficient resource.

Therefore objective 7e within the Introduction chapter was to try and resolve this issue by constructing of a business case template for the introduction of KM.

2.9 Knowledge Management Frameworks

Many KM practitioners have implemented KM solutions but these often concentrate on one aspect of KM. For example, McGarrity (2001) implemented a KM solution by adopting
‘Knowlix’ a database, and Dingsoyr and Royrvik (2003) developed a knowledge repository. Their work detailed the implementation of the tools used but did not provide an overall guide that could be used by practitioners.

Jones (1998) noted the conclusions made by Skyrme (1998), as he reminded us that,

‘KM is a combination of the right technology implemented with appropriate effort on non-technical factors such as human factors, organisational processes, social factors, and culture’.

Despite this, it still seems that KM practitioners are focusing on specific parts of KM implementation and not attempting to join these areas up in a comprehensive systems implementation as Skyrme suggests. Beck (1996) cited by Rubenstein-Montano et al. (2001), stated ‘KM is a young discipline for which a codified, generally accepted framework has not yet been established’. Rubenstein-Montano et al. (2001) argue that most KM approaches do not adequately satisfying the KM needs of the organisation.

Rubenstein-Montano et al. analysed a number of KM frameworks and established that current frameworks tend to be task orientated. Examples of companies using these types of frameworks include; Ernst and Young, Knowledge Associates, the Knowledge Research Associates Group, and O’Dell (Rubenstein-Montano et al., 2001). They recommended that frameworks should be: -

- Consistent with a systems-thinking approach that considers purpose, objective, knowledge, technology, learning, people and culture.
- Both prescriptive and descriptive.
- A link between the goals and strategies to KM.
- Rigorous in their planning.
- Analytical in their cultural perspective and checked that the KM practices are in line with the current culture.
- Learning from both a single and double feedback (reference) loop.

Frameworks that have been proposed lack detail and substance. For example, Newman and Conrad (1999) propose a framework that: -
• Organises and classifies KM methods, practices and technologies by relating them to distinct phases of the targeted knowledge flows.
• Examines knowledge flows to understand the interactions and dependencies among pieces of information, communicators and their associated behaviours.

The main focus of this approach is to evaluate KM tools to establish which ones would best suit the organisation. The review should be conducted by project stakeholders and not by the population that will be using the tools. The people involved within the project should also need to conduct research into the current KM tools available, as there is often no list of tools or information about their functionality within a business.

Newman and Conrad’s framework allows the user to select the ‘activity phase’ such as creation and retention, but after reviewing the tools it may remain unclear which KM activity the company should concentrate on. The framework does not offer a complete guide to implementing KM, rather, it focuses on the analysis of KM tools. The use of KM tools within industry was not analysed, therefore no conclusions could be made on the tools that people favoured or why. There is also no explanation to how the tools should be implemented to equal successful uptake.

Ezingeardet et al. (2000) covers the strategy taken by Ernst and Young including a more comprehensive approach that covers the technology used, the people and cultural aspects. It is a well thought out approach developed with a KM investment of $100 million dollars. The problem, however, is that they describe the tools that they use but do not detail the implementation method or the overall approach to KM in such a way that another company could follow.

Sunassee & Sewry (2002) analysed 11 current KM frameworks and made 3 main conclusions:

1. The KM strategy should be in line with the overall business strategy (only one of those analysed was).
2. The emphasis needs to be placed on people and their importance to the KM effort.
3. The emphasis on people should be the same as the emphasis placed on technology.
After conducting their research, Sunassee & Sewry (2002) created their own framework offering a comprehensive detailing of the high level activities that an organisation would have to undertake. The framework focuses on a balance of KM in the organisation, managing the knowledge of the people and the organisational knowledge contained in the infrastructure and processes, as these are shortfall areas of current KM frameworks. The people aspect of the framework is well documented but still there is no direct contact with the employees to discover their knowledge needs. Also, no suggestion is apparent for measures to see if the programme is successful and meeting the established objectives. The detail of KM tools is very limited and there is no suggestion for a practical method of implementation.

Sunassee & Sewry (2002) also propose a 'rewards and incentive plan' which may work well within certain industries, and highlights an area to explore within Rolls-Royce.

The overall model proposed by Sunassee & Sewry (2003) lists what should be adhered to, to achieve successful KM implementation:

- Alignment of KM strategy with business strategy
- Obtain top management support
- Create and manage knowledge culture
- Use a pilot project
- Create and manage organisational learning
- Manage people
- Choosing the right technology
- Include double loop learning.

Sunassee and Sewry's model (2003) was tested using the Chi-Squared test, which concluded that some areas were not favoured. These included the importance of the chief knowledge officer's role and if it should be independently placed within the organisation, the linkage between the companies IT and their suppliers and customers, and finally the importance of providing alternative technologies for employees that are not computer literate. Therefore any model created would have to incorporate the factors that have been deemed as important by the Chi-Squared test (Sunassee & Sewry, 2003).
Lin et al (2005) took a different approach to looking at KM frameworks as they analysed the gaps that occurred within companies that had implemented KM. They did this by interviewing employees from two different companies. It is important to understand the gaps when creating a KM framework as they highlight lessons that can be learnt by others when they create a KM framework. The gaps highlighted by Lin et al. that have not been tackled within Sunassee & Sewry's (2003) framework are listed below: -

- The difficulty in acquiring valuable information due to the communication barriers between the upper management and line employees.
- A lack of awareness, comprehension or willingness by employees to share their knowledge.
- Limited employee involvement during initial documented review resulting from difficulty in attracting participants, which results in an incomplete knowledge repository.
- Different perceptions of KM between the upper management and other employees due to difference in position, role and professional knowledge.
- Distinct attitudes of employees at different levels towards planning, responsibility, accountability, and authority.
- The feeling of employees that they are not encouraged to share the existing knowledge.
- The deluging of employees with highly specific knowledge that may be difficult to communicate to others.

Sunassee & Sewry (2002) document some of the cultural issues but there is no active explanation of their involvement to gain employees interest. Lin et al (2005) offer some solutions to these issues but not with any specific examples that could be used. Chua and Lam (2005) analysed companies that had failed to implement KM and found four distinct categories of KM failures: technology, culture, content and project management. Chua and Lam detail these areas and specify areas that caused failure. They reinforce the fact that while technology is just an enabler for KM it is an enabler that could cause the whole project to fail. Chua and Lam continue by proposing a KM failure framework, shown in Table 2.4 that maps known failures against stages of the project life cycle. When creating a KM framework it is important to consider all of these failings.
Table 2.4 – A model of KM project failures (Chua & Lam, 2005)

<table>
<thead>
<tr>
<th>Initiation</th>
<th>Implementation</th>
<th>Institutionalisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connectivity</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Usability</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Over-reliance</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Maintenance</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Politics</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Knowledge sharing</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Perceived image</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Management support</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Coverage</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Structure</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Relevance and currency</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Knowledge distillation</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>User involvement</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Technical/business expertise</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Conflict management</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Roll-out strategy</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Project cost</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Project evaluation</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>External consultants</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

King et al (2002) defined the top 10 issues in KM in the order that was given by the study participants. Out of the said top ten issues, the following have been highlighted by the author as lacking the most amount of research: -

- How to obtain top management support for KM.
- How to motivate individuals to contribute their knowledge to a KM system.
- How to identify the organisational knowledge that should be captured in KM systems.
- How to assess the financial benefits of KM.
- How to sustain KM progress in the organisation.
Overall, current literature does not provide a complete and detailed framework that an organisation could use to implement KM. However, collating some of the best practices and avoiding some of the pitfalls could produce an adaptable KM framework that any company could use to help them embark on KM. Objectives 8 and 9 within this research project are to derive a full framework for the introduction of KM tools based on the findings of the above and to test the framework though feedback from internal company managers.

2.10 Conclusion

Organisations looking to invest a small amount of money into KM to see what return they gain from their investment, will struggle to know what to do and how to do it. Therefore, the aim of this review was to analyse the different areas that would create a full KM framework and establish any gaps that would make KM deployment difficult. By offering low cost solutions, companies can invest in KM and reduce the risk that would be involved with a higher level of investment.

The investment made by Rolls-Royce into KM gives an ideal environment to conduct case studies and learn from current and past experiences. Therefore, any recommendations produced will be based on practical industrial experience as well as academic research. The first section of the literature review established that there has been work conducted to try to help resolve the information overload issue but that methods deployed such as by McGarrity, with the software tool Knowlix, have not been well documented and have revealed three areas that he suggests are explored to develop a successful system. McGarrity is a software vendor and it was interesting to see that he had approached this issue with a bespoke tool tailored towards the employees needs. This is an approach that KM tool vendors usually stay away from as they are geared towards maximising their profits and therefore the development of a general plug-in tool is what they generally produce.

Therefore, the aim one of this research is to develop McGarrity's work further and establish whether a knowledge location tool for Configuration Management data can be implemented in a way that is functionally effective, cost effective and satisfies the user needs. An important aspect of this will be the acceptability to the users as a tool is of no use
unless the users are willing to use it in practice. This task will be broken down into the following steps:

1. To establish through interviews and questionnaires the extent of the information finding problem in the Submarines business and the information needs of the users.
2. To implement a tool to satisfy the information needs.
3. To establish the initial success of the tool through feedback and monitoring the use of the system.
4. To establish the longer-term success by interviews and questionnaires after a period of time.

The current literature does not provide a complete and detailed framework that an organisation could use to implement KM. However, collating some of the best practices and avoiding some of the pitfalls could produce an adaptable KM framework that any company could use to help them embark on KM. Objectives 8 and 9 within this research project are to derive a full framework for the introduction of KM tools based on the findings of the literature review and to test the framework though feedback from internal company managers. The framework will be broken down to highlight areas that are currently lacking any detailed reporting within the current literature and therefore areas that current KM practitioners may be struggling with.

The first area is to establish which KM tools to use, as many research papers describe KM tools but there is a lack of research into their usefulness. For example, Seidman (2006) describes a digital coaching technology that accommodates the human aspects of sharing knowledge by using storytelling, and ContactMap was a tool developed by Whittaker et al (2004) to visually represent people's social networks etc. It seems that companies are using KM tools, however, those who are new to the area could be easily misled and consider using tools that have not yet been tested or applied within industry. It is evident that many companies are falling into the latter category as Lucier & Torsiliera (1997) estimated that 84% of KM programmes were found to exert no significant impact on the organisations. Companies therefore need to ensure that the KM tools they choose to deploy have been well researched and meet the requirements of their employees. There is no current method for establishing which KM tools to deploy to satisfy employees' needs. Therefore objective 7c is to conduct a survey of potential KM tools available across the organisation to discover their perceived usefulness.
Research into the implementation of KM tools has established that there is no comprehensive guide that a KM practitioner could follow to help in the successful implementation of KM tools. Therefore this area will be investigated within Rolls-Royce to see if any firmer conclusions can be drawn; as detailed in aim one of this thesis. This will allow the research in aim one to be taken into aim two, to establish if the lessons learnt about implementing a KM tool can be carried across.

The importance of aligning a KM strategy to the business goals is recognised, but the importance of aligning a KM strategy to the knowledge needs of the employees is arguably important, according to Lin et al. (2005), as it is one of the four reasons why KM initiative fail. Establishing the needs of employees is an area that is not covered by current literature. Objective 7b will, therefore, aim to gain a better understanding of employees knowledge needs. Establishing the employees’ needs is the first step, but there is also a gap in the current literature covering the usefulness of KM tools that have been used within industries and whether tools developed in-house can still be successful.

The development of a survey that could be used for any KM tool is needed, so that KM practitioners can gain activity based metrics that can be used to help build up the measurement portfolio for KM. The survey would need to be geared towards the employees, as they would have the best understanding of how usefulness they have found the tools within the working environment. This area will be explored further within chapter 9 to establish the usefulness of the different KM tools within Rolls-Royce Aerospace. This should meet the requirements of objective 7c of aim two.

As with any initiative, measurement is very important to gain an understanding of the successfulness of the programme, in this case, KM. This has been recognised within objective 7d with the identification of the need to benchmark the current state of use of KM tools and techniques within the company to establish a baseline for the measurement of KM implementation. A possible approach could be knowledge-based benchmarking, which is a technique that allows an organisation to assess its current view on KM by carrying out self-assessment on specific areas. According to Collinson & Parcell (2004), the tool is good for visually displaying the current state of KM in areas such as communication and managing contract staff, but it does not pinpoint the effectiveness of each KM tool. By producing graphical images that represent the current state of KM they can be useful in
both measurement and capturing awareness for KM (Collinson & Parcell, 2004).

As the literature review of this was not conclusive, the benchmarking tool within Roll-Royce will be explored as stated within objective 7d. A benchmark of the current state of use of KM tools and techniques within the company will be conducted to establish a baseline for the measurement of KM. This should determine the usefulness of the tool and the current KM state of a particular department.

By investigating current literature into KM business cases (Skyrme, 1998; Owen, 1999; Neef, 1999; Mootanah, 2004) it was found that no formal structure existed for both quantitative (cost) and qualitative justifications. According to Owens (1999), the best way forward in KM is to 'outline opportunities for quick pay-offs'. This will place managers at ease about the investment and should allow other employees to start viewing the advantages of KM and how it can work to help them. While easy in theory, in practice it may not be possible as organisations will not allow employees to start a project unless the project has been accepted by management and they have allocated sufficient resource. Therefore, objective 7e within aim 2 of this research project was to try and resolve this issue by constructing a business case template for the introduction of a programme of KM tools.

It is hoped that by exploring these key stages in implementing KM and building them into an overall framework, that KM practitioners could use it to support their implementation of KM and make KM more successful within their organisation. By using a company like Rolls-Royce to explore these areas and conduct mini case studies, the author can establish 'real' issues with the proposed methods. The next chapters work through the objectives stated within phase one and two, with the final chapter reviewing the work completed.
CHAPTER 3

METHODOLOGY

Chapter Preface

This chapter discusses the methods available and selects the appropriate one to fulfil the objectives stated in Chapter One. By searching current literature, a number of research methodologies were found. The purpose of this chapter is to:

- Discuss the research philosophy in relation to other philosophies, and
- Explain the research strategy, including the research methodologies adopted.

3.1 Methodology

The first step in choosing a methodology is to gain an understanding of the two main methodological schools of thought. With many different options for researchers to consider, it can become confusing when different methods incorporate their own vocabulary. However it is sometimes said that these research methods fall into either the positivist or anti-positivist school of thought. Starting from this simplistic view, an understanding can be gained into which school the research project falls into (Pather and Remenyi, 2004).

3.1.1 Positivism

The work of positivists has been a great help to society in allowing it to shape the physical world, and in understanding human behaviour. Positivists believe that research collected should emerge from natural phenomena within the real world. The belief that an outcome can be debated is not possible, as the outcome would be based on the 'real world'. The facts, which are produced, are seen as timeless and they have no social value.
The main strength of the positive approach is that it is most regularly used to validate a hypothesis. The human culture within the world can allow the generalisation of findings they have but, due to differences in the world such as culture, language and location, this is not often true. The positivism approach does not account for changes that may occur and has therefore stirred the debate that the positivists approach may not be suitable for the information science research methodologies (Kuhn 1970, Bjorn-Anderson 1958, Remenyi and Williams 1996). This led to the rise of anti-positivists that believed individuals do not live in isolation, and that they therefore need to be understood as part of the culture and social environment from which they are part of (Kock et al, 2006).

3.1.2 Anti-Positivists
Burrell and Morgan (1997, cited in Cornford & Smithson, 1996) refer to ‘anti-positivism’ as a more intertwined view of facts and values. The anti-positivism approach does not try to generalise explanations but tries to allow interpretation and to gain an understanding of the situation.

The anti-positivist approach clearly has some validity for this project as the research has been conducted within the engineering environment of Rolls-Royce. The purpose of the research, however, is to give an insight into KM tools and the most appropriate application of KM within industry. In this respect some generalisation is involved, though the scope of this research allows only limited verification of this generalisation. This research, therefore, has many anti-positivist aspects, but does not follow a pure anti-positivist approach.

3.1.3 Quantitative and Qualitative Perspectives
Positivist research is also known as quantitative, based on the notion that research can be objective, that the researcher is independent and that the results are valid, reliable and replicable (Pather and Remenyi, 2004). Quantitative researchers believe that the use of ‘real time’ observations is important in collecting metrics about the observations made. These observations then need to be processed, reviewed, analysed, coded, displayed or structured in a systematic way (Cornford and Smithson, 1996). Quantitative research is based on the use of metrics to describe the phenomenon,
which has occurred, unlike the qualitative method which tries to use methods other than metrics to analyse data.

Table 3.1 - Emphasis of quantitative, qualitative and mixed research. Johnson & Christensen, 2006

<table>
<thead>
<tr>
<th></th>
<th>Quantitative research</th>
<th>Mixed research</th>
<th>Qualitative research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific method</td>
<td>Deductive or ‘top-down’ The researcher tests hypothesis and theory with data</td>
<td>Deductive and inductive</td>
<td>Inductive or ‘bottom up’ the researcher generates new hypothesis and grounded theory from data collected during fieldwork</td>
</tr>
<tr>
<td>View of human behaviour</td>
<td>Behaviour is regular and predictable</td>
<td>Behaviour is somewhat predictable</td>
<td>Behaviour is fluid, situational, social, contextual and personal</td>
</tr>
<tr>
<td>Most common research objectives</td>
<td>Description, explanation and prediction</td>
<td>Multiple objectives</td>
<td>Description, exploration and discovery</td>
</tr>
<tr>
<td>Focus</td>
<td>Narrow-angle lens, testing specific hypothesis</td>
<td>Multilens focus</td>
<td>Wide angles and ‘deep angle’ lens, examining the breadth and depth of phenomena to learn more about them</td>
</tr>
<tr>
<td>Nature of observation</td>
<td>Attempt to study behaviour under controlled conditions</td>
<td>Study the behaviours in more than one context or condition</td>
<td>Study behaviour in natural environments. Study the context in which behaviour occurs</td>
</tr>
<tr>
<td>Nature of reality</td>
<td>Objective (different observers agree on what to observe)</td>
<td>Commonsense realism and pragmatic view of world</td>
<td>Subjective, personal and socially constructed</td>
</tr>
<tr>
<td>Form of data collected</td>
<td>Collective quantitative data based on precise measurement using structured and validated data collection</td>
<td>Multiple forms</td>
<td>Collect qualitative data. The researcher is the primary data collection instrument.</td>
</tr>
<tr>
<td>Nature of data</td>
<td>Variables</td>
<td>Mixture of variables, words and images</td>
<td>Words, images and categories</td>
</tr>
<tr>
<td>Data analysis</td>
<td>Identify statistical relationships</td>
<td>Quantitative and qualitative</td>
<td>Search for patterns, themes and holistic features</td>
</tr>
<tr>
<td>Results</td>
<td>Findings that can be generalised.</td>
<td>Corroboration findings may generalise</td>
<td>Particularistic findings. Representation of insider viewpoint. Present multiple view perspectives.</td>
</tr>
<tr>
<td>Form of final report</td>
<td>Statistical report (e.g. with correlations, comparisons of means etc.)</td>
<td>Eclectic and pragmatic</td>
<td>Narrative report with contextual description and direct quotations from research participants.</td>
</tr>
</tbody>
</table>
Qualitative research methods include interviews, reviews of documents, and participative observations (Myers, 1997). Mixed research involves the use of both qualitative and quantitative research methods (Johnson & Christensen, 2006). For example a researcher may conduct an experiment (quantitative) and then follow this up with interviews (qualitative). Table 3.1 summarises the main emphasis of each research approach.

Due to the wide scope for this research project and the industrial environment in which the research was conducted it was decided that a mixed approach of both quantitative and qualitative research methods would be used. The quantitative methods allowed the researcher to gain an understanding of the current opinions and to generalise them. The qualitative methods offered a means to dig deeper into areas of concern that arose.

**Primary Data Collection Techniques**

As both quantitative and qualitative research methods were favoured, they can be classed as primary data collection techniques as they involve the researcher collecting information first-hand rather than using secondary information from another source e.g. data collected by someone else, reports. There are two types of primary data collection techniques used: questionnaires and interviews. Interviews are well-established methods of data collection. They can be classed within three categories:

- Unstructured
- Structured
- Semi-Structured

An unstructured interview is where the researcher will develop an 'interview eye', which is worked around. The researcher will create the questions spontaneously, and probe into areas, which the interviewee has highlighted. Problems can arise, as often the interviewer will have a completely separate list of questions at the end of their interview, compared to what they had in the beginning. If interviews are conducted with different clients, it may be difficult to collate and evaluate the data collected.
Chapter 3 Methodology

Within a structured interview, the interviewer will ask the same questions using the same wording, and the questions will be asked in the same order. This is usually detailed within the 'Interview schedule' which is the list of questions the interviewer has prepared.

There is also semi-structured in which the interviewer follows a predetermined question set but allows flexibility, following up specific points as they arise and allowing diversions when something interesting occurs.

A questionnaire is a written list of questions, which the respondent has to complete. The distinction between a questionnaire and an interview is that within a questionnaire the respondent has to clearly understand the question, as any arising queries cannot be discussed. An interview on the other-hand gives the respondent an opportunity to ask queries relating to the questions being asked.

The main advantages for using questionnaires have been listed below (StatPac Inc, 2006): -

- Questionnaires are cost effective when compared to face-to-face interviews especially when using with a large sample group.
- Questionnaires are easy to analyse.
- Questionnaires are familiar to most people.
- Questionnaires reduce bias, as the researchers own opinion will not influence the answers.
- There are no verbal or visual clues to influence the respondent.
- Questionnaires are less intrusive than telephone or face-to-face surveys.
- When a respondent receives a questionnaire in the mail, he/she is free to complete the questionnaire within their own time.

To meet the objectives stated within Chapter One both questionnaires and interviews are seen as techniques that can be used for many things such as capturing business requirements, establishing the current 'as is state' of something, understanding specific issues etc. Questionnaires are useful as they allow a researcher to gain the opinions of a large group of people, which within a business is an advantage. Interviews can then be
used to allow specific areas/issues that may have arisen from a questionnaire to be more specifically explored.

3.2 Research Approach

The two broad research approaches are theoretical and empirical. The theoretical approach concerns itself with using outside sources to feed a mental set of procedures as a method of gaining understanding of a phenomena or issue. Empirical research is work concerned with observing events, and trying to seek sense in these observations. Bulmer (1982), has described it as,

‘Good empirical research is meticulous in its procedures, precise in measurements, careful in the extent to which generalisations are being made from the cases studied to a larger population – and frequently boring and even trivial in its contents’

The two methods complement each other, for example theoretical research could reveal a gap in research and motivate empirical work, or an empirical study could provide evidence to construct a new theoretical way of thinking. As the research will be conducted within industry environment it is assumed that the latter of the two combinations will apply. The three main styles of research approach are:

Constructive
Concerned with developing frameworks, refining concepts or pursuing technical developments (Cornford and Smithson, 1996). This approach is popular within Information systems with the development of computer systems. It is only when the development of such systems are tested within an appropriate environment does the approach move away from constructive and towards nomothetic and idiographic.

Nomothetic
Exploring empirical data then allows the researcher to test a hypotheses relating to a specific phenomena. By searching for theories or general laws that will cover a whole class of cases this method emphasizes systematic protocols and hypothesis testing with the scientific tradition (Cornford and Smithson, 1996).
Idiographic
By exploring a single case or event the idiographic approach provides a rich and in-depth picture into what happened so that an understanding can be gained. By using methods such as case studies, subjective accounts of everyday events can be analysed. Most prominently used within the social sciences like history, the idiographic approach is still prominent within information systems due to the vast amount of case studies used (Cornford and Smithson, 1996).

The ideographical approach of case studies will be the most appropriate to meet the aims and objectives of Chapter One.

3.3 Selecting the Correct Research Approach
Galliers (1991) summarised research methods into two streams scientific and interpretivist. The scientific approach is based broadly on positivism with a view that the things studies can be described and observed to produce general results e.g. the testing of a hypothesis. Interpretivist looks into the interpretation of an event, never specific or reduced theories and is similar to anti-positivism. The main information systems approached can be seen in table 3.2 under the two different research approaches.

Table 3.2 - Different research approaches in the context of scientific and interpretivist
(Galliers 1991)

<table>
<thead>
<tr>
<th>Scientific</th>
<th>Interpretivist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory experiments</td>
<td>Subjective/argument</td>
</tr>
<tr>
<td>Field experiments</td>
<td>Reviews</td>
</tr>
<tr>
<td>Surveys</td>
<td>Action Research</td>
</tr>
<tr>
<td>Case Studies</td>
<td>Descriptive/Interpretive</td>
</tr>
<tr>
<td>Theorem proof</td>
<td>Futures research</td>
</tr>
<tr>
<td>Forecasting</td>
<td>Role/game playing</td>
</tr>
<tr>
<td>Simulation</td>
<td></td>
</tr>
</tbody>
</table>
Cornford and Smithson (1996) deduced that six of these approaches were most appropriate to information systems research including; laboratory experiments, surveys, reviews, action research, case studies and descriptive/interpretive research.

Laboratory Experiments
The researcher works within a controlled environment and manipulates some of the variables and observes the results. Due to this research being conducted within a working environment the employees cannot be disrupted any more than necessary, so to control the entire environment without creating a new external environment for the employees to be transferred to would be impossible.

Surveys
Surveys are used to gather information about a situation at a single point in time. They are often carried out to help make a decision e.g. Identifying interests ‘what activities should be selected to motivate the staff to work harder next year’ (Thomas, 1999). Research surveys resemble laboratory experiments in that they aim to collect data in a systematic way and to make recommendations based on the results. The difference is that surveys are usually conducted within the natural environment (Thomas, 1996). Surveys were useful as a method of establishing the user requirements for the first aim of this theses as well as being used within the second aim, to establish the usefulness of KM tools.

Reviews
Most research projects will conduct a review of the past literature to gain an understanding of the progressions made within the field. Frameworks can be devised based on past literature, as the personal insight gained after reviewing the literature may help refine and offer guidance to future trails of thought. Reviews have been used within this project to analyse current and past solutions in creating a KM framework, with the added bonus that lessons that were learnt from the current programme could be built into the new framework.
Case studies
A case study looks into one situation, for example the implementation of a new computing system. The analysis is carried out on a single situation and, therefore, the researcher can apply different data collection techniques and increase the richness of data. Benbasat et al (1987) created a list of eleven characteristics of case studies that had been summarised from papers they analysed.

Table 3.3 - Key characteristics of case studies

<table>
<thead>
<tr>
<th>No</th>
<th>Case study characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Phenomenon is examined in a natural setting.</td>
</tr>
<tr>
<td>2.</td>
<td>Data are collected by multiple means.</td>
</tr>
<tr>
<td>3.</td>
<td>One or few entities (person, group or organisation) are examined.</td>
</tr>
<tr>
<td>4.</td>
<td>The complexity of the unit is studied intensively.</td>
</tr>
<tr>
<td>5.</td>
<td>Case studies are more suitable for the exploration, classification and hypothesis development stages of the knowledge building process; the investigator should have a receptive attitude towards exploration.</td>
</tr>
<tr>
<td>6.</td>
<td>No experimental controls or manipulation are involved.</td>
</tr>
<tr>
<td>7.</td>
<td>The investigator may not specify the set of independent and dependent variables in advance.</td>
</tr>
<tr>
<td>8.</td>
<td>The results derived depend heavily on the integrative powers of the investigator.</td>
</tr>
<tr>
<td>9.</td>
<td>Changes in site selection and data collection methods could take place as the investigator develops new hypotheses.</td>
</tr>
<tr>
<td>10.</td>
<td>Case research is useful in the study of ‘why’ and ‘how’ questions because these deal with operational links to be traced over time rather than with frequency or incident.</td>
</tr>
<tr>
<td>11.</td>
<td>The focus is on contemporary events.</td>
</tr>
</tbody>
</table>

A disadvantage of case studies is the heavy reliance on a single case, as it becomes incapable to provide a generalizing conclusion (Tellis, 1997). It also becomes an issue to try and establish the causality and the variables are not controlled, therefore many case studies are required to build up the case. The use of case studies has its relevance within aim one of this thesis, as an in-depth study has been carried out into the information needs of a business department. The needs of the employees were fulfilled by implementing a solution that helped them locate knowledge and information. The tool was then analysed to evaluate its successfulness.
Action Research

Action research has sound foundations in post-positivism (Bakerville & Wood-Harper, 1996). Action research combines theory and practice through change and reflection in a situation with an immediate problem (Avison et al, 1999). Providing benefits to research and industry, action research has a real advantage over the other research approaches (Kock et al 2006). The issue with action research is that the researcher can become too involved and may loose sight of the bigger picture (Cornford and Smith, 1996). However, action research is the only viable method to create a KM framework in the Rolls-Royce environment, as the timing of the research meant that suitable case study projects in which the author was not involved were not available for observation. A case study would have needed to be carried out from the start of a framework development through its implementation phase and ending with analysis into its successfulness, and this would have required a close match with the author’s period of research to be viable as a case study.

Pinsonneault and Kraemer (1991) found that less then 20% of studies in which researchers collected data directly in the field used multiple data collection methods. They agreed that the single-method approach is unfortunate as it narrows the perspectives from which the phenomena are studied and limits possibilities for gaining understanding. Therefore, a combined approach of both interpretivist and scientific will be taken with action research applied throughout the entire project and case studies, surveys and reviews being used where necessary.
3.4 Research Journey

To meet the aims and objectives stated in Chapter 1, different research methods were used. These have been placed in the following flowchart.

Method 1 - A questionnaire deployed to understand the information overload issue, user requirements and Information Sources. Sample equalled 92. Detailed in Chapter 4, Section 4.3.

Method 2 - A questionnaire conducted as a one-to-one interview to collect the source data and construct the metadata for the Information sources. Sample equalled 99. Detailed in Chapter 5, Section 5.1.3.

Method 3 - A questionnaire deployed to understand the Information Map success. Sample equalled 27. Detailed in Chapter 6, Section 6.2.

Method 4 - A case study detailed the development of an intranet site. The case study included a questionnaire that was used to measure the success of the site. Sample equalled 9. Detailed in Chapter 7, Section 7.4.

Method 5 - A case study to understand employee's knowledge needs. A focus group was deployed to understand two business group's knowledge needs. A questionnaire was used to understand the focus groups use of KM tools. Sample equalled 10. Detailed in Chapter 8, Section 8.2.

Method 6 - A questionnaire deployed to employees within the Aero business to evaluate the use of KM tools. Sample equalled 12. Detailed in Chapter 9, Section 9.2.

Method 7 - The Benchmarking questionnaire used to understand the current KM activity. Sample equalled 29. Detailed in Chapter 10, Section 10.2.1.

Method 8 - An interview was used to understand how the Aero business implement KM tools. Sample equalled 2. Detailed in Chapter 10, Section 10.6.

Figure 3.1 - Research Journey flow chart
3.5 Conclusion

This chapter detailed the research approach that was taken to meet the objectives specified in chapter 1. The overall project philosophy was mostly from the anti-positivist, interpretivist school of thought as recommendations for a KM framework were produced based on gaining an insight into the company's current KM activities. However, the use of surveys and the attempt to draw lessons for the engineering industry in general means that the approach also incorporated aspects of the positivist, scientific philosophy. As the thesis has two aims, it was established that each required a slightly different research approach.

The first aim required idiographic research, as an insight was sought into the current issue of locating information and a case study approach was adopted, incorporating surveys to gain the information and data required. A detailed literature review covered in Chapter 2 will review the work conducted by KM consultants. They have contributed useful information to the KM domain, including the work done by McGarrity (Section 2.2.1) who produced a KM tool to try and address the information overload issue. A consultant's general approach is to introduce KM tools such as those produced by KMx (Knowledge Management Solutions, 2005), KPS (Knowledge Powered Solutions, 2005) and Right Now Technologies (Rightnow, 2005) listed in section 2.2.1 as a one stop KM solution. This is usually done to maximise their profit margins by having a tool that fits many organisations rather than producing bespoke tools. The marketing information is always useful from consultancy firms as it often provides information on the costs associated with KM. These can be taken and used by other companies to help drive the importance of KM to senior managers, as used in Chapter 11 in the development of the KM business case.

The second aim of the project incorporated action research to work within the company and establish lessons learnt using surveys, based on the current KM programme. Different data collection techniques were used within the various project stages and these have been detailed in the related chapters.
The next chapter goes further to explore the extent of the 'information overload' issue highlighted within the Literature Review in Chapter Two, section 2.2.1. Some of the techniques explored within this chapter have been adapted and used to gain an understanding into the current state of information within the submarines business.
CHAPTER 4

ESTABLISHING THE NEED FOR AN
INFORMATION MAP

Chapter Preface

The literature review in Chapter Two established that many companies are struggling to deal with the vast amount of information acquired. This chapter fulfils objective two and three though the use of interviews and questionnaires to determine the extent of the problem of locating information and the informational needs of employees in the Submarines business.

4.1 Background

The Submarines business employs around 2000 people at the Raynesway site in Derby. The Infrastructure operational support department within the Submarines business was the host for the first part of the project. With a primary role of supporting in-service vessels the department holds a vast amount of knowledge and information, which, due to legal requirements, can span back 50 years. This knowledge and information is stored in different formats such as microfilm, databases, by people and on shared networks. One of the main functions of this department is to uphold the configuration details of different submarines.
Configuration Management
Established in the 1950s, Configuration Management (CM) is a technique, introduced by the aerospace industry, to guarantee the consistency of reproduction within their aircraft. The purpose of CM is to:

"Ensure that these changes take place within an identifiable and controlled environment and that they do not adversely affect any properties of the system, or in the case of a trusted system do not adversely affect the implementation of the security policy of the trusted company base" (Menendez, 1988)

The present trading environment can seem like a minefield, with higher customer demands, overseas competition and stretching company budget, yet increased profit levels are still required. The decision-makers within this minefield have to be able to make decisions with the confidence that it will benefit the company, yet, when placed under a lot of pressure, these decision-makers may not be continually equipped with the right information, and this could severally damage an organisation. The use of CM allows a manager to make decisions based on the facts and the present project status. It also allows companies to (Hajek, 1965):

1) Reduce the cost of change management.
2) Improve data clarity and access.
3) Collaborate effectively.
4) Perform dynamic bill-of-materials management.
5) Have unprecedented process control visibility.
6) Assess change impact.
7) Audit tractability and compliance.
8) Provide better customer support.

CM has been recognised as a key enabler within the Submarines business both to excel with its current business commitment and also to move into new areas of opportunity, such as reliability management, commodity management and contracting for availability. Most engineers and technical people within the Submarines business are required to contribute towards CM, or need CM type information to carry out their activities.
The different business areas are shown within Figure 4.1.

![Diagram of different business units]

Figure 4.1 - Different business units

The importance of CM within the Submarines business is crucial. With the main CM data being stored within a master database, it is the CM information and knowledge that is more sporadic. 30 different information sources had been established by the company as important sources of CM information. It was not clear if employees were aware of these sources or if they worked from their own information source. If they did, it needed to be established how many ‘other’ information sources were being used within the business and whether they had been validated. There was a general concern from employees that finding information was not very easy to do. To try and resolve this issue, employees often created their own sources of information that had not been formally identified or validated by the business.

A survey would need to be conducted within the Infrastructure operational support department to try and answer some of the above questions. The survey would also need to establish if locating information and knowledge was an issue for the department, as current literature implies (Chapter Two, section 2.2.1). Key representatives within the CM team had discussed possible solutions and wanted to
know if something as simple as an Information Map (IM) could meet the user/business requirements.

4.2 Methodology

To establish if the employees within the Infrastructure operational support department incurred the same 'information overload' issues that seem to be apparent within current literature, such as those cited by Farhoorand & Drury in 2002, the decision was taken to distribute a questionnaire.

4.2.1 Hypothesis

The hypothesis for this part of the research was that ‘the introduction of the IM would reduce the search time for CM information’. More specifically known as directional hypothesis, it indicates that it is expected the employees within the CM team will reduce their search time with the use of the IM (Salkind, 2000). The equation for this hypothesis is:

\[ H : X_{\text{previous}} > X_{\text{IM}} \]

\( H \) is the hypothesis and ‘\( X_{\text{previous}} \)’ equals the average ‘previous’ search time. The equation states that the search time should decrease in size once the IM is in place (Salkind, 2000). The first questionnaire set a baseline which the ‘after implementation questionnaire’ was later compared against.

4.2.2 Primary Data

To gain an initial understanding into the information needs of the business, it was decided that a questionnaire would be used as it would allow for a larger population to be sampled, and ensure consistency.
4.3 Questionnaire Design and Construction

A questionnaire was seen as the most appropriate tool as it would produce consistent results that could be quantified. Creating the questionnaire in Excel meant that it could be distributed electronically via the internal email system.

A group of 11 stakeholders were gathered to input their knowledge from different business areas and to validate the work conducted on the project. The stakeholders were selected by the manager who was responsible for the IM project and covered different experts/managers from across the business such as Information Technology managers and Configuration Management experts. A presentation was given to the stakeholders (Appendix 1) and was used to introduce the author and to explain the importance of their involvement within the project. The presentation lasted about 30 minutes and aimed to:

- Agree on an IM scope.
- Agree the IM’s functionality.
- Agree the typical profile of users.
- Document potential issues.

The above four points were achieved within the meeting by asking specific questions to the stakeholder group. The questions included ‘Who do you think will use the IM? What do you think will encourage the use of the IM? What criteria should determine the quality of information, which is placed on the information map, including details of experts, databases etc? These questions were discussed within the group and the concluding answers were documented and agreed.

The meeting also allowed the group to review the requirements documents. These were projected onto a screen and each point was discussed and amended as required. The two requirements documents produced were an IUR - Interpretation of user requirements (Appendix 2) document and a DDR - Definition of detailed requirements (Appendix 3).

The stakeholders also reviewed some preliminary questions for the questionnaire and validated their relevance to an average CM engineer.
4.3.1 Questionnaire Construction

When constructing a questionnaire a clear aim has to be established. The aim for the questionnaire was to establish if the employees within the CM department struggled to find CM information or knowledge and if there were any types of information or knowledge sources that had not been officially validated and recognised by the business. As well as establishing the current state of search within the department, the questionnaire was also seen as an opportunity to gain insight into the search preferences of the employees.

The project stakeholder team reviewed the questionnaire regularly during its development to ensure that the content was correct and that it gave the appropriate data to ensure the IM fulfilled the business requirements. It was recognised that the questionnaire may also be needed to secure more funding for the project by using some of the answers to create a business case. It was therefore taken into account that some quantitative measurements where required.

4.3.2 Open and closed questions

There are two types of questions that were used within the questionnaire; open and closed questions. Open questions allow respondents to answer in their own words and give any answer. Closed questions restrict respondents to select an answer from a predefined list of answers (Sunyet, 2006). The type of response that would be most beneficial to the project, determined the type of question asked. For example, if the researcher wanted to gain an understanding of failed searches, it would not be useful just to list random searches as they can vary and are specific to roles and situations. Gaining a real insight into employee's experiences is critical and can only be achievable by using some open questions. However, closed questions have the advantage of yielding quantitative data. Therefore, both open and closed questions were used.
4.3.3 Single vs. Multiple Response

When asking questions you have to consider if a single or multiple response to a question is required (Burgess, 2003). The questionnaire was designed in Excel and therefore selection boxes (tick boxes) and drop down menus could be used. For most of the questions, drop down menus were used as the respondent would only select one option. For example 'How long have you worked for the company?' could only produce a set answer. A multiple response option was used for one question only and that was to establish individuals search preferences, as it was obvious that people may have preferred a number of methods, depending on their role. This was not offered as an open question as the respondents may have responded with answers that were too specific to their roles so more general options were provided.

4.3.4 Questionnaire Distribution

It was essential that the response rate from the questionnaire was high. The method used to deploy the questionnaire would need to be one that communicated the importance of the results to the recipients and covered a wide sample. Employees often received questionnaires from the business and therefore were becoming more and more reluctant to fill them out if they were not mandatory. The method of distribution, which was agreed by the project stakeholders, was to cascade the questionnaire via the management structure. This would ensure that all employees within the relevant areas received a questionnaire. Meetings were arranged with all of the Control Account Managers from across the different business sectors and they were all given a PowerPoint presentation lasting approximately 20 minutes. The contents of the presentation consisted of:

- Authors background.
- IM background.
- Presentations objective and desired outcome.
- Background into CM.
- What the CM IM is.
- The perceived users.
- Benefits.
- Key project dates.
- The requirement for the managers to nominate people within their teams.
The presentation can be found in Appendix 4. There were a total number of 29 managers covering areas from Procurement to the Dockyards. The most important part of the presentation was the last part, as it asked the managers to nominate key people within their team to complete the questionnaire. The managers were asked to write down the employees' names and agree that they would complete and return the questionnaire within a timely manner.

The questionnaires were distributed via the internal email system. The email was sent to each of the managers with a request for them to forward the email to their nominated team members. This would show each of the employees reviewing the email that it was an important email as it came directly from their manager. The email itself stated a return date and the fact that the manager had agreed that the employee would complete the questionnaire. As the managers were involved from the outset it was then possible to contact them directly if respondents failed to reply after a number of reminders.

4.3.5 Questionnaire Sampling

A population is the entire group of people that exist within a place such as a business. A sample is a subset of the population, which should give a good representation of people within the business. When selecting a sample the inclusion/exclusion boundary needs to be set. The inclusion boundary is that which specifies if someone should be included and if they are not within this category then they are bound to the exclusion group. The boundary for this questionnaire would be set to include all employees, who create, maintain or reference CM information sources within their job roles.

4.3.6 Response Rate

According to Cornford and Smithson (1996), a survey send out to sample groups with no communication beforehand has an average response rate of 20%. By adding a little effort this can easily be raised to 70%, so this is why, in this case, the managers were asked to communicate the project to the employees nominated to complete the questionnaire.

The effort was also taken to call each of the people who had not yet responded to the questionnaire by the final response date written on the email and this increased the
responses from 74 to 94. Other methods used to encourage the response rate included an entry into a prize draw for all respondents. The prize was £25 which was agreed with the department manager. The work under progression on the IM was also communicated within the local business newsletter so people could gain an understanding of the project and what it was aiming to achieve. The second article posted included a picture of the prizewinner being awarded his prize by the departmental manager.

The total number of questionnaires distributed within the Submarines business was 143. The number of responses received by the 23rd of September 2003 was 94. The respondents were given three weeks to respond to the questionnaire and then an additional two weeks was used to chase responses. The percentage of people who responded equalled 65%. It is believed that within the time frame available, all possible steps to encourage responses were carried out, i.e. offering a prize, cascading questionnaires via managers, chasing responses.

4.3.7 Confidentiality and Ethics

As the questionnaire was not based on personal information, confidentiality was not seen as a significant issue. The questionnaire was accompanied by a disclaimer that reassured the respondents that their personal responses would be kept confidential. The respondents completed the questionnaire within their own time so the researcher could not influence the responses in any way.

Once all of the responses had been collected, the questionnaires were then analysed. The findings are reported in section 4.4.
4.4 Questionnaire 1 Analysis - Section 1

The questionnaire created is given in Appendix 5 and was segregated into two main sections. The first section was used to gain an insight into the survey population with questions including the respondent's name and current business area. The second part of the questionnaire was used to analyse the search issue, and to gain further information that may be useful if the decision to create a tool was made. The analysis of the questionnaire was conducted by working through the relevant questions individually. Some of the respondents did not supply responses to particular questions and these answers were therefore void and not included within the analysis.

4.4.1 Question 2 - Business area

This question allows the respondent to specify the business area that they are currently working in. By gaining an insight into the business areas an understanding can be gained into whether the correct sample was targeted. The results are shown in Figure 4.2.

![Figure 4.2 - Questionnaire 1, Current Business Area.](image-url)
The only area that had no respondents was the Business Development area. This was not a concern as they do not deal with CM information. All of the responses covered areas that are important and, with most of the CM work conducted within the Flotilla Programmes area, it was felt that the sample selected would provide relevant responses as 57% of the sample were working within the ‘UK Submarine Flotilla Programmes’ department.

4.4.2 Question 4 - How long have you worked within your current job role?

The ‘business group’ the sample came from gave a good understanding into the respondents background, but to understand the level of experience and knowledge they had within their current role could only be attained by finding out how long they had worked within their current roles. The largest segment was 28 responses, which represented the 2 to 5 year range as displayed in Figure 4.2. The overall mean calculation for the results was five years, showing that the majority of employees within the business were well established within their job roles. 20 respondents said that they had only worked within their roles for ‘under 1 year’ but that could be explained by the last organisational change in August 2003. On the other end of the scale, 22 employees said that they had worked within their roles for over ten years.

If the search time is high it should be of concern as, on average, most employees have worked within their roles for five years. If after five years, people are still spending substantial time searching for information and knowledge then it is evident that help is required. For those who are new to the business it is expected that their search time would be greater and therefore it would be useful for them to have a point of contact to refer to when searching for CM information.
4.4.3 Question 5 - How long have you worked for Rolls Royce?

An understanding was needed into the amount of time that an employee has worked within the company to gain an insight into their general experiences of the business and how it works. Gaining an understanding into the length of time an employee had worked for the company, allowed the author to understand the survey sample and their familiarity with the business. Figure 4.3 shows that the majority of people have worked within the company for over ten years. The time within the job role on average is 2 to 5 years showing that employees should have an understanding of their current role and are familiar with the contacts and sources of CM information they need.

![Figure 4.3 - Questionnaire 1, Years in current job role/worked for Roll-Royce](image)

It was important to gain an understanding into the length of time that employees had spent both within their job roles and within the company because if the employees spent lengthy amounts of time searching for information, it was not likely to be a result of their experience of company knowledge not being comprehensive. Out of the respondents that said that they had worked within their job roles for less than a year, 60% of them had worked within the company for ten years or more, and another 30% had worked within the company for 5 to 10 years. As all of the employees had worked for the company for two or more years, it is expected that their knowledge of the business would be extensive enough to allow them to conduct comprehensive searches and to have gained a network of useful contacts. Further insight into this
area is given in Section 4.5 as the number of years within the job role will be analysed to assess if the search time is less for those who have worked within their job roles for longer. Section 4.5 also evaluates the other 'search' related questions that were within the second phase of the questionnaire.

4.5 Questionnaire 1 Analysis - Section 2

The second part of the questionnaire was used to establish the amount of time it takes the average person within the company to search for the CM information they require to complete their daily tasks. This was done to see if the literature analysed gave an accurate representation of the company.

4.5.1 Question 6 - Presently, how easy do you find it to search for CM information?

The introduction to the questionnaire was given to each respondent defining what was meant by CM information so that there would be no misunderstanding of the terminology used. From the answers to question 6, an understanding was gained into the employees views on searching for CM information. If all of the respondents answered 'very easy', then it could be concluded that the search process may take time but it is an easy process to follow. This would imply that a mapping tool would not be required and it would be better to analyse the current process to see if the search time could be reduced.

The results from this question are shown in Figure 4.4. It was found that 66% of the respondents found it 'Very difficult' to find CM information within the company. This shows that searching for information is not an easy process for the employees. Only one person found it 'Very easy' and they have worked for the company for over ten years and worked within their job role for 5 - 10 years, so it may be that they have acquired all of the CM information needed to complete their tasks or that the tasks they complete do not require them to search for CM information.
Figure 4.4 - Questionnaire 1, How easy is it to find CM information?

The experience of the employees is relevant to this result as those who had not worked within their current roles for long periods of time had particular difficulty searching. 83% of the respondents that had under a year in their current job role also found CM information either 'Not very easy' or 'Very difficult' to search for. It could be concluded that only those new to a job role would find information difficult to locate, but when the respondents who had worked within their roles for over ten years were analysed, the results concluded that 80% of them said that it was 'not very easy' to find CM information and 5% of the respondents indicated that it was 'very difficult'.

If those that have worked within the company/job role for long periods of time are finding it difficult to find the CM information they required, then the issue is not a lack of business experience. Question 7 was used to explore this issue in more depth and to also gain a baseline to compare the difficulty of search before the implementation of a solution.
4.5.2 Question 7 - In an average day, how much time is spent looking for CM information/advice?

This question leads on from question 6 by trying to quantify the amount of time that is spent searching for information. Figure 4.5 shows the results collated from this question. 57% of the respondents said that they spent an hour or more searching for information. A reduction on this time would make it easier for employees to conduct their tasks as they would not have to spend so long searching. It would also improve the efficiency of the workforce, as they would have more time to conduct their tasks and be more productive.

![Figure 4.5 - Amount of time spent searching for CM](image)

The results from question 6 were used to try and create a monetary value for the current search time. Two of the responses were excluded from the calculations, as they did not respond to the question.

The total amount of time spent by all of the respondents searching for information per day, equalled 78.5 hours. The average amount of time spent per employee searching for CM related information was **51 minutes** per day.

If a full time employee is working a full week, then they will be spending **4.25 hours** per week searching for information. In a typical 46 week year this would equate to **195 hours**.
The technical people within the business will be the people who would benefit most from the use of the Information Mapping tool as they are the people who search more within their roles. The cost for staff is segregated into two categories. The first is for employees at levels eight, nine and ten who had a cost of £59.11 per hour. The second is for employees at levels six and seven that cost £48.57 per hour.

The total costs are therefore calculated as follows:

- **Grades six and seven** - The total number of technical employees at level six and seven is 137. The total amount of money spent searching for information within 1 year for grades 6 and 7 is £1,300,000.

- **Grades eight, nine and ten** - The total number of technical employees at level 8, 9 and 10 is 343. The total amount of money spent searching for information within 1 year for grades 8, 9 and 10 is £3,960,000.

- **All grades** - Based on the questionnaire results it is estimated that the total amount spent searching for information a year is **five and a quarter million pounds**!

The questionnaire highlighted a requirement to improve the efficiency of finding CM information within the business. The survey at Rolls-Royce has shown that the need to support employees in their search is real, and that the cost to the company is substantial. If the time searching was spent more productively then this would equate to a more efficient process.

To try and establish why the search time was so high, the respondents were asked if it could be reduced if they knew where to find the information they were looking for. This issue had been highlighted by a number of employees because they often struggled to know where to go for information and knowledge. It was observed that once employees built up a network of contacts this task became easier, but they would still have to trail through several people before they found the CM information required, as shown by the results of the questionnaire as employees working within the business for a number of years (established contact base) are still struggling to find information.
4.5.3 Question 8 - How much of this time could be saved if you knew where to look for this information/advice?

This question was asked to try and establish if a search time established was as a result of the employee not knowing where to look for the CM information they required. After analysing the responses it was established that an approximate average of 18 minutes (using question 7 and 8 responses and taking the mid range of the band e.g. 21 to 40 = 30) could be saved for each search. Therefore, on average, each employee could save one and a half hours per week if they new where the information was that they were looking for. This would reduce the search time for each employee from 51 minutes to 33 minutes.

![Bar chart showing time saved]

**Figure 4.6 – Questionnaire 1, Percentage of time per day which could be saved if the whereabouts of information was known**

If there was a tool developed to help support employees locate the knowledge and information they are searching for it could save them approximately 7% of their working day. 7% from the total search cost established in question 7 for the year is £368,000 which could be the saving to the business if the employees were aided in locating the information and knowledge they required.
4.5.4 Question 9 - Within the past year, how much time do you think you have wasted as a direct result of not knowing about information that was available within the company?

This question was used to try and establish the time that may have been wasted creating a document that already existed and time wasted by making the same mistakes again. Employees within organisations should also be building on past knowledge that has been documented, so that they are continually learning from past lessons.

The answers varied between different people with the most time being spent by one respondent equalling 400 hours. There were three other people that responded with three weeks (111 hours). All of the other responses showed that people were wasting substantial time. The lowest amount of time wasted reported by a respondent was for recreating a document, which took them a day. Creating a document instead of building on the knowledge that already exists is still wasting valuable time.

Respondents were given the opportunity to document specific examples to question 9 and some of these are listed below:

- Struggling to find information such as:
  - Definition of a Design.
  - Pipe work configuration drawings.
  - Interrelationships between data sources to support design, concessions and safety case processes.
  - Drawings.
  - Safety reports.
  - Technical reports.
  - Procurement information.
  - Manufacturers information.

- Trying to locate the correct person
If the employees were equipped with a tool that could allow them to know the main sources of information within the business they could reduce the search time which was spent looking for the different types of information listed.

Question 10 established that a number of employees had created work, only to later discover that the work had already been created e.g.

'Spent months processing hard copies of Quality Documents then discovered an electronic version at site'

These months could have been spent conducting the work that the electric documents would be used for rather then trying to process documents that had already been done.

4.5.5 Question 11 - How often have you successfully found relevant CM information?

Even though the average search time is high it was seen important to establish how successful the searches were. If employees found that the searches were not successful then the company would need to analyse the information quality. If people found that their searches were successful then locating the information would still be the main issue.

The most selected option was 'Frequently' showing that on average people are frequently finding the CM information they require. 37% of the respondents said that they found the information they required 'Occasionally', which is worrying as it indicates that some people cannot find most of the information they need, especially when 3% respondents said that they 'never' found the relevant CM information. 11% of the respondents did say that they 'always' found the information that they were looking for.
4.5.6 Question 12 - Please state below what type of CM information you find difficult to retrieve

Question 12 gave the respondents an opportunity to list sources that in the past they had found difficult to locate. Most of the examples are very detailed, defining a specific document, but some were more general, such as:

- 'Drawings specifications'
- 'Design specs'
- 'Build information, component change information'
- 'Operational advice'
- 'What's in peoples' heads but nowhere else'

From the answers retrieved, it was established that there are many different areas that people are struggling to find information in. The last point is interesting as the respondent highlighted tacit knowledge, and maybe an information mapping tool could encourage employees to share the knowledge they hold.

4.5.7 Question 13 - Please state below the circumstances under which you would use the Information Map?

Suggesting the idea of an IM to the user allowed the stakeholders to see if it would be a viable solution to reduce the current search time. The responses were grouped into four main categories. One person suggested that the IM could be used to highlight gaps in current CM information. By collating all of the CM information sources available and creating a matrix against product data that should be stored, these gaps could then be highlighted. This was done and is available in Appendix 6. The next group of three respondents said that the IM could be used to help employees trace old data:

'If it helped trace old data then it would be used in our area'.

Eight respondents said that they would use the IM to find out who knows what within the business:

'When I need a contact name within the area'.
Chapter 4 Establishing the need for an Information Map

The most prominent use for the IM, as suggested by the questionnaire respondents is to locate information. This high response shows that people have gained the correct understanding of the IM and its functionality. One response highlighted another issue:

'Finding the information is only a part of the problem, knowing it is right information is an issue'.

Any solution will have to ensure that the information is validated and recognised as the verified source across the business.

4.5.8 Question 14 - Could your current search time be reduced with the use of an Information Map?

By issuing the respondents with a script describing the IM and what it would achieve the respondents could gain an understanding of the tool’s functionality. Question 14 was asked to gain an understanding of whether the IM tool, if implemented, would be successful in reducing the search time.

79% of the respondents believed that with the use of an IM, their search time would be 'very likely' or 'likely' to reduce. Question 13 showed that the majority of the sample population have a good understanding of the IM and its functionality, so if 79% of that population believe that the IM would save them time searching for information/knowledge, then a real quantifiable benefit could be gained.

4.5.9 Question 15 - If you think that you would not access the Information Map then please state why

The respondents had an understanding of the IM and how it worked; therefore it was seen as crucial to the project that an opportunity was given to the users to voice their concerns. Two respondents gave individual answers:

- 'It is nothing new and already exists'
- 'It will direct people towards me and give me more work'

The first respondent said the tool already existed, which was not true. People pages exist on the company intranet and work by people volunteering their areas of

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expertise on a web page that everyone within the business can search. The idea of the IM is that it would collate different sources of information and not just people sources. It would also hold information specific to CM, instead of trying to hold information that was used across the whole of the Submarines business. The second respondent believed that more work would be put their way, when they may actually find that the requests they gain after the implementation of the IM are more specific to their areas of expertise and therefore queries can be dealt with faster.

Two respondents said that the tool would not be used if it was not maintained. This is a valid answer that is applicable for any IT implementation. If a tool is to store information, it has to be continually updated and the information has to be validated for its relevance. The maintenance issue is one that will be built into the final solution to try and make sure that it is self-maintained. Four respondents said that they do not use CM data and therefore would not need to use the tool to search. This is also a valid answer and, even though people are interested in the tool, they may not need the information, which is located within it. This point needs to be considered as part of the scope for the IM tool. If the IM is successful, the main principles behind the tool could be used across the business to store different types of information such as Safety or Materials.

Out of the 22 employees that responded to the question, nine of the respondents stated that the employees have all the information they need to conduct their work. As shown in section one of the questionnaire, many of the employees had worked within the company and within their job roles for a number of years. If their role was repetitive in nature then it is unlikely that they would frequently have to look for new information. Therefore, it is concluded that 98% of the sample could see benefit in using the IM.
4.5.10 Question 16 - If you were presented with an Information Map, how would you prefer to search for your required CM information?

This question was used to try and gain insight into the methods of search that employees would prefer to use. An option was given to the respondents to choose more than one method as the search method may change depending on the current search query. Figure 4.5 displays the results and the search options that were given to the respondents.

![Bar chart showing search method preferences](image)

**Figure 4.7 - Question 16, Preferred search method**

The search options were all agreed by the project stakeholders. The preferred method of search, highlighted by the sample were 'Parts/Products' followed by 'System' and then 'Submarine'. The project requirements stated that the 'Product life cycle' needed to be reinforced within the business, and therefore, this was favoured to be used as the underlying structure to any IT tool created. As the respondents were allowed to select more than one option, the search options all had high scores with the exception of the 'product life cycle' or 'other'. This indicates that the information stored within a tool should be searchable via different methods and categorised using methods familiar to the users.
4.5.11 Question 19 - Do you have any other comments concerning the Information Map?

Asking the respondents if they could see any issues with the implementation of a new tool, allowed the collation of points that may have otherwise been missed. It would also reduce the risk for the project as all of the issues were reviewed before the project and appropriate action was taken. After revising the comments made, they could be grouped into the following concerns:

- Maintenance - 5
- Should be user friendly - 2
- Offer direct links to sources - 2
- Not relevant to specific groups - 2
- Sources need to be made into a more workable state - 2
- The tool development needs to be well documented - 2
- Will only be used by new people or those changing their roles - 2
- Too general - 2
- Does not include sources that are available outside of the company - 2
- Unsure if the IM will offer enough information - 1
- Should refer to a relevant contact person - 1
- Need to have a well defined scope - 1
- After implementation a review needs to be conducted - 1
- Sources need to be grouped properly - 1

All of the concerns were used to help structure the project and were placed on the project’s risk register. The possible solutions were used to try and resolve these issues. None of the respondents said that the tool would not be used, so the demand is evident. The issue that had the most responses was the ‘maintenance issue’. The importance of this issue would need to be resolved to ensure that the tool would always contain relevant and up to date information. This is explored in the next chapter.
4.5.12 Other Questions

In question 20, the respondents were asked to list the information sources that they used within the business. This enabled the list to be analysed to gain an understanding of the sources most frequently used. The respondents chose the information sources from a list of recognised sources across the business. They were also given the opportunity to list information sources that were not on the official list. 112 extra information sources were identified as an important source of CM information.

Explicit information was also asked about each information source mentioned for example, 'who is the current owner?', 'What format is the data in?' All of the information gained would be used to populate a tool.

The author then presented the results to the project stakeholders so that they could make a decision to how they wanted to proceed with the project. The need to support searching within the business was recognised and the decision was made to support the creation of an IM tool.

4.6 Conclusion

The questionnaire confirmed the need to help improve the efficiency of finding CM information within the business. On average, each employee spent 51 minutes a day searching for information. This time could be significantly reduced, by implementing a suitable tool as the employees believed that 18 minutes a day could be saved on their current search times if they knew where to look for the CM information they required. The questionnaire highlighted that many of the employees are not aware of the location of information, which could shed light on the reason for the search time being so high and, consequently, employees are creating document that have already been produced within the company. Due to a lack of a search facility, these documents are not being found and therefore people are unaware of their existence. This shows an inefficient process and could lead to negative feedback from the customer. The need to support the employees search has been established and the option selected, is discussed within Chapter Five.
The first questionnaire gave a good insight into the employees' thoughts and highlighted over a hundred information sources that had not been formally recognised as sources of information by the business. It gave an understanding into the current issues within the business and gave an indication of the way forward. The maintenance of the tool was a very important issue that required careful consideration in the development of the Information Map solution described in Chapter Five.

Chapter Four fulfils objective two and three though the use of interviews and questionnaires to determine the extent of the problem of locating information and the informational needs of employees in the Submarines business. This chapter has highlighted the need to support company employees in their search for information. However, to unlock the true potential of the knowledge in the company a system is required to encourage person to person contact. The system proposed will provide "signposts" to information and knowledge. The need was established for a tool to identify owners and experts of information. The development of this tool, The Information Map is described in Chapter Five.
Chapter Preface

Chapter Four established the need for a tool to search for CM information. This chapter details the work conducted to fulfil the fourth objective which was to implement a tool to satisfy the information needs of the employees in the Submarines business.

5.1 Solution Development

Eleven key stakeholders were selected from across the Submarines business to be involved in monitoring the project and providing any guidance required. These are the same eleven stakeholders that are mentioned in Chapter Four, section 4.3. They were selected on the basis that they were all experts/managers within different fields and had worked within the business for a considerable number of years. The first stakeholders meeting was arranged to try and decide on a solution that could be developed to help the search for CM information as detailed within Chapter Four, section 4.3.

5.1.1 The Information Map Concept

The two requirement documents (IUR and DDR) detailed within Chapter Four, section 4.3 were agreed by all of the stakeholders and this became the guide used to ensure that the developed solution met the business requirements. It was decided that an IM would be produced and used as a “sign-posting” tool, directing the users to information of interest by holding ‘knowledge meta data’ (Seiner, 2006) about each information source. This would involve a central hub containing ‘meta data’ which is information specific to that source, but not the source itself. Each source would have
an ‘owner’ tag, indicating the person responsible for maintaining the accuracy of the
information. If a search of the IM produces a specific information source, then the
user will be able to view the information about the source. This information would
include the source format (e.g. a document, a drawing or a person with the required
knowledge), the owner responsible for maintaining the information, an expert, who
may be a different person to the owner and a description of what data are held within
that source. The user could then contact the source expert who would provide the user
with the ‘knowledge’ they have gained, through their experience and expertise with
that particular information source. The IM would not give the users a direct link into
the IS as it would often be very complex and specialised.

This tool would encourage a knowledge-sharing environment, as users would have to
go to the expert to investigate the information they need. This type of tool is
recommended by Swan et al. (2000) who stated that it is more effective than a linear
information flow. They believe that knowledge sharing through social networks,
including occupational groups and teams; will encourage a more productive
knowledge management environment. Weenig and Midden (2001) also agree that;

\[ friendship \text{ and personal contacts heavily influence communication between } \]
\[ individuals; \text{ when these exist, the likelihood of information sharing is increased}. \]

The IM would tackle the problems highlighted by the Product Data Management
systems as it would be developed in-house and this would encourage the company
standards and practices to be used on the IM. The user-interface would be created
with the current, company-standard intranet format so that it would be familiar to the
users. The growth of the IM was seen as being organic so that it grew with the
business and its user requirements. As new information sources were validated and
added to the IM it would encourage people to use the corporate information sources
which they may otherwise have missed and created their own.

Research conducted by Keith et al. (2001) concluded that information within
companies is a valid resource that is not being utilised to its full potential. They
highlighted three factors which encourage knowledge sharing - ownership attitudes,
instrumentality and value for feelings. ‘Ownership attitude’ is the importance, of
making people feel valued for the information for which they are responsible. 'Instrumentality' includes the size and amount of information requested, the power represented and the value given to the sharer. 'Value for feeling', is dependent on the owner and how their attitudes may reflect the user, based on past experiences.

With respect to ownership attitude, the search results of the IM varied in both their format and the expert assigned to the information source. The IM highlighted different types of expert including owner (the person who is responsible for the source) and expert (company expert) contact details. This will increase the level of communication within the company, make the owners feel valued and place the users in contact with the information source expert. Instrumentally would be different per request made by each employee using the IM. Each owner will be recognised as being the 'owner for that information source' and they should be rewarded with gratitude by the employees requesting their help. The IM was aimed to foster valve for feelings by creating a spirit of cooperation with each information source signpost on the IM having a comments box so that the user can express their opinions and comments on the information source for other users to view. These factors were all considered within the development of the IM to aid its adoption and success.

When creating a tool like the IM, there are many issues to consider such as those raised by Keith et al. (2000). Further issues were discovered as the design and implementation of the tool progressed. These show that, for the effective implementation of a knowledge management tool, many of the more complex issues and design decisions require considerations that extend well beyond the technical aspects. The next sub-section highlights these issues and gives some initial indications of the design decisions required.

5.1.2 The Information Map facilities

Categorisation within the IM is an element of the project that needed to be established before any data could be collected. The type of categorisation needed to be familiar to the whole business and had to be simple to understand. One good way to establish categories is to ask the system users. As with most search tools, such as 'Google', the most common way to search is by one or more keywords, which provide the user a
list of possible results. This is one of two search methods employed by the IM. The second search method used a structured, hierarchical method, so that people can browse over information. This would be useful in those searches where users are not sure of specific keywords and could benefit from exploring the IM to see what is available within their general areas of interest.

There is a lack of published research on the type of search preferred by users. Keywords are very popular as shown by search engines such as Google, Yahoo and AltaVista. The only problem with keywords is that if you are not sure what you are looking for but you want to browse information then it may be difficult to determine the right keywords. The browse function lets the user view information in a progressively more focussed selection. The user navigates through the selection stepping through a progressively, more refined criteria. There is no current research to conclude which search method is preferred, or in which circumstances a user may use each type of search. To ensure all needs are met, the pilot implementation of the IM incorporated both search methods. An initial review of available CM information suggested the browse function would be best served by refinement criteria based on the product life cycle and component types, though this, again, was a design decision requiring further research.

Access to data is an important issue as information may be restricted for security purposes or it may only be assigned to management. Would it be unproductive if only certain people could use the site? Should the information be at a suitably low level so access is not an issue? The solution adopted was to allow access to certain information based on the user login details. People without access to certain types of information may not be able to view the information itself but they could still be supplied with a contact name, allowing the users to obtain basic contact level information such as the expert/owner tagged to that information source so it is therefore the owner/experts decision to share or not share the requested information with that employee.

The size of the community is also an important point as the system would have to be capable of allowing a number of users to have access to the tool at the same time. With a wider scope of users, the management of the tool also increases as the
Chapter 5  The Development of the Information Map

likelihood is that more users will result in suggestions for more information sources which are currently not included within the IM. If these new sources cover a wider scope, for example another disciple, then additional management experienced within this area would have to be consulted. A possible solution to mitigate this issue is to upload a new information source with the permission of the owner and allow people to add comments within the comments box assigned to each information source. These could then be reviewed by the relevant expert.

With KM systems, people need the opportunity and the facility to express their comments to encourage a sharing environment. The advantage of sharing knowledge can be illustrated by ‘knowledge forums’ implemented within many companies. Knowledge forums allow people to post questions or suggestions on a notice board so that they can be viewed throughout the company and other people can respond with their own ideas. This makes everyone within the company feel valued for the information they have. This idea was incorporated into the IM as a comments box. To ensure constructive use of the comment facility, the system will attribute all comments with the users login ID to deter any inappropriate comments, and the administrator is able to remove any comments that are judged to be unjustified, offensive or otherwise inappropriate. Placing the login ID into the comment also keeps the comment’s author anonymous to other readers by name but easily traceable to the administrators if required.

The only concern with the comments box is that there is nothing to motivate its use. Some KM systems reward people for sharing the knowledge they have. An idea is for people within the business to award knowledge points to other people who provide them with useful knowledge. These points can then be collated and the person with the most points gets rewarded as advocated by Adelmann and Jashapara (2003). The idea could be used within the IM by monitoring useful comments and then awarding the person who has contributed the most. This would create a knowledge-sharing environment and promote the use of the IM.

The perceived value of an information source can vary from person-to-person depending on the specific information required. Tools often have rating facilities allowing them to rate a source. The rating can be conducted either subjectively, by the
users allocating points to each information source viewed, or quantitatively, by the number of hits on the information source. The benefit of the subjective method is that a high rating is dependent on the collective high score based on people’s opinions. The drawback of the subjective method is that an individual could rate the source as being very low because it does not hold the specific information they are looking for, whereas a second user could value the information greatly. This method of rating may be specific to the nature of the individual’s role and not the information within the information source. The advantage of the number of hits is that it is not influenced by people’s opinions. On the other-hand, users may have thought that an information source contained information that was not useful when the source was opened.

CM determines the type of information to go into the IM, but how do you decide when information should be taken out of the system? Do companies find information ages with time and becomes redundant or is information always useful regardless of age? Some of the factors taken into account when establishing the value of holding information are:

- Is storing the information a legal requirement?
- What could the information be accessed for?
- Does the information need to be used to support the life cycle of the product/service?

Information has to be assigned a value for the company to establish its use and when it becomes redundant. The research available on the age of information is not well established so, for this project, information sources that have been identified by the employees as being useful to their work regardless of age will be added to the system.

5.1.3 Collecting the Information Sources

To try and establish the information sources that are used within the company that deal with CM information, the first questionnaire asked people to list the information sources they used. There were a number of questions that were used to gain details about the information source from the respondent e.g. ‘who owns the source?’ Once all of the responses were collated the information sources and their associated information were collated and alphabetically listed within a spreadsheet by the author.
This list was then split into two further spreadsheets that separated the recognised information sources from the new ones (identified as new CM information sources by the respondents to questionnaire 1). An example of what information was collated against each information source is given in the following example. 'Archives' was an information source selected by 24 of the respondents. The 'data types' that the respondents believed archives included were:

1. Database
2. Hard document
3. Person
4. Microfilm
5. Drawing (EDM or Microfilm).

As 'Archives' was a store for past information, it was possible to have information stored within the different formats listed above. The other information collated against this information source included a description of the source and who owned it.

There were 33 information sources that had been recognised within the business as validated sources of CM information. By analysing the results that were collated from the first questionnaire, another 102 information sources were identified as being used to access CM information within the Submarines business. There were instances that involved several respondents naming the same information source but providing different supporting evidence. An example of this is shown with a source called 'VDMA', the six respondents that mentioned this source all said that it had the same owner. The difference highlighted was that they suggested that it was available in three different forms (a drawing, database and an electronic document).

These newly identified information sources were presented to the stakeholders in a spreadsheet form by the author. The stakeholders then grouped the information sources into four categories:

- **N/A** - Source that the stakeholders deemed to be out of the CM scope.
- **Current** - Source that would be incorporated immediately.
- **Future** - Source that would be incorporated in the future.
- **Duplicate** - Source that had been collated within another of the groups.
By taking the current list of 33 validated information sources and the ‘current’ list, this left 84 sources that would be placed within an IM tool.

A second questionnaire, given in Appendix 7, was then produced to gain more detailed information about the newly identified information sources. The first questionnaire identified an owner for each information source so this second questionnaire was conducted as a one-to-one interview with the source owner. The source owner was initially taken through some background information that can be found within Appendix 8 as part of the consent form. This provided them with the project background and an explanation of terminology used such as “Configuration Management”, “Information Map” and “Information Sources”. The questionnaire took between 20 to 30 minutes to complete with the respondent.

The questionnaire was split into two main sections;

1. General Information.
2. Specific information about the information source owned by the employee.

The ‘General’ information section collates information such as the respondents name and the business unit they work in. As they where seen as a person who would be contacted via the users of the IM it was seen important to establish their level of visibility across the business. Therefore questions where asked such as whether they were in the Rolls-Royce phone book (an electronic on-line phone book) or if they had a people profile page (online people directory holding specific information about employees and their work experiences) and how up-to-date this information was.

The second part of the questionnaire asked more specific questions about the information source, such as establishing whether the person interviewed was really the owner, and if not, who the owner was. Questions were also asked to determine the different formats the information source was available in. If it was discovered that the information source was available within different formats, for example a hard document and an electronic format, then the master information format would need to be established. It may be that the information source is a series of reports that are held
within a filling cabinet but for easy access they have been made available across the intranet and hence in an electronic format.

The next questions related to gaining an understanding into the relationship between the information source and specific parts, systems and life cycle stages. The relationships with individual parts was established by listing the main parts and asking the owner to select those that the information source held information about. The same was done for the different systems, such as Primary circuit, Pressuring etc.

As mentioned previously, there was a business drive to support the Rolls-Royce product life cycle and to establish the information and IT systems relating to its different stages. Each information source owner was therefore asked to identify which of the different Rolls-Royce product life cycle phases the source related to and which documents the information source references. For example, within the Concept phase, the information source may refer to 'evidence of customer agreement'.

As the IM will require some searching capability so that the users can query the information, it was seen that the tool would need to be supported by a database and, therefore, the information will need to be well structured. This would also support the ability for the user to interrogate the 'hierarchical' view of the information. Collating the information from the second questionnaire would be sufficient to populate the database and allow employees to search/view the information via a number of methods, such as via parts, product life cycle and systems.

The interviewees for each source were also asked to nominate other experts that could be referenced as points of contact. Each completed questionnaire was then presented by the author to senior company engineers to test there consistency and accuracy by checking it through. This was especially important for question 15 which asked for the owner to give a description of the information source. By asking the senior engineers to review each response, it made sure that the information placed within the IM would be consistent and at the same level of detail.

The final question asked the information source owner to assign the quality of information that is held within the source. They had an option of selecting high,
medium or low. This question would be used to make the users of the IM aware of the quality of the information that was being made available to them.

After the questionnaire was completed the information source owner was asked to complete a consent form which they were asked to sign to agree to the following statement;

"I agree that the information which has been provided is correct and that if any changes do occur, I will inform the nominated Map owner as soon as possible. I will ensure that the Information Map is reviewed and maintained on a basis to be agreed, and that if my responsibilities change, I will inform the next person within the role"

This was a way of ensuring the information source owner understood the importance of the information they gave and acted as a reminder that they need to keep the IM administrators informed of any changes that may occur.

5.1.4 Creating the Information Map Software

The IM software was developed in three phases. In each phase the software was developed by students at Loughborough University under the supervision of Ray Dawson, a senior lecturer in the Department of Computer Science, with the assistance of the author. In each case, the author acted as the customer on behalf of Rolls-Royce, setting the initial specification, answering questions, and continually reviewing the software developed. When necessary, the author acted as a ‘go-between’ when questions from the students required answers from the Rolls-Royce experts and stakeholders, so that at no time did the students need to contact the company directly. The software consisted of a database created in Access, and with an intranet front end working on Microsoft Internet Explorer version 5 or above.

The first phase, which acted as a proof of concept for the IM, was developed by a single MSc student. This phase explored the initial ideas for the operation of the IM and allowed a more detailed specification to be prepared for the next phase. The second development phase was to produce prototype software for the IM. The work was carried out by teams of final year students of the Masters in Computer Science
programme. Three teams of students, each with three or four team members, developed their own versions of the IM in parallel with the other teams. At the end of this prototyping phase the author arranged for all three prototypes to be demonstrated to the stakeholders at Rolls-Royce. After due consideration, the stakeholders decided which features they wanted from the three prototypes, deciding on one prototype as the platform but with features incorporated from the other two prototypes.

In the final development phase, the team of students who had produced the accepted platform for the final development continued the development to produce the final desired IM software. The other teams developed further prototypes with more advanced features to act as an ideas base, should the company decided to enhance the IM in the future, though at the time of writing this thesis the original working IM was still being used without any significant further development.

The author acknowledges the assistance of the Loughborough University students in producing the software. This enabled a sophisticated and robust software development to be carried out while the author was able to get on with other aspects of her research. A copy of the supporting development documentation can be found within Appendix 9.

5.2 Information Map

The information collated from the responses to questionnaire two was used to populate a database that would allow the users within the company to search for information.

5.2.1 Logging into the tool

Due to the nature of the work conducted within the Submarines business, work is conducted on a secured computer network, which only allows those with a valid password and username to access. The IM is placed on this network and therefore anyone logged into the network can access the IM. Figure 5.1 is the index page for the IM and introduces people to the tool. The image of the sign pictorially represents the IM as a signposting tool. The page describes the main function of the IM and offers links for the user to either search the information provided or explore it.
5.2.2 Navigation

Navigation throughout the IM is accomplished using the menu bar, which is located at the top of the Website as shown in Figure 5.2. By clicking on any of the headings the site takes you to the relevant page. The pages and features linked from the entrance page are as follows:

- Home - the page in Figure 5.1, providing links and a brief introduction.
- About - provides an introduction and general overview as to the purpose of the IM.
- Search - provides a means to 'Keyword' search for an information source.
- Explore - provides a search function using a hierarchical structure.
- Feedback - allows users to submit feedback to the IM owner.
- NM Home page - provides a link to the local intranet.
- RR InfoCentre - provides a link to the Rolls-Royce corporate website.
- Help - contains HTML and PDF versions of the IM user guide (given in Appendix 10) and a frequently asked questions page.
- Print - allows the user to print the currently displayed page.
The navigation is also aided with the use of a breadcrumb trail, situated underneath the menu bar on all pages, that is used to tell the users their current location and route to that location, as shown in Figure 5.2

![Figure 5.2 - Breadcrumb trail of the Search page.](image)

All of the data that is displayed within the screen shots in this thesis is dummy data that was used when the tool was in its pilot phase.

### 5.2.3 Searching for Information

Searching for information sources on the IM can be done via two different methods. The first is the search page which allows the users to insert a keyword and select from the following phases of the product life cycle (PLC): Concept, Definition, Design, Creation, In-Service and Disposal. People usually work within one or more of these phases when they are conducting a task, so within the search page they can refine their search to one or more of these phases. Figure 5.3 displays the search page and highlights the main functions of the page.
When a keyword is entered the ‘auto-complete’ keyword function can be used to enable the user to choose from multiple keywords. As shown in Figure 5.4, as a word is being entered a drop down menu appears from which the user can either select the required word or continue to type.

Once the search has been submitted, results are returned and listed in a format displayed in Figure 5.5.
An button may appear next to the Information button. This will only appear if you are the owner of the source, in this example Tom Hook. By pressing the edit button, Tom would be able to edit the information that is available on that source as he is the owner. If no results are found for the user’s search criteria, the user is informed with a note stating ‘Sorry no records were found. Please feel free to send feedback’. This gives the tool users an opportunity to suggest areas of CM information that they believe should be covered by the IM.

5.2.4 Advanced Searching

The advanced search option available on the search page, display all of the available advanced searching options. These can be chosen via a scroll down menu, such as:

- Level
- Class
- Model
- System
- Component
- Type
5.2.5 Viewing an Information Source

Once the results from the search have been displayed the user can select the information button and view the source information, as shown in Figure 5.6.

The other method of search is via the 'Explorer' page. The Explorer page allows the information in the system to be browsed. The Explorer consists of two parts, the tree on the left-hand side and the information sources on the right-hand side (see Figure 5.7). The tree shows all of the product life cycle and each phase can be expanded to show the levels and component types within them by clicking the '+ 'next to the desired phase. In order to view the information sources related to a particular phase (or level), the user has to click the relevant 'folder' that represents the phase (or level) that they wish to view. This will display all related information sources on the right-hand side of the Explorer.
5.2.6 Editing an Information Source

The source owner and IM administrator’s owner have the right to edit an information source. If this privilege is granted then the edit button will appear next to the information source. In the editing pages, drop down menus are used to try and simplify the process. All aspects to the information source can be modified from changing an expert to adding new keywords. More detail of this process is offered in the User Guide in Appendix 10.

5.3 Testing

Although the students had been able to do some testing, they only had access to limited sample data so the full detailed testing was conducted at the Rolls-Royce site when the IM had been delivered, and populated with information source meta-data.

The testing process started by creating a test schedule that can be found in Appendix 11. The test schedule is structured in the following format:

- Test Environment
- Generic System Requirements
Chapter 5  The Development of the Information Map

• Functional Testing
  o Functional and field format testing for the Home page
  o Functional and field format testing for the Site Map
  o Functional and field format testing for the Search page
  o Functional and field format testing for the About page
  o Functional and field format testing for My Documents
  o Field format testing for the Explore function
  o Field format testing for the Feedback page
  o Testing the Print option
  o Testing the Logout function

• CM Information Map Test Result Approval

Each area noted above had a number of tests associated with it. Each area was tested and the results were recorded within the test schedule with any errors being corrected.

5.4 Maintaining the Information Map

With a developing and growing system, it is anticipated that changes will be made on a daily basis. How these changes are managed is a very important question. An early decision was made for an administrator to be responsible for the smooth running of the IM. The administrator is responsible for the user access accounts, checking and coordinating the response to reported errors, and for the general integrity of the information held. The information source 'owner' is responsible for their information source.

The shared responsibility for the integrity of the information source gives rise to a number of design questions. Would it be useful for the administrator to know the changes which have been made by the information source owners, or should all changes be made by the administrator? If the information source owners are allowed to make changes themselves they become more involved with the running of the system which should lead to a more productive site (encourage knowledge sharing). It is believed the active participation will enable the system to grow as users contribute to it. This should also maintain the accuracy of the data as it is more likely to be
maintained if users can make updates themselves. The only concern with a self-populating IM is that the information may become uncontrollable and the quality of the information may deteriorate. Without any form of regulation, less experienced users could place information on the IM, which is inaccurate or invalid, compromising the IM integrity.

The alternative is to restrict updates to those made by one or more administrators. In this case users will have to contact the administrator with the request for changes. This could cause a backlog for the administrator if many changes are requested simultaneously. The advantage of an administrator making all the required changes is that they are able to verify the changes made and, therefore, have more control over the site. The danger is that people become tired with the routine of sending emails and not receiving efficient responses due to an administrative overload. Users may then feel detached from the system and not bother to send updates, resulting in out-of-date information.

A possible compromise could be to allow the users to update existing information source meta-data and for new information sources to be automatically held in a ‘pending’ state where the updates are not visible to other users until they have been approved by the administrator. This involves the user and reduces the load on the administrator, but they will still keep overall control. Another alternative is to allow some “super users” with permission to update and add information sources, and possibly, to approve the updates and additions by other users. It is not obvious where the balance should be between allowing users the freedom to actively contribute information verses retaining overall control by a responsible administrator. It is possible that there is no one-size-fits-all solution with different situations requiring a different balance.

By studying the implementation of the IM, the research in progress will attempt to workout what factors should determine where the balance of user freedom and administrator control should be. Incorrect information can be more damaging to a business then no information. There is a need to clearly establish if information becomes redundant, or if it will always be required as a source of reference data. Some companies have a legal requirement to hold information for a number of years,
but would this information still be used within the company or need to be accessible through the IM? There is little research available on this specific topic, but it seems likely that companies would have to draw their own conclusions about the value of information in their own context. The rules for information deletion would have to be set by a number of company stakeholders, as the administrator may not be in a position to determine the overall importance of specific types of information.

As the IM only contains metadata, it will not need to be changed as frequently as the information held at the source. An example of a typical change would be when a source owner or expert changes their job role. For a growing system, however, adding an information source will be a regular activity, but it is in the regulated addition of new information that the greatest risk of inaccurate or invalid data occurs. At Rolls-Royce it was noted that the CM information held by the information source was relatively stable. It was decided to allow information source owners to update their own, existing meta data as they are responsible for the information source itself. The addition of new information source will for the time being, be restricted to the administrator. The administrator will also be the person allowed to ‘delete’ the meta data for an information source. In practice, however, the system will archive the information source meta-data so that it is no longer visible through the IM, but if necessary it could be accessed by the administrator.
5.6 Conclusion

The last chapter highlighted the need to support company employees in their search for information. However, to unlock the true potential of the knowledge in the company a system is required to encourage person to person contact. This chapter describes the development of a system to provide “signposts” to information and knowledge. By identifying owners and experts of information, the IM encourages users to make contact with the people that can provide knowledge and expertise in their area of interest.

![Configuration Management Information Map]

Figure 5.8 - Configuration Management Information Map

If this tool is successful then it will deliver the answer to the original question of ‘where is the information I am looking for within the company?’ Figure 5.8 shows the summary of the IM with its creation, development and maintenance. This chapter has detailed the work conducted to meet objective four by implementing the IM to help the information needs of the employees in the Submarines business.

The IM has been piloted using CM information within the company. To establish its success and what lessons could be learned from the introduction of the KM tool a careful evaluation of the IM is required and is described in Chapter Six.
CHAPTER 6

EVALUATION OF THE INFORMATION MAP

Chapter Preface

This chapter covers the evaluation of the IM. It fulfils objectives five and six stated in Chapter One. Firstly this chapter establishes the longer-term success by questionnaires. Secondly, it establishes the lessons that can be learnt from the development and use of this knowledge management tool.

6.1 Determining the Success of the Information Map

Once the IM was implemented, it was expected to benefit the company in the following ways:

- It will allow the user to have instant access to the location of CM related information sources within the business without leaving their desks.
- It should reduce the total amount of time being spent trying to find the answers to user queries.
- It will direct people to the correct information experts and not to people who ‘think’ they know.
- It should encourage a more productive working process by reducing the amount of time used to find information.

The benefits of the tool can only be recognised by measuring its success. Fitzpatrick has listed a few software measurement methods including:

- Observations of the users - Noting their likes/dislikes, difficulties and attitudes.
- Questionnaires - Capturing the profiles of the users and their attitudes.
- Interviews - Similar to questionnaires but face-to-face.
Chapter 6 Evaluation of the Information Map

Metrics have already been collected with the first questionnaires and these will act as base line measurements for CM information handling against which any improvement resulting from the IM implementation can be compared. A similar questionnaire was used after the IM had been used within the company to see if any improvements had been made.

6.2 Questionnaire Three - To Evaluate the IM Success

This questionnaire was designed to analyse the success of the IM. Some of the analysis has included making some comparisons to the results of the first questionnaire used to establish the need for the IM. The most relevant questions have previously been discussed in Chapter Four.

The responses to questionnaire three were segregated into three groups. The first group was made up of those who had completed the first questionnaire. This group gave a response rate of 20% for the third questionnaire. These responses are used to compare with the initial results obtained in questionnaire one.

The IM arose from a CM improvement project that was being carried out by Rolls-Royce. It included analysis of the current CM process and the training of employees in CM best practice. The IM was used as part of that training and people were told about the tool and how it could help them. Therefore the second sample of questionnaire responses was people who attended the CM training. The third group of recipients were employees who had been logged by the IM as users. It was felt that all three groups of respondents would give different and new insights into the IM. The questionnaire was sent out to a total of 189 employees and the response rate per group can be seen in table 6.1.
Table 6.1 - Responses from user groups

<table>
<thead>
<tr>
<th>Respondent groups</th>
<th>Completed Questionnaires One and Three</th>
<th>Attending the CM training</th>
<th>Logged as IM users</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of responses</td>
<td>12</td>
<td>3</td>
<td>12</td>
<td>27</td>
</tr>
</tbody>
</table>

There were no respondents that had completed both questionnaires and had attended the CM training.

6.2.1 The Questionnaire

Questionnaire three was within the same excel format as the other two questionnaires and distributed via email. The email note covered the following points:

- Why and when the IM was launched (including a live link).
- Why the respondents were being asked to complete the questionnaire.
- What the questionnaire was designed to do.
- When and how they should return the completed questionnaire.

Questionnaire three (Appendix 12), contained both open and closed questions. The first part of the questionnaire includes its purpose and confidentiality. The questionnaire was split into a further four sections:

1) General information
2) Search
3) Submarines NSRP Information Map
4) Search Method on the Submarines NSRP Information Map.

A review of the results for each of the above questionnaires sections is given in the following sections of this thesis.
6.2.2 General Information

This section is used to gain an understanding of the sample by asking general questions about themselves such as their name, business area etc.

Question 2 - Business area?
The sample used within both of the questionnaires (one and three) are similar as 57% of responses from questionnaire one came from the UK Submarines Flotilla Programme and 47% of respondents from questionnaire three came from the same business group.

Question 4 - How long have you worked within your current job role?
Questionnaire three found that 76% of the population had worked within the company for ten years or over. On the original questionnaire 23% selected the same ten years or over but the highest selection was 2 to 5 years at 30%. It seems that the new sample may hold more experience within their current roles due to the time they have spent within in their job roles compared to questionnaire one’s sample.

6.2.3 Search

This section asked some specific search questions:

Question 6 - Presently, how easy do you find it to search for CM information?

The average time spent searching for CM information

![The average time spent searching for CM information](image)

Figure 6.1 - The average time spent searching for CM information
Figure 6.1 shows the average search time taken by the respondents of both questionnaires one and three. The response to questionnaire one shows a high peak in people spending an hour searching for CM information whereas questionnaire three shows that people are spending half an hour. This reduction could be due to the IM or other company initiatives that have saved people search time. The fact that the recent sample has spent more time within their roles may also be a factor, as they will have a well-established network of the information sources required to complete their jobs.

**Question 7 - How often have you successfully found relevant CM information?**

It still seems that people are ‘frequently’ finding the information they require as shown in Figure 6.2. The sample size in question ‘frequently’ found NSRP information was 52%, showing an increase from 44% in questionnaire one. This could be due to the IM helping people search for the CM information they are looking for.

![Figure 6.2 - How often have employees successfully found relevant CM information](image)

**6.2.4 Submarines NSRP Information Map**

**Question 8 - Are you aware of the Submarines Information map?**

From a total of 46 responses 85% of the sample population were aware of the Submarines IM. Factors contributing to a high percentage could be the high level of communication which included a poster campaign, placing articles within departmental news letters and/or the CM training program.
Question 9 - How many times a week, do you use the Information Map?
Ninety-Eight percent of the respondents said that they used the IM once a week which shows that people are finding benefit in using the IM, as they seem to be reusing it the following week.

Question 10 - Do you believe that the Submarine Information Map has met your expectations?
Two-thirds of the sample believed that the Submarines IM has not met their expectations. There could be a number of reasons why this is the case, for example people expected it to be more like a search engine e.g. Google. The respondents who had not attended the CM training may have been unaware of the CM jargon used. This area needs to be explored to try and establish what people were expecting from the tool and why two-thirds of the respondents felt their expectations were not met.

Question 11 - Is the Submarines Information Map intuitive to use?
Forty percent of the respondents said that they felt the IM was not intuitive to use. It seemed to be the same people that believed that the Submarines IM did not meet their expectations. There is a help function available but this issue needs to be addressed as it seems that people are still struggling to use it.

Question 12 - With the use of the Submarines Information Map, how easy do you find it to search for the whereabouts of Submarines CM information?
Finding it ‘very easy’ and ‘easy’ accounted for 63% of the sample. So the majority of the sample found it easy to locate the information they required from the IM. The other 37% seem to be struggling to find what they were looking for. This could be because that data is not within the map or because they are not using the tool correctly. It would be useful to encourage people to provide feedback on failed searches so that gaps in the sources can be filled.

Question 13 - As a percentage, how much of your time do you believe has been saved with the use of the Information Map?
Ninety-Eight percent of the sample said that the use of the IM had saved 0-20% of their time. One respondent said that they had saved 21-40%. On the original questionnaire respondents were asked how much time they believed could be saved if
they knew where to find information/advice. 32% choose 0-20% closely followed by 41-60% with 30%. It seems that in the original questionnaire, the sample generally felt they could save anywhere between 0-60% of their time. Now that the IM has been released into the company, it seems that the respondents believe it will save them 0-20%, which is still a recognised time saving.

**Question 14 - At a personal level have the benefits below been achieved?**

The question suggested sample benefits that the respondents could select as true in their case. The options provided are listed below with the percentage of the sample response.

- **Provide a good starting point for networking** - 87% of the sample believed that the IM would be a good starting point for networking, showing that people have an understanding of the functionality of the tool being used as a signpost.

- **Information/expert searching becomes less hit and miss** - 38% of the sample thought that the IM would not increase the effectiveness of the process to search for experts. The IM would not be of any benefit to the business if it listed all of the company experts and their areas of expertise as these are recorded within the Red phone book (an internal address book stating peoples names, telephone numbers and job titles) and in the Internal Authorities List (list of the people within the department that have been highlighted as leading experts in certain areas).

- **Provides incidental learning** - 20% of the respondents believed that they could not gain any incidental learning. If the 80% of the sample did come across one thing each it could save time by not 'reinventing the wheel'.

- **Identifies different information storage media** - 60% of the sample agreed that it was beneficial to know the different types of media that information sources are available in. This information is not difficult to retain and is benefiting over half the sample.
Question 15 - At a business level have the benefits below been achieved?
Again possible solutions were suggested to the respondents that they had to select if they believed the statements to be true.

- Promotes the sharing of expert knowledge - 86% of the population believe that the IM has been beneficial in promoting knowledge sharing. This is very important within the business, as the aim of the IM is to offer signposts to promote communication with experts.

- Promotes greater efficiency in the workforce - None of the responses believe that it would not make the workforce work more efficiently showing that everyone can see benefit in the tool and can recognise its use.

- Provides opportunity to build on past experience – From the responses gained 84% believed that there was a ‘reasonable’ or ‘some’ opportunity to build on past experiences. This is encouraging, as building on past experiences is an additional benefit and not the prime function of the IM.

Question 16 - What problems might the submarines NSRP Information map encounter?
The main points are ranked below in the order of most selected first:

1. Maintainability.
2. Too difficult to use.
3. Lack of visibility.
4. Lack of interest.

The points will all be analysed and the relevant ones will be built into any future progression plans the tool may have.

Question 18 - What additional features would you like within the site, if funding were to become available?
This question gives an insight into the future customer requirements for the IM. The most popular answer was to have the facility to open documents. The second most
Chapter 6 Evaluation of the Information Map

popular answer was to have higher level of detail relating to each source of information and a better search engine. Other suggestions included:

- The last date the source was updated.
- An organisational structure chart to see where relevant experts sit.

6.2.5 Search Method on the Submarines NSRP Information Map

Question 19 - Which search method do you find more successful?
Respondents were given the option to tick one or more of the search methods on offer. Forty-one percent of the sample preferred to search via the hierarchical method leaving the rest of the population preferring the word search. It is good to see that people are using and found benefit in the hierarchical search, as it is different to the norm in most search engines. It may be more successful because it allows employees to view all of the information sources that are present within the IM.

Question 20 - Is this your preferred search method?
Almost 80% of the sample said that they preferred the keyword search. This may be because it is easy to use. The keyword search needs to be well monitored and the administrator needs to send out monthly notes to each information source owner to remind them to keep their source up to date.

Question 21 - If you could choose to search via an additional method, what would that be?
The responses grouped by popularity are listed in Table 6.2.

Table 6.2 - Searching method

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Search Method</th>
<th>Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Google type search - keyword and phase match</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>More graphical - point and click</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Browse a list of topics - more exploratory search</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>By most recently changed/what’s new</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Boat ID - unique boat number</td>
<td>1</td>
</tr>
</tbody>
</table>
Again the strongest point made by the sample group was the need for a better search method. This could be based on their general use of the Intranet as there is a current need for a better company wide Intranet search engine.

**Question 22 - Would you/have you recommended the Information Map to colleagues?**
Fifty three percent said that they had told their colleagues about the IM but there is just under half that had not. This shows the need to invest more into the tool and implement some of the functionality that has been suggested by the respondents.

**Question 23 - Do you consider the Information Map part of your ‘tool kit’ for obtaining product information?**
Well over half said that they considered the IM to be part of their tool kit, showing that half of those using it have found benefit to use it again.

**Question 24 - Please provide an example of using the Information Map Successfully?**
Some of the best examples have been listed below:

- “Searched for SG as part of my test. It came up with a number of sources of info related to SGs, along with the names I would expect to see associated with them.”
- “On return to work from maternity leave I needed a reminder of what a specific database contained and I used to the Information Map to obtain this information successfully”
- “Found it very useful in finding out who now owns the DGS Specs. Answered an argument.”
- “Searched on the word ‘database’ to find local engineering databases which may be candidates for migration into the PDM / E&CM tool.”
- “Used to identify contact area for Core Mechanical Design data”
- “Tracking down Safety Alert”
Question 25 - Please identify any new Information Map sources that we should follow up.
From all of the suggestions made a list was prepared by retrieving the ones that were within the CM scope of this project. These were all explored by adding them to the ‘future list’ of information sources that was kept by the IM administrators. This list was then reviewed and the information sources thought to be within the IM scope were then be added to the IM:

1. “Inclusion of non metallics database is essential”
2. “Post irradiation inspection of core components does not appear to be in the database”
3. “Might also be helpful to cover company contacts for external data sources such as SSMG SDD (Submarine Design Definition) and SEDR (Submarine Equipment Data Records), etc.”
4. “Live Files” Storage of files relevant to the current fleet.
5. “Internal authorities”
6. “Chief Engineers”
7. “JSP518 or BR3018” Specific reports.
8. “RRA 6636, which lists Pre-Service and In-Service Inspection Results for all PWR1 submarines up to 1996 (based on the version we have).”
9. “There are also the transient summary reports, which list the number of transients experienced by various plants, e.g. RRA 1070 and RRA 13377.”

6.3 Comparing the different groups of questionnaire respondents
As shown in Table 6.1 the respondents were segregated into three groups:

1. Respondents that had completed Questionnaires one and three.
2. Respondents that had attended the CM training
3. Respondents that had been recorded as logging onto the tool.

As the different groups had had different levels of exposure to the tool and CM as a discipline it was possible that these employees would differ in their views about the
tool. For example, those who had attended the CM training would be aware of the product life cycle and would have been introduced to the tool within the training so would therefore be more aware, whereas those who had just heard about the tool based on the internal communication may have struggled in using the tool. Therefore the different groups of respondent's results have been compared.

6.3.1 Comparing CM training respondents with those who used the IM

Three respondents had completed the CM training but had not used the IM so their view of the tool would be based on what they had heard about it from the training that they had attended. There were no significant findings from this group and it was therefore seen as an opportunity to see if there was a difference between those who had used the IM and those that had attended the training. The results from the two groups showed no significant difference as all of the results were very similar. This therefore indicated that the questionnaire respondents that had attended the CM training were not swayed in their views after visiting the site.

6.3.2 Comparing the users of the IM who had been on the training against those who just used the IM.

The employees that have been on the CM training should have a wider understanding of CM then those who have just visited the IM. The group of respondents that had conducted the training and had used the IM were found to have spent double the amount of time searching than those who had just used the IM. This could be because they work within the area of CM and therefore spend more of their time searching than those who viewed the IM for other reasons. When each group of respondents were asked how successful their searches were, the group that had attended the training and used the IM seemed to be more successful. Three more respondents who had attended the training found that the IM was more intuitive to use. This may be because they work within the area and therefore felt more familiar with CM jargon and the information structure.
The respondents that had used the IM without training found that a little more time had been spent searching for information. Overall the respondents that had attained the training found the IM more useful. Question 22 from questionnaire three asked respondents “Would you/have you recommended the Submarines NSRP Information Map to colleagues?” The respondents who had attended the CM training and had used the IM that said that they would recommend its use was 50% more than the respondents who had just used the IM. This shows that the employees who used the IM and attended the training found the IM much more useful than those who just used the tool.

6.3.3 Comparing the users of the IM and the CM training respondents

As the responses differed, the mean was calculated for the time spent searching. The users of the IM only spent approximately half an hour searching, and the CM training people spent just over one and a half hours searching. The search time for those who conducted the CM training may be greater because:

1. The CM staff placed on the training may need to search more for CM information within their roles
2. The employees that had been on the CM training may not have used the IM.

There was no significant difference found between each group in how successfully they found the CM information they were looking for. Sixty Seven percent of the trained respondents said that they would add the IM to their toolkit and recommend its use to others whereas only 30% of the IM users said that they would place the tool in their toolkit and recommend it to others. This may be due to some of the IM users not being familiar with the subject area of CM and therefore would not find the tool or the information contained within it of any use. People who have an active interest in CM as part of their roles (those attending the training) have shown that a large percentage of them would add the IM to their tool kit and therefore find it useful.

These results are non-conclusive and therefore the results of original sample of questionnaire respondents were compared with those of the third questionnaire. The
relevant statistical tests are used to note if a significant difference has been established and if the significance agrees with the suggested hypothesis.

6.4 Statistical Testing

'Paired samples or repeated measured $t$ test' are used when data is collected from one group of people on two different occasions (Pallant, 2001). The group is evaluated to see if there is a difference between the results for the two occasions based on the same variable (Salkind, 2000). A repeated measured $t$ test was selected for use on the sample of respondents that had answered both questionnaire one and questionnaire three. There was one independent variable, time, which is set at two different levels, before and after the implementation of the IM. One dependant variable will be the response to each specific question measured before and after the IM implementation.

Three questions were selected from the questionnaire to analyse the significance rating. The questions were selected because they were seen as representing the main fundamental benefits of the IM. The first question aims to justify the original hypothesis, to see if the search time had reduced. It was found that the search time between the two groups had reduced with the help of the IM by a total of five hours so the sample size search time had reduced. A paired-samples $t$ test was conducted to evaluate the impact of the IM on the employees search time. There was not a significant decrease in search time from the time 1 ($M = 1.0$, $SD = 0.82$) to the time 2 ($M = 0.6875$, $SD = 0.814$), $t(15) = 1.071$, $p < .301$ (SPSS results, where $M$ is the mean, $SD$ is the standard deviation, $t$ is the time and $p$ is the probability). The reduction in time was not significant enough to conclude a significant decrease in time saved. Therefore based on this $t$ test the hypothesis would have to be rejected.

Stevens (1996) has explored the $t$ test and its results in relation to the sample size used. As the sample size used was limited to the people that completed both questionnaires (16) it was relatively small. He believed that when a sample size is large (e.g. 100) then the 'power is not an issue' However if the sample size is small (e.g. 20, and it was less in this case) then the fact that the result is non-significant may be due to insufficient power. He suggests adjusting the alpha setting from .05 to 0.10 or 0.15. The sample sized used, therefore, could contribute to the test showing a
reduction in the mean value but not the reduction being a significant one. The overall analysis of all of the questionnaire responses did show that the IM on averaged saved each employee 11 minutes a day.

The second question tried to establish how easily the employees found CM information. The amount of time spent searching has not significantly reduced, but other benefits may have been gained by the employees, such as finding it easier to locate the information they require with the use of the IM. A paired-samples t test was used to evaluate the impact of the IM on the employees search success. There was not a significant decrease in search time from the time 1 (\(M = 2.2500, SD = .57735\)) to the time 2 (\(M = 2.6250, SD = 0.80623\)), \(t(15) = -1.861, p < .083\). The ease in finding CM information was not significant enough to produce a significant decrease in time taken. The significance level was higher than that of the previous question but it was not enough to be classed as significant. Generally people had found that their search was easier and the reason for a significance not being recognised could be again due to the size of the sample used.

The last t test conducted was to establish if the sample successfully found the CM information that they were looking for. If people did find more CM information successfully after the implementation of the IM than before, then it would ensure that people are finding what they need and not recreating documents, which has proven to be costly. There was not a significant increase in the search success from the time 1 (\(M = 2.5625, SD = .62915\)) to the time 2 (\(M = 2.6875, SD = 0.79320\)), \(t(15) = -.460, p < .652\). The significant was not enough to conclude a significant increase in successfully found CM information.

Out of all of the t tests conducted it the greatest significance was gained from the question that asked about the ease of finding CM information. This point is important as it displayed that the employees who used the IM found that they located information more easily than they did before the introduction of the IM, therefore reducing their frustration in not finding what they are looking for quickly and creating a more efficient process. There are benefits of the tool and even though they may not have been tested as significant and so could not be considered proven, they did give
an indication of the improvement in the current process and the use of the IM offers the department a saving with a solution that was very low cost. Many lessons were learnt throughout this project and they are explored within the next section.

6.5 Lessons Learnt

The IM project was very innovative in what it was trying to achieve by offering a low cost solution via a signposting tool to help people within a department locate the whereabouts of the information they required. More specifically the IM would:

- Enable the user to have instant access to the location of CM related information sources within the business without leaving their desks.
- Reduce the total amount of time being spent trying to find the answers to user queries.
- Direct people to the correct information experts and not to people who 'think they know'.
- Encourage a more productive working process by reducing the amount of time used to find information.

The project had a number of lessons that could be taken forward on to different projects:

Lesson 1 - Analysing the literature allows developers to gain from others' experience and helps identify best practice.

By reviewing current literature into KM tools to help support the search for information, the author establish the type of tool that would best meet the employees' needs. It was concluded that a signposting tool would unlock the knowledge within the business by encouraging person-to-person contact. Therefore any KM tool development should be done after an extensive literature review is conducted.

Lesson 2 - Close collaboration with the users

This is invaluable as it (1) enables a complete and accurate set of requirements to be gathered, and (2) enables a clear set of targets to be set for the project. The stakeholder group was seen as the steering group for the IM in terms of targets and requirements.
Lesson 3 - Ongoing communication
It is important to keep the user population updated with progress so they continue to feel involved. The IM proposal was documented within two of the department’s newsletters and communicated to the user population through presentations, meetings, news articles and posters. The relationship with the project stakeholders was very close and regular meetings were held with them to ensure the project was meeting both the business and user needs.

Lesson 4 - Understanding the business requirements
A well designed questionnaire which allows unstructured free-form input as well as structured answers to questions is a useful source of data as it (1) allows requirements to be gathered, (2) identifies potential problems, and therefore, (3) enables priorities to be set. It also (4) sets a baseline against which improvement can be measured. The careful design of the questionnaire, accompanied by a well thought-out method of deployment across a business is essential.

Lesson 5 - Involvement in key decisions
Involving the users in design decisions helps ensure the users ownership of the development and makes them feel responsible for the project. This user buy-in then significantly contributes to the success.

Lesson 6 - Maintenance
Attention to the maintenance of a new system is important and needs to be considered in the system design, as keeping a system up-to-date has been shown to be a major source of concern amongst users. This was managed by allocating information source owners which worked very well (see lesson 7). Each employee who owned a source had to sign a document to say that they would always keep the source up to date, and surprisingly people were happy within the business to do this as they felt valued.
Lesson 7 - Allocating information owners
Allocating owners to information and knowledge sources is an effective way of (1) involving users in the maintenance of a system, and (2) ensuring it is carried out more effectively. The importance of ownership within the business was recognised. It is recommended that all information sources should be allocated owners. This will ensure the information is kept up to date and will also support those using the information sources as they will know that there is a contact available if any issues/queries arise.

Lesson 8 - User Population Size
Even though significant findings were not found through the $t$ tests, benefits have been recognised from the use of the tool. Due to the large population the tool would serve, a stakeholder group was required to help create the specifications. It may have been more useful to select random people within the business to also be on the panel so that a wider set of requirements could be gained. Involving people from different levels within the business may have led to a wider acknowledgment of the tool. Another option could have been to produce a tool like the IM for much smaller groups of individuals such as 20-50 and see if, by making it more specific to their needs, they would embrace and use the tool. It is therefore proposed that the developers of any information mapping tool to support employees searching for information should engage with the employees that will be using the tool so that they can tailor the tool to their specific needs. This will be explored further in Chapter Seven.

Lesson 9 - Direct access to information (where possible)
Offering links into specific information sources where they are available on-line would have offered the system users more information without having to contact the owner. The issues relating to this include the possible misinterpretation of data by those who were less familiar with the source. When developing this type of tool, there needs to be careful consideration into the level of access given to the users. If the information is widely known and easy to understand, then links directly into the information would be advised. As the information referenced within the IM was very specific and specialised it was not seen appropriate to link directly into it. Therefore the level of information access is dependent on the type of information held within the tool and the users' familiarity with this information.
Lesson 10 - Post implementation review

Finally, it is important to review a system after it has been implemented and, in particular obtain users' opinions and measurements of use, as this helps identify any initial failings of the system so they can be put right. Measurement of the success of a system also helps obtain buy-in to the new system. It may have given more insight into the project if the last questionnaire had gained more responses. The sample should have been encouraged more with the kinds of techniques that were used within questionnaire one, but due to the time restrictions and the fact that the work towards aim two of this research project had already begun, this became very difficult.

6.6 Conclusion

Chapter Five described the development of an IM tool to provided “signposts” to information and knowledge. By identifying owners and experts of information, the IM was designed to encourage users to make contact with the people that can provide knowledge and expertise in their area of interest. This chapter has given an evaluation of this KM tool and analysed the lessons that could be learned from its development and use.

The development of the IM has highlighted a number of design considerations which require further research to determine the optimum solution. The decision needs to be made regarding the issues to give the optimum conditions for the success of the tool, and the sharing of knowledge within the company. Some of the more significant design decisions requiring further research are:

1. How do users search for information and what search facilities are required in different circumstances?
2. If a browse facility is provided, what refinement criteria will help find the necessary information quickly and efficiently?
3. What is the optimum size of a community to be served by a tool to be developed?
4. What feedback facilities are required for the information source and the IM itself, and how can users be encouraged to use the facilities to provide feedback?

5. How can information sources be rated?

6. Does information age in terms of its usefulness and need?

7. What level of regulation is required to (a) update existing information, (2) add new information? Should users have the freedom to add and update information themselves, should all such changes be controlled by an administrator or is there some form of middle way?

8. Should information ever be deleted from the system? Can information ever be regarded as redundant or is it always required for reference?

These design considerations are not just specific to Rolls-Royce and the IM but are also applicable to the development of KM tools in general. Table 6.3 groups the above points into those specific to Rolls-Royce, the IM and KM tools generally.

Table 6.3 – Design Considerations

<table>
<thead>
<tr>
<th>Design Consideration No</th>
<th>Rolls-Royce</th>
<th>IM</th>
<th>KM tools</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4, 5</td>
<td>1, 2, 3, 4, 5, 6, 7 and 8</td>
<td></td>
</tr>
</tbody>
</table>

It is interesting to see that none of the design considerations are specific to Rolls-Royce’s development of the IM, but are all relevant to the development of KM tools. Points 4 and 5 are specific in their content to the IM, but could be generalised to any KM tool.

These are all research areas needing exploration in detail to establish the criteria for an optimum system for knowledge provision. The success for the IM will be dependent on the users and how they perceive it. Initial indications do appear to show that the IM has indeed helped answer the question, ‘where is the information I am looking for within the company?’ Although the small sample size meant that the success of the IM could not be statistically proven, the results nevertheless give a healthy indication that this is the case. The potential saving to the company runs into
many thousands of pounds. The IM will be rolled out and used to locate tacit as well as explicit information to make the working process more efficient throughout the company.

6.7 Summary

The development and evaluation of the IM has met all of the business requirements stated by the stakeholders and is used to aid peoples search for information. The IM also contributed towards the overall aims and objectives of the thesis in completing aim one and objectives one (first part of), two, three, four, five and six, as shown in Chapter One and Table 6.4.

Table 6.4 - Objectives (One to Six) that achieve Aim One of the Thesis

<table>
<thead>
<tr>
<th>Objective</th>
<th>Achieved</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. To determine what guidelines exist for the implementation of KM tools though the examination of current literature and through interviews with consultants who give guidance to KM practitioners</td>
<td>Chapter Two</td>
</tr>
<tr>
<td>2. To establish though interviews and questionnaires the extent of the problem of locating information in the Submarines business.</td>
<td>Chapter Four</td>
</tr>
<tr>
<td>3. To determine the information needs of the users in the Submarines business though interviews and questionnaires.</td>
<td>Chapter Four</td>
</tr>
<tr>
<td>4. To implement a tool to satisfy the information needs captured in objective three.</td>
<td>Chapter Five</td>
</tr>
<tr>
<td>5. To establish the longer-term success by interviews and questionnaires.</td>
<td>Chapter Six</td>
</tr>
<tr>
<td>6. To establish the lessons learnt from the first aim of the thesis to form the basis for the development of the KM framework for the second aim of the thesis.</td>
<td>Chapter Six</td>
</tr>
</tbody>
</table>

The lessons that were learnt in the implementation and evaluation of the IM have been adopted and developed in Chapter Seven through the implementation of a low cost knowledge sharing tool.
GETTING THE BEST VALUE FROM THE INTRANET: A CASE STUDY

Chapter Preface

Chapters Five and Six documented the development of the IM which offered an innovative, low cost solution to direct employees to the whereabouts of information. In order to validate the lessons learnt from the IM, they were applied to a new project (objective 7a). A similar issue to the one that the IM resolved was discovered within another part of Rolls-Royce. In the newly identified area, the user requirements of the team differed due to their size and infancy. They required help to locate information but also to make others within the business aware of their role and expertise. The issues of the team were explored and the use of the intranet was chosen as the solution as the team could not justify an Information Mapping tool due to their smaller size. This chapter explores whether the principles established on the IM project could be transferred and used to develop other KM tools.

7.1 Introduction

As mentioned within the literature review in Chapter Two, the development of intranets over 30 years ago, started as a US defence initiative and is now one of the main communication mechanisms within companies (Stroud, 1998). An intranet is an organisation specific version of the Internet, allowing access to only those within that organisation. Intranets have become extremely popular ‘to gain competitive advantages, expedite information sharing, provide enhance customer service, conduct on line training, improve productivity and quality’ (Koehler et al, 1997). Intranets are used as vehicles to deliver information across organisations, and are particularly useful when organisations are geographically dispersed.
The spending on intranets is due to exceed that of the internet, as discussed within the literature review in section 2.2. Establishing if any quantifiable benefits could be gained from the use of the intranet was raised and a study conducted within Rolls-Royce Naval Marine to look at sharing information within a department using an intranet to see if it was capable of offering a solution to help employees locate the information they were looking for within a small team environment. The literature available was analysed to determine general success factors and to see if our case study reflected these findings.

The literature review explored the benefits of intranets and how companies have gained financial rewards from their use (McGrath & Schneider 1997). After exploring the literature to determine what was required to produce a successful intranet it was found that the current literature is not comprehensive and does not cover the content of sites, but focuses more on the graphical user interface. Therefore a case study was explored within Rolls-Royce and this is documented within the next sections of this chapter.

7.2 Case Study within Rolls-Royce

Rolls-Royce has a well established intranet site which was developed as a knowledge management tool to help engineering and technological disciples share information and knowledge. It was developed with the look and feel of a Microsoft interface as employees within the company were familiar with Microsoft applications and it would therefore not be necessary to train users, except for the intranet site developers. The intranet currently works on a corporate level proving generic information to all employees and has proven to be successful with over 60% of the population regularly using it. According to Duane & Finnegan (2000) the literature available on intranet development focuses on the visual and technological aspects of the site and not on the information content or user needs.

A case study was conducted within the Total Care Programmes department at Rolls-Royce. This department was selected for study as the users were involved in a wide range of projects and workgroups. The nature of the work involved supporting different projects across the business, with an overall aim of creating total care
contracts. Unfortunately, as a result of this, the team often felt divided as they did not converge on similar projects. The primary focus of the task was to unite the team and allow them to have a knowledgebase that they could refer to. The importance of evaluating the current literature (lesson one from Chapter Six) in preparation for the implementation of a KM system was essential. In doing so, best practices were identified and the developer gained benefit from evaluating the experience of others. Following the suggestions of the literature, the aim of the development was to gain management buy-in, create an overall strategy and work with the users to produce a site that the team believed belonged to them.

As the Total Care Programmes group were small in size (approximately 30 employees) the implementation of an Information Mapping tool was not applicable and other factors needed to be considered as the Total Care programmes TCP team were geographically sparse with members located some 150 miles apart. The information within the site needs to be useful to the users or the site will not be used and will become out of date.

7.3 Site Development

The first step was to assign a web-editor, site co-ordinator and site owner within TCP as outlined by Lovatt in 1997. As suggested by Scheepers & Damsgaard (1997), the intranet was developed in line with the company procedures and did not challenge the social or organisational working methods. In accordance with Blackmore (2001), the requirements were well documented and agreed by the team. An initial meeting was conducted with the nine Derby team members to determine both their individual and team requirements. This also gave them an opportunity to gain insight into the work plan and feel involved in the project development. A presentation (Appendix 13) was given to the team and incorporated the following:

- Meeting objective - ‘To gain agreement with the team to help support the creation of the TCP Intranet site’
- Site Vision - ‘The Intranet site’s primary aim was to increase collaboration within the team and other business units within Rolls-Royce that are also developing (TCP) solutions
- Benefits - Highlight possible project benefits
• Timescales - Projected project timescales
• Site content - Discussed below

An A1 sheet of paper was used to display the proposed site content so that employees felt that it was not something that had already been agreed upon and therefore not flexible to change. The team were given the opportunity to voice their opinions on the proposed content and iterative changes were made. The continued site development involved close contact with specific individuals, for example the finance page which was moulded by the finance employees within the team, so it held links to pages they used regularly or often found difficult to retrieve. Group wide issues that arose were discussed with the entire group to uphold their level of interest and to communicate the project progression. This extensive consultation was one of the lessons gained from the IM project as the value of communication with the end users was very important. The advantage of this project was that the small size meant a stakeholder representative group was not required to indicate the users needs so what was developed was specifically catered to the whole group.

An example of an issue arose when the initial project scope highlighted a need for a more social side to the site which would include social events, a calendar of events and things for sale. As with every part of the site, it was important to establish if the information that the team was proposing was not being replicated elsewhere on the intranet or that it would not be best placed at a higher level of the intranet. It was established that the Naval Marine business already had a social site in existence. Holding a meeting with the team and asking them to decide whether they should have their own social site or if it should be incorporated into the corporate site, made them feel part of the decision making process for the site and therefore responsible for it. An overall decision was made not to include the social page and allow employees to view the corporate site. This level of engagement with the users was not possible with the development of the IM as the user group was too large. Lesson eight from Chapter Six highlights the importance of involving the users in key development decisions even if this is done via a small sample of users who represent the rest.
Another part of the site would hold details of individuals so that employees outside of the team could view the expertise available. As the company had already introduced 'people pages' which were a voluntary set of pages that employees chose to fill in, including past projects, areas of expertise, current projects, and what they would like to hear about. It was therefore suggested that employees populated the corporate employee pages and the created site would link to them. There was a little resistance as some employees were reluctant to complete the pages, but others within the team soon gathered round in support of the project and helped gain their buy-in.

Throughout the duration of the site development the 10 points for a successful intranet site suggested by Blackmore (2001) were complied with as stated below:

1. Regular meetings between the developers and the users were held to discuss the site plans and gain agreement.
2. Goals and aims for the site were stressed at the beginning of the development and the detail regarding the site's functionality was discussed within the meetings.
3. The site content was well documented and feedback was encouraged by asking employees to review the content for correctness.
4. The site relates to individuals' work including project documents and links to relevant corporate knowledge.
5. The site has easy-to-use navigation buttons.
6. In addition to the regular meetings, all users were kept informed of developments with regular emails.
7. Users were encouraged to make suggestions but these would be reviewed by the developers before implementation.
8. All assumptions were discussed with the users and the corporate IT department to ensure there were no misunderstandings.
9. Users were assigned responsibility for passing the relevant information to the developers.
10. The developers and users considered the suggestion to update the site on a daily basis but as the site requirement were to be low maintenance; such frequent updates were considered unnecessary.
After a number of meetings with the users/stakeholders the required content of the site was established. All decisions were based on the consensus of the whole group with individuals given the opportunity to voice their concerns. The main deviation from Blackmore's suggestions is highlighted in point 10 above. It was believed that the initial purpose of the site was for it to be the main source for stable user information that would not change on a daily basis. The long-term aim is for the site to be more interactive with changes made on a regular basis, adding/removing project documents as required.

The final constructed site was then presented to the team before it was launched to see if they believed anything was missing or that anything required changing. The presentation given to the TCP team that was made up of nine team members from Derby who varied in experience, can be found within Appendix 14, and covers:

- Meeting objective - to agree to the site content
- Review project milestones
- Review each area of the site for its content
- Ask for maintenance suggestions

As the Derby based team were working within the Submarines business they were constricted to working on a secured network. It was therefore difficult to share documents with the other half of the team that were based in Bristol. This was a major issue that needed to be resolved as the two teams did not have access to the same documents which could be beneficial to both. After exploring the possible options it was proposed to the team that they share documents via the use of Microsoft Outlook, where they could both place and have access to each others documents. Once the content had been agreed by the team the site was then created. There was a further meeting to obtain buy-in for the created site which was presented to the team. Minor iterations were made and the site was then launched onto the corporate intranet (Screenshots of the site can be viewed in Appendix 15).

The success of the site then needed to be measured to try and gain an understanding into whether the tool had been successful in meeting its original objectives.
7.4 Measurement

The research available on the best evaluation techniques to measure the success of intranet sites is limited. This may be due to the difficulty in establishing accurate measurements (McNay, 2000). The research methodology used was based on the techniques of Koehler et al, 1997, who suggested key measurement techniques of:

- Passively tracking usage.
  A standard quantitative measurement tool was placed on the site to produce statistics such as the number of hits per page, the length of time spent viewing pages, and the most popular entrance page
- Actively soliciting feedback.
  The site, having a prominent feedback page, encouraged feedback from users.
- Conducting ongoing surveys.
  To obtain the user’s initial views, a survey was carried out a few days after the launch to establish if the site had met the users’ perceived expectations. The results of the survey were fed back to the users in a report and are discussed below.

The questionnaire was designed as follows:

- Questions 1-2 were used to identify the number of times people from the team expected to view the site and the number of hours they feel they have contributed to the sites development.
- Questions 3-5 were used to establish the benefits of the site to the individual, team and business respectively and whether people believe these benefits will be realised.
- Questions 6-7 were used to identify problems and concerns people have with the site together with how these problems or issues could be resolved.
- Question 8 was used to identify additional features people would like to see on the site.

The questionnaire (available in Appendix 16) was conducted as a one-to-one interview with each of the nine Derby team members in turn. They received it in excel format via email and were each asked to attend a quick meeting with the author to complete the questionnaire. The questionnaire took approximately 10 minutes to
complete, and contained both open and closed questions. The response rate was 100%. The first question explored the number of times the site would be used.

**Question 1 - How many times do you think you will access the Intranet site?**

Two thirds of the group said that they would visit it on an average of 2 to 5 times a day, showing that the team feel the final version contained useful information. If an intranet site is not being used, it is important to establish why at an early stage, then work towards correcting the errors.

**Question 2 - How many hours of time do you feel that you have contributed to the site?**

Blackmore (2001) suggests it is necessary to include everyone within the team when creating a site. Figure 7.1 shows that this was achieved, as 44% of the group contributed 4 to 5 hours towards the development through interactive sessions.

![Chart to show the number of hours contributed to the site creation](image)

**Figure 7.1 - Chart to show the number of hours contributed to the site creation**

As sites are placed on a corporate intranet, employees from different areas of the business would be able to view the information, so it has to be presented at a level they can understand. Questions 3, 4 and 5 were based on assessing the benefits at an individual, team and business level.
3. What benefits do you hope to get from the site and how confident are you that each benefit will be achieved?

4. What benefits do you, think the site will bring to the TCP group and how confident are you that each benefit will be achieved?

5. What benefits do you, think the site will bring to the business and how confident are you that each benefit will be achieved?

**Question 3 - What benefits do you hope to get from the site and how confident are you that each benefit will be achieved?**

The benefits to the individual were generalised into five categories and each statement from the questionnaire (Table 7.1) has been assigned the relevant category number.

<table>
<thead>
<tr>
<th>Number</th>
<th>Category</th>
<th>Tally</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The general sharing of information</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Team members saving time through accessing the information they require</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>from the site.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Team marketing to enhance individual profiles</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Improved Team working and efficiency</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>A greater understanding of the relationship between the department and</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>the business</td>
<td></td>
</tr>
</tbody>
</table>

As the above categories have been generalised into wider groups there are more tally responses then the total number of respondents for some of the categories. For example, number 2 had 13 (tally) responses that fitted within this title of ‘Team members saving time through accessing the information they require from the site’. Examples of respondent’s answers included; team objectives, referencing information, single point for project documents, financial reports etc, this is how the number of respondents are less then the tally numbers as the same respondent may have written a number of answers (tally) that were then grouped under one heading.
Table 7.2 - Responses given for individual benefits by each respondent

<table>
<thead>
<tr>
<th>Benefits to Individual</th>
<th>Not at all confident</th>
<th>Some confidence</th>
<th>Reasonable confidence</th>
<th>Very confident</th>
<th>Category number</th>
</tr>
</thead>
<tbody>
<tr>
<td>The bringing together of important information</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>It should be the first contact point for information</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Convenient access to information</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>An alternative route for briefing staff about new information</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Help people communicate the message about TCP to people outside team</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Provides an overview of the activities occurring within the team</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Progress of key projects</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Team objectives</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Relationship to business and departmental objectives</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Improve team communication</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>A wider advert for my skills across the team</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>The site will be used for reference information, e.g. CoP</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>By viewing the financial reports we can view the direction of the team</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Mission and vision on the strategy page will give more direction</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>2, 4</td>
</tr>
<tr>
<td>Beneficial to see the contacts through the CoPs</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>It would help to look at the Matrix table to view the current project and to see if my skills could be useful</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>2, 4</td>
</tr>
<tr>
<td>The project documents/processes would be useful to refer to when creating them myself</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>The reports and contracts structure will be useful to view the project documents within a structured way</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>A single place to store important project documents</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>A method to organise project related information via outlook</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Highlight what I do for R-R</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>General awareness of the TCP department</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Easy access to certain documents</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

Table 7.2 shows the level of confidence in the benefits the team believe they could gain from the site. It is positive to see that no one was ‘Not at all confident’ that any of the benefits would be achieved.
After looking at all the points raised it was established that the main benefit to the individuals in order of popularity were:

1. ‘Team members saving time through accessing the information they require from the site’
2. ‘A greater understanding of the relationship between the department and the business’.
3. ‘The general sharing of information’
4. ‘Improved team working and efficiency’
5. ‘Team marketing to enhance individual profiles’

The most prominent point for the individual was that team members could save time through accessing information on the site efficiently and effectively. As the user group was based in two business sites in different cities 150 miles apart, this was a significant benefit. The team found that the information relevant to their work could be accessed from the intranet site, and highlighted this by quantifying the largest benefit as time saving through accessing the information they require faster.

Question 4 - What benefits do you think the site will bring to the TCP group and how confident are you that each benefit will be achieved?

The benefits to the team have been generalised into four categories and each statement from the questionnaire (Table 7.3 and Table 7.4 holding the individual results) has been assigned the relevant category number.

Table 7.3 - Benefits to the team from the site and tally of responses

<table>
<thead>
<tr>
<th>Number</th>
<th>Category</th>
<th>Tally</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Allows for a more efficient way to collaborate with the Bristol team</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>Information and project documents are easier to access</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>A stronger identification for the team and a collaborated direction</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>A raised team profile to the rest of the business.</td>
<td>4</td>
</tr>
</tbody>
</table>
Table 7.4 - Responses given for team benefits by each respondent

<table>
<thead>
<tr>
<th>Benefits to Team</th>
<th>Not at all confident</th>
<th>Some confidence</th>
<th>Reasonable confident</th>
<th>Very confident</th>
<th>Category number</th>
</tr>
</thead>
<tbody>
<tr>
<td>It could help with the collaboration between the Derby and Bristol team</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>A good way of the group to share information which includes the info which has been disseminated through the company</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>The team in Bristol can view the team members in Derby</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Ready access to information</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Stronger sense of team identity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Efficient configuration management of the information within the team</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>It should bring some focus to the team</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>It should enable other areas access to the TCP activity and raise the team's profile</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>The team should be producing documents which are of the same format and to the same standard</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>The strategy page will be a great enabler in directing the team</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Improve visibility of team projects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>The team will be working towards the same goals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>It could be a vehicle to improve communication of TCP information within the team</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>A single place to store important project documents.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>A method to organise project related information via outlook</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Improved communication of what we do to the outside world</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>The team would have access to the finance page allowing them to see how when they book to contacts/expenses, this then effects the finance of the department</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>The integration of the two teams will be more visible as the team in Bristol is often kept separate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Should improve communication across the team</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>It will ensure that everyone within the team has access to consistent data</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>
The main points raised were:

1. ‘\textit{Allows for a more efficient way to collaborate with the Bristol team’.} This should try and bridge the link between the two different locations.
2. ‘\textit{Information and project documents are easier to access’}.
3. ‘\textit{A stronger identification for the team and a collaborated direction’} The team are hoping that the site would encourage a stronger identity and direction, so this must be something that the group feels it lacks.
4. ‘\textit{A raised team profile to the rest of the business’}.

From a business perspective the team believed that the site would enhance their visibility across the business. Other employees could view the site and gain an understanding of the department’s function. Other benefits included enhanced team working towards the same business goals and raising the awareness of the key resources and skills available within the team.

\textbf{Question 5 - What benefits do you think the site will bring to the business and how confident are you that each benefit will be achieved?}

The main benefits highlighted were:

1. ‘\textit{Marketing the TCP team’} this aspect is very important and people feel that the TCP area is not well established within the Marine business.
2. ‘\textit{An efficient team operation with its projects being coherent’} should encourage a more productive team, which will benefit the company.
3. ‘\textit{External benefits to the rest of the business’}
4. ‘\textit{Expert individual skills which could be used across the business’}

The benefits to the business have been generalised into four categories and each statement from the questionnaire (Table 7.5, with each individual response given in Table 7.6) has been assigned the relevant category number.
Table 7.5 - Benefits to the business from the site and tally of responses

<table>
<thead>
<tr>
<th>Number</th>
<th>Category</th>
<th>Tally</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Marketing the TCP team</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>An efficient team operation with its projects being coherent</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>External benefits to the rest of the business</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>Expert individual skills which could be used across the business</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 7.6 - Responses given for business benefits by each respondent

<table>
<thead>
<tr>
<th>Benefits to Business</th>
<th>Not at all confident</th>
<th>Some confidence</th>
<th>Reasonable confident</th>
<th>Very confident</th>
<th>Category Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>It could be used as a marketing tool for the TCP team</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>More efficient team working</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>More coherence between TCP projects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>More visibility of what the TCP team are doing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3, 1</td>
</tr>
<tr>
<td>It should integrate the team, department and business objectives</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Perhaps the capabilities, skills and expertise within the team may be recognised and used more effectively</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1, 4</td>
</tr>
<tr>
<td>Wider visibility of the teams skills and capabilities across the whole business</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1, 4</td>
</tr>
<tr>
<td>Should give confidence to the business that we are aligned with the corporate strategy and vision</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>It will increase visibility of the team so that other business areas can see what we are doing and suggest other uses.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>People outside the department can view the site and see the different activities which are going on within the team.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Using the site we can make the team skills and capabilities more visible across the business.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1, 4</td>
</tr>
<tr>
<td>Reduced duplication of activity due to improved knowledge of what people are doing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Easier access to corporate knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Proactive knowledge management</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>It will improve the visibility of the TCP team</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>
Question 6 - What problems do you envisage the site may encounter and how probable do you think these will be?

The problems that were envisaged by the users of the site have been generalised into four categories and each statement from the questionnaire (Table 7.7, individual responses are shown in Table 7.8) has been assigned the relevant category number.

Table 7.7 - Problems the site may encounter

<table>
<thead>
<tr>
<th>Number</th>
<th>Category</th>
<th>Tally</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Maintainability</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>The interest in the site depreciates</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>There is a time delay between Bristol and Derby sites</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>General conflicts of interests</td>
<td>3</td>
</tr>
</tbody>
</table>
Table 7.8 - Responses given for the problems by each respondent

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible but unlikely</th>
<th>May Happen</th>
<th>Probable</th>
<th>Almost Certain</th>
<th>Category number</th>
</tr>
</thead>
<tbody>
<tr>
<td>People may not look at the site</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Maintenance</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>People asking more questions then the information provided</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Access to the site may be restricted</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>After the initial surge of people viewing the site the interest may wear off</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>The site may not be maintained efficiently</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>After the initial hits on the site the usage could die off</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>At the next company reorganisation the team may not exist within its current form</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Maintenance of the site could become a burden, as people have other jobs to do.</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Maintainability may be an issue</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>People may not view the site</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>We may get a lot of feedback which encourages the site to grow to an uncontrollable capacity</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>It could cause conflict within the team, as certain projects may be focused on more then others</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>There could be a problem where the information displayed represents the wrong message and people misunderstand what the TCP group are/does</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>People not viewing it</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Information is not updated</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Difference in project information submitted</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>The split of the team between Derby and Bristol and NNPPI and Aero networks could lead to confusion</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>The site may not be maintained efficiently and the information may therefore become out of date</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>At the moment Hardev is within the department and looking after the site, when she has gone will other people have as much time to look after the site?</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>If the site is not maintained then success will be limited</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>If a high level of awareness is not given throughout the team then the site will not be used.</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>If a high level of awareness is not given throughout the business then the site will not be used.</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>
This question helps us understand the confidence people have and to also see if there are any risks which we did not include in our risk register. Problems highlighted from the questionnaire are shown in Figure 7.2, which displays the number of users identifying each category of concern.

Figure 7.2 - The concerns of the users of the new Intranet site

Maintainability was seen as an issue by all of the users, as they were concerned that the site content would become out of date. Many intranet sites fail to have employees revisit them when the initial interest vanishes. Three quarters of the group thought this would be a problem, particularly if the information was not regularly updated. From the outset, therefore, careful attention was given to the problem of site content maintenance. Site content was therefore monitored to ensure:

- All information was relevant.
- All information would be low maintenance, requiring few changes.
- An owner was assigned for each individual page to be responsible for its content. This technique is known as 'distributed authorship' and is being used at many companies, for example Siemens Energy & Automation. (McNay, 2000).
Question 7 - How do you think that your concerns could be dealt with?

This question helps gain new ideas for possible solutions to risks. For the main points, such as maintainability, suggestions included placing owners on pages so that they are responsible for the maintenance of that particular page. To try and encourage people to use the site, suggestions included advertising and adding new areas to the site. A list of all of the responses can be found in Table 7.4. These have been generally grouped into four sections.

Table 7.9 - Concerns and possible solutions

<table>
<thead>
<tr>
<th>Concerns – Generalised</th>
<th>Possible solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Maintainability</strong></td>
<td>The site maintenance needs a facilitator to prompt people into maintaining their areas</td>
</tr>
<tr>
<td></td>
<td>To give each page an owner who is responsible for the information on that page (Name the person on the page - so that people know who to contact)</td>
</tr>
<tr>
<td></td>
<td>The administrators need to be effective, and keep on top of the maintenance</td>
</tr>
<tr>
<td></td>
<td>Making the pages dynamic and interactive</td>
</tr>
<tr>
<td></td>
<td>Making use of effective time management to keep the site up to date.</td>
</tr>
<tr>
<td></td>
<td>The actions placed on the team need to be acted on by the TCP manager</td>
</tr>
<tr>
<td></td>
<td>Make it very easy to update</td>
</tr>
<tr>
<td></td>
<td>People need to be responsible for certain areas of the site. If they have not got the time these updates need to be highlighted to others in the team.</td>
</tr>
<tr>
<td></td>
<td>We need someone with the same knowledge who has the time to continue the work which Hardev has done</td>
</tr>
<tr>
<td><strong>2. The interest in the site depreciates</strong></td>
<td>At the moment it is not a problem but to remind people its there it could be an idea to hold odd update meetings (e.g. Twice a year)</td>
</tr>
<tr>
<td></td>
<td>We could use fliers to try and gain peoples interest</td>
</tr>
<tr>
<td></td>
<td>The nominated people who maintain these areas, need to make the group aware when they make a change - could be an automatic flag or an email.</td>
</tr>
<tr>
<td></td>
<td>We need to promote and advertise the site. Constant communication about the site development.</td>
</tr>
<tr>
<td></td>
<td>Corporate communication to support use of Intranet</td>
</tr>
<tr>
<td></td>
<td>We could advertise within the company magazines that it is there.</td>
</tr>
<tr>
<td><strong>3. There is a time delay between Bristol and Derby sites</strong></td>
<td>Survey that people have access</td>
</tr>
<tr>
<td><strong>4. General conflicts of interests</strong></td>
<td>The feedback which is gathered needs to be selected within a structured manor with all ideas being captured officially.</td>
</tr>
<tr>
<td></td>
<td>Communication is the key, making sure that everyone is happy and making it clear that the site is for the team and not just for individuals</td>
</tr>
<tr>
<td></td>
<td>By gathering feedback from the wider community from people who have viewed the site and seeing their reactions.</td>
</tr>
</tbody>
</table>
Question 8 - What additional features would you like within the site?

The additional features suggested are listed below:

1. Links to all R-R support sites - Civil, Submarines, Defence Aero, Commercial Marine, Corporate.
2. Comments board - viewable by all site users so have a direct link to people’s emails from either the people profile pages or the site. (Resources and skills)
3. The appointment notices - Aero network that is at R-R corporate level.
4. Balance score card - Naval Marine
5. To communicate the site to HR and any resource managers within the business
6. It may be useful to have a link to the 'Local operating Procedures for Finance' which is held in the quality system
7. Link to the local marine job vacancies

7.5 Results Summary

The main findings from the questionnaire are listed below:

* Everyone within the team has contributed towards the site content and expects to visit the site at least once a week, with the average being between 2 to 5 times.

* The main benefits to the individual, team and business are summarised below;
  * Individual
    * Team members will save time through the access to the information they require from the site
  * Team
    * It will allow for a more efficient way to collaborate with the Bristol team
  * Business
    * Marketing the TCP team

* The main issue concerned with the site is maintainability. To resolve this, the decision was made to allocate page owners.

* The suggestions for new functionality for the site will be proposed to the team and the ones agreed will be added to the site.
7.6 Does the Size of the Sample Matter?

The intranet site developed was a success, fulfilling the user requirements as shown in Section 7.5. However, could this be due to the small size of the group it was developed for? There is no conclusive research to determine the effect group size has on the use of an intranet site. A smaller group allows more interaction with the developer so that the users' needs can be specifically catered for. A larger group may have to allocate stakeholders who represent the group. However, this could hinder the site development, as it is difficult to make generalisations for large groups based on a small sample. Within large organisations it can be difficult and costly to develop sites based on small groups rather than a corporate wide intranet.

In addition, it is possible that consultation with the users is more effective with a small group, as everyone has the ability to voice their opinions without feeling intimidated by the group size. Intranet developers need to establish if their intranet site offers information the users actually require. To improve the relevance of their intranet content, Rolls-Royce are now trying new ways of developing sites by training employees within different business areas to be responsible for gathering the specifications, creating and maintaining the site.

7.7 Review of the Lessons Learnt from the 1M Case Study

Chapter 6 concluded the work conducted on the 1M and identified the lessons which could be adopted by other projects. The lessons that were taken from the IM included:

Lesson 1 - Analysing the literature allows developers to gain from others' experience and helps identify best practice.

Before the Intranet site development began, current literature was reviewed and best practices established to ensure the site did not make the same mistakes other sites had previously.
Lesson 2 - Close collaboration with the users
The group meeting were used to work closely with the team and help them feel involved within the development, both in understanding their user requirements and to establish targets.

Lesson 3 - Ongoing communication
The intranet project was fortunate in that the target user group was small and, therefore, it was easier to collate the group together to discuss the site content, format etc. The IM developers tried to handle the large group by communicating the tool through departmental newsletters, presentations, meeting etc. In both case studies the relationship with the project stakeholders/users was very close and regular meetings were held with them to ensure the project was meeting both the business and user needs and expectations.

Lesson 4 - Understanding the business requirements
Whilst the IM used a questionnaire to understand the business requirements due to the large user population, the development of the Intranet site could hold meetings with the user group to gain their requirements. Regardless of the size of user group, the development of any KM tool needs to include the users, whether they are a representative sample or the whole group.

Lesson 5 - Involvement in key decisions
Due to the small user group size any major decisions were made via group consultation.

Lesson 6 - Maintenance
The maintenance issue was highlighted as important for the IM and the intranet site but the issues were dealt with differently in each case as the IM had information source owners. The Intranet site on the other hand was kept as low maintenance as possible. Editing access was given to the whole team so they could update it when required.
Lesson 7 - Allocating information owners
The IM identified information source owners who owned and updated their sources. Each employee who owned a source had to sign a document to say that they would always keep the source up to date, and surprisingly people were happy within the business to do this as they felt valued. It was felt that the information on the site would not be updated daily except for the uploading of project documents for which the department members all had the access necessary to do so. There were a few areas of the site that were assigned owners for example the Finance pages were owned by the Finance Manager and she was the only person who was allowed to update the page due to the sensitivity of the information.

Lesson 8 - User Population Size
The development of the IM has proven that a tool for a larger group can be useful but it is recommended that a small representative group of users should be included as stakeholders. The development of the Intranet site was relatively straightforward as the smaller user size meant the requirements were easier to capture and, therefore, a tool was developed that met the user’s needs.

Lesson 9 - Direct access to information (where possible)
The Intranet site linked directly to most documents referenced as the content of each one was reviewed. Where documents were more sensitive, there were links in place, but access was controlled.

Lesson 10 - Post implementation review
As the group size was small it was easier to encourage the sample to respond to the post implementation questionnaire as they were all located in the same building and well known to the author.

The 10 lessons captured from the development of the IM have all been applied to the development of the Intranet site. As the user’s requirements for each tool differed and the application was in a different part of the business, it is still interesting to see that all the lessons are still applicable to the development of another KM tool.
7.8 Conclusion

Blackmore’s theory was adopted and worked well except for one revision to the original list (detailed in section 7.3). Blackmore suggests sites should be updated daily but, as the site requirement was for a low maintenance site, such frequent updates were considered unnecessary.

After reviewing the questionnaire results, the conclusions obtained were that the team were pleased with the site and will go on using it. It allowed the members to have all of their relevant information collated within an easily accessible central location. Why was it a success? Attention to the users’ needs played a big factor in the intranet’s success. The main lesson learnt from this case study, is that intranet sites are developed to provide employees with the information they need to complete and do their jobs. If information is not present then employees are wasting time looking at colourful HTML pages. This is both inefficient and costly, and will ultimately lead to the sites becoming out of date and unused. The same principle can therefore be applied to KM tools as employees will only use the tools if they can aid them in their tasks.

Rolls-Royce has a very efficient intranet site which delivers information to all employees at a corporate level. Smaller departments are using the advantages of the intranets to allow them to share information which is department specific. It is successful if the site contains the information the users require. It was felt that the current literature available on intranets did not detail the importance of the information contained within the site and how this information should be collected, though it did provide useful guidelines for intranet development such as those from Blackmore.

Within this site’s development, regular meetings were conducted with the users to ensure that the information within the site met their needs. This may have been made easier by the small size of the user group. For a larger group, attention must be paid to ensure there is adequate consultation with the users. For example, prototypes and plans for the site could be emailed to users to give them an opportunity to raise issues.
Further research is required into the effect of the size of the user group on the success of an intranet.

This chapter has established that a successful intranet requires careful planning and consultation with the users. Above all, to avoid failure it is important to ensure the information is relevant and maintainable. A site would be better without an item of information if it cannot be kept up to date as this could potentially lead to the whole intranet losing credibility. Rolls-Royce is continually taking active steps to ensure its intranet sites are tools employees want to use, by being easy to use, relevant and easy to maintain. The author suggests that other companies would benefit from following the principles employed by Rolls-Royce in the development of their intranet sites.

7.9 Summary

By reviewing the lessons that were learnt from the IM project, it can be seen that the same lessons can be applied to a different application with different user requirements. The importance of consulting the target users was fundamental to the success of the intranet site. The effort that was made to embrace the concerns and ideas from each of them within the site development paid off. The idea of allocating owners to the different sources of information from the IM was also used and embraced by having page and content owners. One thing the IM lacked was the online access to information and this was achieved with the intranet as documents were either directly linked to or placed within the Microsoft Outlook folders.

It has been established that KM tools if implemented need to be focused towards the users and their needs, for them to be successfully used. Establishing if users have different KM requirements within a business is an area that will be explored in Chapter Eight.
Chapter 8

Establishing knowledge needs

CHAPTER 8

ESTABLISHING THE APPROPRIATE KM TOOLS TO SATISFY THE KNOWLEDGE NEEDS

Chapter Preface

The case study into developing the intranet site established that KM tools need to be focused towards the users needs to be successful. Even if the implementation of KM tools involved company employees, can companies still assume that all KM tools are useful to all their employees? This chapter explores the knowledge needs of employees and tries to establish guidelines for companies looking to implement KM tools.

8.1 Introduction

With the vast amount of KM research currently available, it is still surprising to see that an 'Estimated, 84% of KM programmes exerted no significant impact on the adopting organisation' (Lucier & Torsiliera, 1997). To try and establish why KM projects have failed, many researchers (Lin, Yeh and Tseng 2005, Chua & Lam 2005) have analysed case studies and highlight the common failings.

Lin, Yeh and Tseng (2005) created a list of six KM gaps that may occur in KM projects causing them to fail. Gap 4 stated that 'limited employee involvement during initial documentation review resulting from difficulty in attracting participants, and it results in an incomplete knowledge repository'. Involving the employees and focusing KM to their needs should be the main priority of any KM project. KM projects must focus on the importance that should be placed on a company's most valuable asset.
and skill base, its employees, who give a firm its competitive advantage (Kotelnikov, 2006).

This chapter proposes to establish employee’s knowledge needs in terms of the tacit and explicit knowledge used. Desouza (2003) defines explicit knowledge as ‘words and numbers shared in the form of data, scientific formulae, product specifications, manuals, and universal principles’. Tacit knowledge is ‘highly personal and hard to formulise, thus making it difficult to communicate or share with others’ (Nokaka & Takeuchi 1995).

Current literature covers the complexities of tacit and explicit knowledge (Williams 2005), but the root of this area of research steams from Nonaka and Takeuchi (1995) as displayed in Figure 8.1.

![Figure 8.1 - The relation between tacit and explicit knowledge, created by Nonaka and Takeuchi (1995)]

Figure 8.1 shows that tacit knowledge is passed through people via the medium of teamwork and coaching, known as socialisation. Tacit knowledge if captured and shared can be externalised into explicit knowledge, which is very useful within an organisation as it captures knowledge stored within people.
Chapter 8 Establishing knowledge needs

Within the Combination phase, the explicit knowledge is then systemised and classified so that it can then be internalised by understanding or learning from the explicit knowledge to complete the cycle. The early development of KM led the focus to be on the capture, storage and access of explicit knowledge. Within time the importance of tacit knowledge has begun to emerge. As ‘Explicit knowledge aids tacit knowledge’ (Quintas, P and Ray, T, 2002) most KM theorists believe that both are required to develop successful KM.

8.2 Case Study

When companies initially embark on KM the budget is often restricted. Companies have to make sure that the activities they carry out are successful and focused to their employees needs. A case study was conducted within the Naval Maine business of Rolls Royce, Derby to gage an initial perception from employees of their knowledge needs.

Two groups were chosen to partake in the study from two different business areas, Support and Safety. The groups were briefed about the reason for conducting the meeting and shown a poster (Appendix 17) aiding the explanation of explicit and tacit knowledge. The meetings were conducted as ‘focus groups’. The focus group concept is about 50 years old, with its roots dating back to World War II, when a group of sociologists were asked to investigate how their audiences received military propaganda films (Luntz, 1994). Focus groups can be used during a study perhaps to evaluate or develop a particular programme of activities (Race et al 1994) but in the case of this study they were used to explore the importance of issues (Morgan 1988).

Focus group research is based on ‘facilitating an organised discussion with a group of individuals selected because they were believed to be a representative of some class’ (Garson, 2006). As only a representative sample is selected, it can therefore be difficult to generalise findings to a whole population because of the small numbers of people participating and the likelihood that the participants will not be a representative sample (Garson, 2006). Taking this into account, the author still believed that the focus group would be the most appropriate method in gaining an
insight into the employees knowledge needs as the team sizes in question were small so a generalisation may still be possible.

As there were a small group of representatives from each of the two business areas, it allowed for group discussion when answering questions rather than individual responses as you would get from a questionnaire or an individual interview. By allowing the group to discuss the answers to questions and collectively agree on an answer it was found that the answers considered different experiences and were more general, rather than being extreme based on individual responses.

Each group exercise took approximately an hour. The support group consisted of 6 people and the safety group consisted of 4. The author facilitated the meeting to give each group an opportunity to voice their opinions on KM. The main aim was to try and establish if employees preferred to use tacit or explicit knowledge within their working roles. There were a number of open questions directed towards the group and they were discussed with the answers to the questions being documented in Appendix 18.

The facilitator had a questionnaire (Appendix 19) that the respondents were asked to complete alone. Each of the focus group members was asked to complete the questionnaire independently by filling out a paper copy before taking part in the focus group. The questionnaire included a list of KM tools that are available across the corporate business. There were four questions that they were asked about each KM tool. The questions are listed below with a breakdown of each question and an explanation to the reason for each question listed below:

1. *Are you aware of the tool?* This question was used to establish the awareness of the tool by the group. The tools were split into a list of tacit and explicit tools.

2. *Have you used the tool?* Awareness of the tool does not mean it has been used, so this question was used to establish if they had actually used the tool.

3. *Have you contributed to the use of the tool?* For example an employee may have been involved within a lessons learnt review but not explicitly used the tool themselves.
4. *Frequency against each tool?* This question was used to try and establish the number of times people had used the tool.

Each focus group was given a list of business advantages and disadvantages for both tacit and explicit knowledge (Appendix 20). The list consisted of a table that, firstly, listed several advantages of explicit knowledge, such as 'explicit knowledge is auditable', 'explicit knowledge can be stored and searched effectively', 'explicit knowledge can be transferred quickly via PCs' etc. Each one of the advantages was illustrated with examples so that the respondent could understand its relevance. For example, 'explicit knowledge is auditable' was illustrated with the example of the auditing company that comes in to audit the business. The next table then listed four disadvantages of explicit knowledge. These included, 'explicit knowledge can age so needs constant maintenance' and 'explicit knowledge can be liable to corruption'. These were again illustrated with examples.

The tacit knowledge part of the document is again split into two tables covering the advantages and disadvantages. The advantages included 'tacit knowledge can be just-in-time' and 'the transfer of tacit knowledge can be rewarding/empowering'. With the tacit knowledge table a number of assumptions had to be documented such as, 'people are willing to share knowledge' and 'the person is available to answer your query'. The disadvantages of tacit knowledge were documented in a table below the advantages. Examples included, 'if tacit knowledge is not formally captured then it could be misinterpreted' and 'people may leave the company with important tacit knowledge'.

Each team involved within the focus group activity (Safety and Support) collectively was asked to rate every point with a level of importance. For example the first advantage under tacit knowledge was 'Tacit knowledge can be JIT (Just-in-time)'. The weights assigned ranged from 1 to 5, with 5 being extremely important. The participants were also asked to add a frequency that would be used to try and determine the likelihood that an event would occur with 5 being the most likely, as it was important to understand the likelihood that an event would occur against the impact of the event occurring. It was seen better to allow the exercise to be conducted within a focus group as people working within the same business group come from
different backgrounds and therefore may be unduly influenced by their own previous business experiences. Within the focus group, people spoke of their own experiences but tended to restrict themselves to talking about experiences most relevant to their colleagues and these were discussed to create a collective rating rather than having extreme individual views.

At the end of the scoring exercise there were some questions that were given for discussion such as ‘which type of knowledge do you prefer to use, tacit or explicit?’

8.3 Results

Both groups agreed that they used tacit and explicit knowledge equally. The support group agreed that when dealing with a query they used tacit knowledge first to help them establish where to start. Tacit knowledge sharing is encouraged through some processes within the company, especially when teams are brought together. It is also recommended that experts from other areas within the business should be brought into projects to offer their tacit knowledge as expertise and experience. One surprising factor was that both teams agreed that it would be bad to reward people for sharing knowledge as in techniques such as ‘knowledge points’, where employees reward points to other employees for sharing their knowledge with them. These then equate to company rewards e.g. holidays etc (Adelmann and Jashapara, 2003). The two teams believed that it would be unfair, as knowledge sharing opportunities may be more prominent in certain job roles than in others.

The groups preferred tacit knowledge because:

- It is quick.
- They liked people contact.
- It is often found that other people do not want to put their knowledge on to paper or electronic equivalent so it is better to get these people to talk about their knowledge.
- Sometimes there is too much information to look through.

One aspect the groups felt strongly about was the company culture, as both groups agreed that change was needed. They both agreed that the boundaries within the
company were too prominent and that they found the interaction between the staff and the managers to be too sparse, especially when it came to gaining recognition. The company also needed to encourage KM from both a tacit and explicit prospective by having group building exercises and providing more documented knowledge for people to access.

The above study allowed an insight into whether teams within Naval Marine prefer to use tacit or explicit knowledge. Each group discussed the points highlighted and came to a collective answer. This was believed to be a better method to get the views relevant to each group's department context.

8.4 Analysis of Results

After analysing the results from the two groups and multiplying the importance value against the frequency value (likelihood an event would occur), it was concluded that the Safety team regarded explicit knowledge to be more important whereas the Support team rated tacit knowledge as more important. Even though the gap between the two groups' knowledge preferences was small, it still emphasises the importance of establishing the correct KM tools for each working area.

Consideration of the two groups studied, in fact, gives a likely explanation for their differing preferences. The Safety team work in a highly regulated environment. An explicit knowledge environment that documents all the rules and regulations is, therefore, an advantage. The Support team studied, on the other hand, were looking for innovative ways of providing total care support packages. This team, therefore, needed to be free thinking, building on ideas that are new, not fully formulated and, therefore, unlikely to be explicitly documented. These different working modes illustrate why different teams may have different needs and why it is necessary to identify the best tools for each team.

Once the knowledge needs have been established, the tools that can help encourage or capture this knowledge need to be made available to the group. The different KM tools available within the business need to be segregated into the types of knowledge
they encourage, as shown in Table 8.1. A detailed explanation of each tool can be found in Chapter Nine section three.

Table 8.1 - Different KM tools and the knowledge type they support.

<table>
<thead>
<tr>
<th>KM Tool</th>
<th>Tacit knowledge</th>
<th>Explicit knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lessons Learnt Logs</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Structured Knowledge Audits</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Capability Intranet</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Benchmarking</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>TRIZ</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Lessons Learnt Reviews</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Hazard Identification Prompt Lists</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>People Pages</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Communities of Practice</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Telephone Conferencing</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Video Conferencing</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Peer Assist</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Story Telling</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>DreD</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Knowledge Acquisition Modelling Process</td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

Table 8.1 has split the KM tools available within the Roll-Royce Aero business into those that encourage tacit knowledge e.g. lessons learnt reviews and explicit knowledge e.g. lessons learnt logs. The Rolls-Royce Aero business has KM tools that are more established than those in other business units. Chapter Nine therefore explores the use of KM tools within the Aero business. This was done by the dissemination of a questionnaire which is described in detail in Chapter Nine Section 9.3.

To illustrate the use of the focus group results, the author has taken one of the questionnaire results from the questionnaire detailed within Chapter Nine (section 9.3). The question asked the respondents to rank if they believed that if specific KM
tools would be of use to others within the business. The results are displayed in Figure 8.2.

Figure 8.2 - KM tools and their benefit to others.

A KM tool may be very helpful to some people and may score well within the questionnaire results for usefulness as a result, but if it is a rather specialised tool this does not mean it will be as helpful to the company as a whole. The question therefore gets around this issue by asking the respondents how helpful the respondents believed the tool would be to others. The company intranet and the capability intranet scored the highest from all of the tools. Based on Figure 8.2 the tools were rated by their perceived benefit and placed in Table 8.2.

The list in Table 8.2 is the ranked list of KM tools that the employees thought would be most useful across the company. They have been ranked in order of usefulness specifically for the Support team as they believed that they required more support for their tacit knowledge and this was the part of the business sponsoring this research. The list could be used by someone looking to implement KM to help guide them in
the decision process of the tools that would be best to implement and within what order.

Table 8.2 - KM tacit tool usage

<table>
<thead>
<tr>
<th>Rank</th>
<th>KM Tacit Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lessons Learnt Reviews</td>
</tr>
<tr>
<td>2</td>
<td>Telephone conferencing</td>
</tr>
<tr>
<td>3</td>
<td>Peer Assist</td>
</tr>
<tr>
<td>4</td>
<td>People Pages</td>
</tr>
<tr>
<td>5</td>
<td>Communities of Practice</td>
</tr>
<tr>
<td>6</td>
<td>Story Telling</td>
</tr>
</tbody>
</table>

8.5 Recommendation

Businesses that are looking to embark on KM or wanting to check if their current tools are meeting the employee's requirements could employ the exercise conduced within the Naval Marine business. By ranking the advantages and available tools by their use, a comparison can be made to see if the tools selected meet the requirements of the team. For example with the safety team the emphasis has been placed on the explicit knowledge and by studying the notes made during the focus group sessions it became apparent that tools such as the Intranet and structured knowledge audits would be useful. From a tacit perspective the use of peer assist, people pages and communities of practice would be useful for the Support team to explore.

8.6 Conclusion

This chapter has established that, within the same company, employees' knowledge needs differ. Current literature does not focus on this concept. By analysing the tools used within Rolls-Royce a greater understanding needs to be established into the company's experiences in using those tools. Chapter Nine explores the use of these tools and aims to bridge the gap between establishing employees knowledge needs (Chapter Eight) and which KM tools would best suite those needs.
Chapter Preface

Chapter Nine fulfils objective 7c by reporting the results of a survey of KM tools across the Aerospace business to discover their perceived usefulness. By distributing a questionnaire to establish the successfultness of KM tools within Aerospace business, lessons were learnt into how these tools have been embedded into working practices and how they have been successful in providing what the users required. The results proved an indication to why some KM tools might be more successful than others.

9.1 Introduction

There are a wide range of KM tools that have been developed over the past few years. Some companies opted to use KM consultancy firms such as KMx, KPS and Right Now Technologies (2005) to provide them with the KM tools they required. Other companies have chosen to develop and implement their own suit of KM tools and this is the focus of Chapter Nine. Current literature promotes the usefulness of KM tools such as Communities of Practice (CoP), Peer Assist, Yellow/Employees Pages, etc., (Collison & Parcell, 2001), but there seems to be a lack of analysis carried out on the usefulness of the tools.

The mid-1990s saw a surge of publications, conferences and consultancy activity in the Knowledge Management area, and many organisations woke up to the challenges of managing their knowledge’ (Quintas, Ray & Little 2002).
There are many different approaches that companies have taken in KM. Carillo has tried to segregate these approaches into three types (Carillo, 2004):

1. IT perspective - focus around delivering KM tools
2. Human resources perspective - reliant on employees to deliver the solution.
3. Combination - a combined approach that focuses on both IT and the Human aspects of KM.

Rolls-Royce Aerospace are ahead of Marine in the deployment of KM, so the decision was made to look at them to see what lessons could be learnt. Rolls-Royce Aerospace opted for a combined approach with the majority of the work to date, focusing on the implementation of KM tools. The first KM tool to be introduced within the Aerospace business was the Capability intranet in 1996. The capability intranet was an extension of the current intranet that focused on capturing best practice. The development of the KM programme at Rolls-Royce has been recognised as being in the top 20 of the MAKE (Most Admired Knowledge Enterprise) list, for the past few years. Rolls-Royce Aerospace has continued its KM programme with the implementation of new tools and techniques and research conducted with a number of universities. This has ensured that the Aerospace business is aware of the latest tools and techniques and is, therefore, up to date with the latest advances in KM.

Current literature covers many different types of KM tools (Skyrme, D. J 1998, Collinson & Parcell 2001) but the usage of the tools does not seem to have been explored. The aim of this chapter is to analyse the usage of KM tools across the Aerospace business and to make recommendations based on the findings to Naval Marine.

9.2 Methodology

There are many techniques recognised for measuring KM, including the Balance Score Card (Haghi 2004). Current research however, does not detail the best way to measure the usefulness of implemented KM tools. A questionnaire was therefore created to try and establish this. A member of the KM team in Aerospace selected 20 company representatives who could meaningfully complete a questionnaire on KM
tools (Appendix 21). Out of the 20 employees within the Aerospace business approached to complete the questionnaire, 12 responded. They included individuals from different professional backgrounds e.g. Team leaders, Technologists, Commercial Executives etc. These individuals also specialised in different business areas such as Stress, Business Capability, Weights and Customer accounts.

The questionnaire was created in excel and sent to the respondents via email. They were each given two weeks to complete the questionnaire and return it to the author. The questionnaire was composed of 11 questions. The first three questions were aimed to gain an understanding of the respondent. The questions were:

1. Name?
2. Which Business do you work for?
3. Please name your current business unit?

Questions four to eleven were based around specific KM tools. The respondent was faced with a list of the KM tools and the following questions were asked for each tool.

4. On average, how often have you used the tool? The respondents were given drop down options of:
   a. Never heard of the tool
   b. Never used the tool
   c. Daily
   d. Weekly
   e. 6 monthly
   f. Yearly

5. Why have/do you use the tool? This question aimed to gain an understanding into the reasons for using the tool. The respondents were again given a drop down with several options to choose from:
   a. It's the only way to complete the task
   b. It's easier than the alternative method
   c. More effective than other methods
   d. Because it's good practice to use it
e. Because someone else gains benefit
f. Because it is part of the processes
g. Because I enjoy it

6. **When did you first use the tool?** The respondent was given six options to choose from:

   a. In the last month
   b. In the last 3 months
   c. In the last 6 months
   d. In the last year
   e. In the last 2 years
   f. In the last 3+ years

For those who had not used the tool before, they were asked the following questions.

7. **Why have you not used it? (Please ignore if you use the tool)**

   a. Not available/unaware of its availability
   b. Didn’t think the tool would be of any benefit
   c. Thought it would be too time consuming
   d. Thought it would be too difficult to learn
   e. It is not part of the process
   f. Lack of resource

**Do you think that it may benefit others?**

   a. Yes Definitely
   b. Probably
   c. Possibly
   d. Unlikely
   e. Don’t Know

8. **Do you think everyone who could benefit is using it?**

   a. Yes Definitely
   b. Probably
   c. Possibly
   d. Unlikely
e. Don’t Know

9. How many other users, do you think use the tool?
   a. 0
   b. 1 to 5
   c. 6 to 20
   d. 21 to 50
   e. 51 to 100
   f. 101+

10. Generally how often do you think other people use the tool?
   a. Never
   b. Daily
   c. Weekly
   d. Monthly
   e. 6 Monthly
   f. Yearly

At the bottom of the questionnaire was a comments box which the respondents could use to add any additional comments. The questionnaire should not have taken more then 15 to 20 minutes to complete.

9.3 Results for Each KM Tool

The findings regarding the KM tools have been summarised according to the questionnaire results.

Lessons Learnt Logs

The logs enable employees to share their experience by contributing new knowledge and experience. If something has been learnt whilst working on a particular project, an employee can go into the logs via the intranet and post a new lesson. They are also useful for those embarking on a new piece of work as they can reference the logs to make sure there are no related lessons they need to consider. One third of the group used it once a month. The tool seems to be well known across the business as only
one person did not know about the tool. The majority of the team have found benefit in using the tool and would therefore recommend its use to others.

**Structured Knowledge Audits**

These allow managers to understand their knowledge needs and assets, the risks and what they should do to manage those risks. Half of the respondents had used the tool but the other half were not aware of the tool's existence. The main view from the sample was that the tool was not used widely across the business. Those that had used the tool found benefit and believe that others could also gain benefit.

**Capability Intranet**

This encourages the online global sharing of process, technology and best practice. The tool is accessible globally by all Rolls-Royce employees who have access to the intranet. The editing is restricted to only those who have been on the training. The majority of the sample that used the tool had done so for a number of years. They found it useful and they suggested that the tool could benefit others.

**Benchmarking**

Benchmarking is a method that establishes strengths and weaknesses across a wide range of KM issues, capabilities and establishes improvement targets and measurements. The tool is based on a questionnaire that employees within a department would complete. No one within the sample had used the tool and one person had not heard of it. The main issue concerning the tool is that employees found it 'not available' or were 'not aware of it'. Due to a lack of understanding of the tool, employees cannot recognise any value. The tool is very successful in displaying the strengths and weaknesses in KM, across different business areas. It is therefore a good tool to start with when embarking on KM and needs greater promotion across the business.

**TRIZ**

TRIZ is a collection of tools that has been developed from an analysis of over 2 million of the world's best patents. Primarily used by designers, it is a tool that helps generate innovative ideas and solutions for problems. The questionnaire analysis showed that employees had heard about the tool but had never used it. This is
probably due to the tool being catered for those within the design community. Even though the sample did not use the tool, they had still perceived it to be useful to others.

**Lessons Learnt Reviews**

A lessons learnt review is a facilitated session held at the end of a key phase in a project. It is a simple process in which lessons are captured and shared with current and future projects to avoid past mistakes and to repeat past successes. The tool can be used by anyone within the company working on any type of project. The questionnaire revealed that 83% of the sample used the tool and everyone had heard of it. The general consensus from the sample was that it is not being used enough by others within the company.

**Hazard Identification Prompt Lists (HIPLs)**

The HIPLs are lists of 'things to think about' when tackling a new problem or project. HIPLs can be used as triggers for use in risk identification sessions, or used as a reference tool as early as possible during a package of work. HIPLs are mainly used by the engineering community when working on a new project.

Only half of the sample seemed to have used the tool, the other half either hadn't heard of it or hadn't used it. One quarter of the sample said that the tool was 'not available' or were 'unaware of its availability' and others said that they did not think that it 'would be of any benefit'. Over half the sample could see benefit in the tool and that those who could gain benefit from the tool were using it.

**Employees Pages**

These gave a means of finding employees based on what they do and their experiences. The pages help to put you in touch with someone who can help. The people pages cover all employees within the business and are accessible by everyone via the internal intranet. Half of the population had 'never heard of' or 'never used' the tool. Half of the sample that had heard of the tool believed it could be of benefit to others.
Communities of Practice
This is a facilitated network of employees, sharing knowledge and expertise across organisational and geographical boundaries. Communities of Practice (CoP) are based around topic areas such as ‘Knowledge management’ or ‘Graduate trainees’. They are accessible by all employees via the intranet and people can add themselves to groups they think may be of interest to them.

Just over half the sample used the tool, with most of them using it every six months. For a CoP to be successful, the usage needs to be more frequent. Employees within the sample that did not use the tool had the opinion that using the tool would not bring then ‘any benefit’ as it would be too ‘time consuming’. Three respondents did not know that the tools existed. CoP do not seem to be living up to employees expectations as those who have used the tool cannot find any benefits to make them recommend the tool to others.

Telephone Conferencing
Widely available to global employees and a more economical alternative to travel, telephone conferencing is a very convenient way to speak to people in different locations. The tool is very well used and employees can see the benefit with just fewer than half the respondents saying it is ‘the only way to complete the task’. There is speculation that the entire population could benefit from using the tool.

Peer Assist
This involves a meeting to get new project teams to learn from similar and previous experience from across the organisation. Half of the sample had never used it or heard of it, but the other half of the sample that had used the tool seemed to like it. Most of the sample perceived that others used the tool regularly. The lack of use of the tool could be a ‘cultural issue’ as employees may be reluctant to gain outside expertise about their projects.

Story Telling
This is a reworking of an old KM technique based on indigenous cultures. When the time spent by employees in face-to-face knowledge sharing is considered, this can be powerful.
This tool is still in its piloting stage so it was not surprising to see that eight employees had never heard of it and three further employees had never used it. Employees may be using the principal of storytelling several times a day, but are not aware of it as a KM tool.

**Design Rational Editor (DRED)**

DRED helps structure, present and review decision processes and captures the decision rationale for future use.

This tool is specific to the design community, which explains why 66% of the sample group that had not heard of the tool. The awareness of this tool seems to be very poor but this could be due to the sample that was used. A questionnaire run by the EDC (Engineering Design Centre) at Cambridge University in 2003, received results back from 32 Rolls-Royce designers of which 30 had attended the DRED training. Twenty of the respondents said that they had not used the tool and seven said that they had used it sometimes. This shows that even within the design community the uptake is limited.

**Knowledge Acquisition Modelling Process (KAMP)**

This is a comprehensive method for capturing, structuring and publishing knowledge. The tool is suitable for those who are not knowledge management experts. Half of the sample had ‘not heard of’ or were ‘unaware of the tool’. Twenty-five percent had used it and found benefit, believing that others should use it across the business. The respondents seemed to be aware that the tool is not currently being used by a wide sample of employees.

**Email**

This is a means or system for transmitting messages electronically between computers on a network. All of the respondents said that they use the tool on a daily basis. Most employees seemed to be satisfied with the use of the tool, but when asked if they thought others could benefit from the tool one respondent said ‘unlikely’ which is surprising as they used the tool daily themselves.
Company Intranet
Online information is available globally to all employees. The company intranet is used regularly, with ten employees using it on a daily basis and the other two using it weekly. The sample was aware of the general usage of the tool and perceives this usage to be high.

9.4 Overall KM Tool Analysis

There were a total of 11 questions that related to the KM tools. Figure 9.1 shows how frequently employees used each tool (Question 4).

![Figure 9.1 - How often KM tools are used](image)

Six KM tools were highlighted by the sample as tools used on a daily basis. Email was the most frequently used, followed by the Company Intranet. There were only three tools that had been used by the whole sample, Email, the Company Intranet and Telephone Conferencing. Murray and Myers (1997) and Chase (1997, cited by Skyrme 2006) agree, showing that email, intranets and the Internet are effective KM tools. Also video conferencing, document management, online information sources and decision support tools are quite widely used as such, although views diverge as to their effectiveness’ (Murray and Myers 1997, Chase 1997).

It was interesting to see that ten of the KM tools had never been heard of by some of the respondents, even though most of the sample were at a managerial level or above.
The tools that were most often placed in the ‘never been used’ category are specialised tools such as TRIZ and DRED. Peer Assist was rated by just under half, 42% as ‘never heard of it’. It may be possible that employees are seeking opinions from other parts of the business, but are not aware of its official, ‘Peer Assist’ name. When the sample was asked ‘why they used KM tools?’ the following three reasons were most prominent as shown in Figure 9.2: -

- ‘It is good practice to’
- ‘More efficient then other methods’
- ‘It’s the only way to complete the task’.

![Figure 9.2 - The reasons given for using the KM tools.](image)

In ideal KM practices, the tools should be incorporated into business processes, so that they are built into the work routine. Currently only 8% of the tools are part of existing business processes. It is good that employees are recognising the value in the tools and using them on their own accord. Employees that had not used the tools described in Section 9.3 said that it was due to a lack of awareness and not due to a lack of interest in the uptake of the tools.
The sample was then asked to state when they first used the tool. The majority of the sample selected the Company Intranet as being first used, closely followed by Email and Telephone Conferencing. The tools that were used mostly within the company were the tools that had been established for the longest period of time. With regards to the date of release, Employees Pages, HIPL and the Capability Intranet (1996) soon followed. As shown in the employees' order of using the tools, this is not representative of the release of each tool. There are a number of tools that only seem to have been explored by employees within the last month. Could this have been down to a recent publicity campaign?

When the sample was asked about why they didn't use certain tools the main answer from 64% of the sample was that they were 'not available/unaware of its availability' as displayed in Figure 9.3.

![Figure 9.3 - Reasons why employees had not used the KM tools.](image)

The promotion of KM tools needs to be increased so that employees are aware of the tools and can therefore make the choice to whether they use them. The second most selected option was that the tool would not be of any benefit. If the benefits were made clear to the users then they would be more inclined to use the tools. Three percent of employees are not using the tool because it is not part of their business process, implying that if it was, they would use it. By tackling the issues highlighted by the figure, the uptake of these tools should increase.
Enquiring whether the tools could benefit others provided a good understanding of the usefulness that employees found in the tools. The tools that the sample felt would benefit others are Lessons Learnt Logs, the Capability Intranet, Lesson Learnt Reviews, Telephone Conferencing, Email and the Company Intranet (Graph 9.4). The tools highlighted as useful are generic tools that can provide benefit to anyone, unlike TRIZ and DRED that are specialised to specific roles such as design.

![Graph 9.4](image)

Figure 9.4 - Did the sample believe that the KM tools could be useful to others?

The next question tried to establish if the wider audience used the tool. The results are shown in Figure 9.5. The same five tools listed in Question 8 seem to have the same prominence in Figure 9.4, showing that the sample believe that the tools which can give generic benefits are being used across the business. Communities of Practice and Structure Knowledge Audits also seemed prominent in this area.
Figure 9.5 - Gaining an understanding into the number of employees that may use the tool.

9.5 Why are some KM tools used more than others?

The intuitiveness of a tool could be a factor that affects the use, as employees within a working environment may not have the time to work through/attend training on new tools. The tools that are used on a daily/weekly basis are all tools that are intuitive to use e.g. Capability Intranets, Email, Company Intranet and Telephone Conferencing.

There were two main KM tools that were used for communication purposes, Telephone Conferencing and Email. Email was the most used tool of the two as it was found to be used daily, whereas Telephone Conferencing was seen to be used weekly. The two tools are still used frequently and this may have been because they have proven to be practical and effective methods of communication. If KM tools were built into the communication process it may be possible that they too would be used more regularly.
Figure 9.6 - The amount of usage of KM tools that assist employees with their job

Figure 9.6 shows the usage of the KM tools that assist employees within their roles. For example, Lessons Learnt Logs could save employees time having to search through similar or past projects to see if anything could be passed on to their current project. The company intranet seems to be the most successfully used tool out of all of the assisting tools. If the users of a tool find it to be useful in assisting their roles, then the likelihood is that they will be used more frequently. It is a shame that there is still a proportion of the sample that had not heard of certain tools as they could be useful in aiding them within their roles.

The KM tools which are used to measure current knowledge use within business areas, have been very infrequently used (Figure 9.7). This is either showing that the business as a whole is not measuring the current level of KM, which means they will be unaware of their current practices and which areas need to be concentrated on, or that it is expected that the usage will be low because the tool is limited to use by KM practitioners only.
9.6 Unsuccessful KM tools

There were two tools that were selected by two individuals as being 'unlikely' to be useful to others. The Hazard Identification Prompt List was the first of these tools and was used once by a respondent because they were told to use it for a specific project. There were no general comments to why others had not used the tool. The other tool was KAMP which was used yearly by the user as part of a business process.

Those who had used the KM tools have found benefit as they recommend the use of the tools to others and have continued to use the tools. As these tools are very specialised the respondents may not have believed they would be useful to 'others' in the more general sense of the wider Roll-Royce community but they believed the tool to be useful to people specialising in the same area as themselves.

This therefore suggests that a general lack of awareness of the tools is restricting their use rather than employees finding no benefit. An unexpected finding was that Communities of Practice and the Employees Pages seem to not be living up to the expectations as employees have used them as their use soon diminishes and employees do not think that these tools could generally benefit others.
Chapter 9 Knowledge Management Tools

9.7 Conclusions

Successful tools like the Company Intranet, Capability Intranet and Email could offer great insights into their successful use. These insights could be applied to other KM tools such as the implementation of Microsoft-styled user-interfaces, as these are familiar to the users and, therefore, are easier to use and lead to a greater uptake. Lessons need to be gained from how these tools have been embedded into the working practices and how these tools provide the services requested of them. Email is the most highly accepted tool and the reason why needs to be established.

It seems that the sample of employees used in this research displayed a lack of awareness of many of the KM tools. In the short-term, Rolls-Royce needs to promote their current KM tools to increase usage by publicising success stories and the potential benefits that can be gained. In the long-term, they need to look into embedding the tools into existing business processes, and also positively encourage those that are using the tools. The importance of the Company Intranet has been prominent in the survey and needs continual investment from the company to ensure that the information employees require is available and easily accessible.

The majority of the existing tools do not require employee training and therefore could be made widely available to the whole of Rolls-Royce. The research established that there is a need to benchmark the current state of KM tools and techniques within the Marine business. This enables a baseline to be established of the current use of KM tools in order to both gain an understanding of what tools are used and to provide a baseline measurement to assess future development.

Objective 7c, is fulfilled within Chapter Nine as a survey was designed and deployed to understand the perceived usefulness of KM tools within the Aerospace business. The survey revealed that different tools were embedded within the working procedures and how successful each tool had been in meeting the users requirements. The survey also gave insight into understanding why some KM tools may be used more successfully than others.
Chapter Preface

The research in Chapters Eight and Nine has shown that (a) employees’ Knowledge Management (KM) needs differ depending on their job type; (b) it is feasible to gain an understanding of the usefulness of KM tools. Chapter Ten shows that by studying the KM activity level of the Naval Marine business it is possible to identify areas for improvement and by capturing a baseline, future improvements can be measured. A benchmarking tool currently used within the Aerospace business to analyse the current KM activity and to provide a baseline of the Naval Marine business is used to achieve objective 7d. This work builds into the KM framework described in Chapter 12. The process step 5 describes how the benchmarking tool can be used to measure the current state of KM activity and, therefore, establish the best tools to implement to fulfil the KM needs identified by the benchmarking.

This chapter also covers the work undertaken to establish a method to implement KM tools with Marine by applying a similar method that was deployed within Rolls-Royce Aerospace.

10.1 Introduction to Benchmarking

Benchmarking is a well established technique that is used within companies to assess the impact of a change by getting a reflection of how things are before and after. By benchmarking a current situation before changes are made, for example the implementation of new tools, it can also provide an in-depth reflection of a current situation.

The KM team based within R-R Aerospace devised a benchmarking tool that allowed them to determine the current level of activity within the following areas:
1. Establishing a Knowledge Sharing Environment
   • Motivation & Rewards
2. Understanding the Knowledge Needs and Assets
   • Structured knowledge Audit, Knowledge Acquisition
3. Sharing Experience between People
   • Peer Assist, People Pages, Communities of Practice
4. Documenting Knowledge and the Capability Intranet
   • Capability Intranet & Prompt Lists
5. Learning Lessons
   • Lessons Learnt Review & Lessons Learnt Logs

Benchmarking is primarily used to establish strengths and weaknesses across different KM issues. Another important use of the benchmarking tool is to establish a baseline for current KM activities across Rolls-Royce, so that if any future KM programmes are conducted then they can be measured. The benchmarking tool used within Rolls-Royce has been sufficiently tested on many businesses and used successfully.

10.2 Benchmarking KM activities

The Support business within Naval Marine had just started to explore KM and wanted to gain an insight into its current status of KM activity within its business. The benchmarking tool was seen as an appropriate tool to use as it had been established based on the tools implemented within the company and the activities of engineers.

10.2.1 Benchmarking Tool

Roll-Royce has developed two versions of the benchmarking tool for use depending on the level of detail required by the department conducting the activity. The two versions are:

1. Simplified benchmarking
2. Comprehensive benchmarking

The simplified version is shown in Figure 10.1 and is used by knowledge engineers and managers to gain a snap-shot of current KM activities within a specific department.
It asks one question in relation to each area of KM and the individual completing it decides where they are on a scale of 1 to 5. Examples are given to aid the understanding of the scores, such as 'Establishing a knowledge sharing environment' included under the level '1' rating 'we strongly communicate the need for knowledge sharing, we do not generally reward knowledge sharing'. Under level '5' it states 'We have communicated the need for knowledge sharing very well, we routinely reward employees for knowledge sharing activity'. These are given as a guide so that the people completing the questions are more realistic about the answers they provide as they can rate them again specific activities/examples.

Figure 10.1 - Simplified benchmarking tool.

The comprehensive benchmarking tool is used to gain a greater understanding of the current level of KM activity and therefore has 40 questions. An example of a typical question is shown in Figure 0.2. Here the respondent is asked more questions about each one of the five specific areas. The area of the questionnaire relating to
‘Establishing a knowledge sharing environment’ now asks the respondent direct questions such as ‘Is the need for knowledge sharing communicated?’ The respondent can then rate themselves from 1-6. Explicit examples are provided, such as selecting ‘1’ would show that within the business area there is no communication on lessons learnt of knowledge sharing, whereas level ‘5’ would indicate that the need is routinely described and should identify how or with whom. The simplified benchmarking tool covers five main areas of KM but when the results are taken from the detailed benchmarking results they are represented in four areas;

- Establishing a knowledge sharing environment
- Understanding of knowledge needs and assets
- Sharing experience between people
- Documenting knowledge.

This is because the ‘lessons learnt’ covered in the simple benchmarking tool is covered within a few of the detailed sections such as Sharing experiences between people and Documenting knowledge. An in-depth level of understanding was required to show awareness of current KM activity to management so it was therefore decided that the comprehensive method of Benchmarking should be used.

<table>
<thead>
<tr>
<th>Questions</th>
<th>Level</th>
<th>Description of level 1 practice</th>
<th>Between levels 1 and 3</th>
<th>Description of level 3 practice</th>
<th>Between levels 3 and 5</th>
<th>Description of level 5 practice</th>
<th>Even better practice. Please attach a description or provide a contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the need for knowledge sharing, communicated?</td>
<td>1</td>
<td>No communication on lessons learnt of knowledge sharing</td>
<td></td>
<td></td>
<td></td>
<td>Routinely describe need and identify how or with whom</td>
<td></td>
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<tr>
<td>Are you rewarded for knowledge sharing activities?</td>
<td>2</td>
<td>No recognition</td>
<td></td>
<td></td>
<td></td>
<td>Reward specific instances or put good examples forward for awards</td>
<td></td>
</tr>
<tr>
<td>Have you been involved in the development &amp; promotion of knowledge sharing?</td>
<td>3</td>
<td>Opportunities not explicitly identified</td>
<td></td>
<td></td>
<td></td>
<td>Frequently identify specific opportunities and how knowledge should be shared</td>
<td></td>
</tr>
<tr>
<td>Does your process/team have a knowledge sharing vision?</td>
<td>4</td>
<td>No explicit knowledge sharing vision</td>
<td></td>
<td></td>
<td></td>
<td>Frequent communication on how knowledge should be shared. Team &amp; individual knowledge sharing metrics and targets are set</td>
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</table>

Figure 10.2 - Comprehensive benchmarking questionnaire
The benchmarking exercise was carried out on the Support Department within Naval Marine based in both Derby and Bristol. The exercise was targeted at all of the managers, and they were asked to nominate three different employees working within their teams that varied in their levels of experience, e.g. an employee working for under a year, another working for 2-3, and another working for four or more. Out of 11 managers contacted ten responded.

A total of 29 Support employees were approached to complete the questionnaire. The questionnaire was conducted on a one-to-one basis with all of the participants. This ensured that the participants understood the format of the questionnaire and they could ask questions that may have arisen through a lack of understanding. There was also supporting evidence which was used to help people understand terms that they may not have been sure about, such as 'knowledge' and 'Communities of Practice'. The supporting evidence was taken from the Rolls-Royce corporate Intranet site so that it would be in line with any literature the respondents may have already seen.

The questionnaire (Appendix 22) was in a standard, structured format consisting of 40 questions. In addition to the questionnaire questions the participants were asked to provide the following information:

- Name
- Business area
- How long they have worked within their current job roles
- How long they have worked for Rolls-Royce.

They were also informed that the questionnaire results would be completely confidential and of the need for them to complete the questionnaire.

10.3 Results

As the questionnaire was completed by both the manager and the employees within each of the 11 business units within Support, the results were initially analysed separately.
Managers Benchmarking Results

Due to the sensitivity of the results each manager’s team was issued with a team letter so that this information could reside within the organisation. The benchmarking tool works by taking the individual questionnaire results and collating them so that they can be easy assessed. The results are grouped into four main areas that are specified by the benchmarking tool: -

- Establishing a knowledge sharing environment
- Understanding of knowledge needs and assets
- Sharing experience between people
- Documenting knowledge.

Each one of the 11 managers results are shown in the following histogram (Figure 10.3). The main conclusions drawn from the results are: (1) None of the managers believed that their KM activities were being conducted to their best ability as the highest score given by a manager was 75%. (2) The area of KM that the managers believed they were the most successful in was ‘understanding of knowledge needs and assets’. This was followed by ‘sharing experiences with people’, and then ‘establishing a knowledge sharing environment’. (3) The area that they felt they were least efficient in was ‘Documenting knowledge’ (with 73% of managers selecting it), followed by ‘sharing experience between people’.
Figure 10.3 – Managers’ Histogram Results

Some of the managers rated the ‘sharing of knowledge and experiences’ as both their best and worst KM attributes. The manager’s results confirm that there is not currently a standard for Marine managers to follow as they seem to be deploying their own ideas. It was surprising to see that the manager’s scores were generally below 50% showing that they are fully aware of the gap they have to overcome to complete KM activities successfully.

**Teams Benchmarking Results**

The teams’ results were very similar to those of the managers as they believed that the area of KM they were best at was the ‘understanding of knowledge needs and assets’. Second and third were also the same as those results from the management. The main difference is that the teams believe they are stronger at ‘understanding their knowledge needs and assets’.

There is a very strong indication (90%) from the team that they believe they are not efficient at ‘documenting their knowledge’. It seems that both the managers and employees are clear on the areas that they feel need improving.
Managers and employees results

By looking at the whole of the group results, which includes both the managers and their team members (displayed in table 10.1), it is clear to see that the team are struggling to document their knowledge, but do feel that they are good at understanding knowledge needs and assets.

<table>
<thead>
<tr>
<th>KM area the whole team are most efficient in</th>
<th>Team A</th>
<th>Team B</th>
<th>Team C</th>
<th>Team D</th>
<th>Team E</th>
<th>Team F</th>
<th>Team G</th>
<th>Team H</th>
<th>Team I</th>
<th>Team J</th>
<th>Team K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establish a Knowledge sharing environment</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Understanding of Knowledge needs and assets</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Sharing experience between people</td>
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<tr>
<td>Documenting knowledge</td>
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</table>

The benchmarking tool was very interesting as it provides a clear understanding of the implementation of the four different areas specific to KM and how certain teams are performing in relation to others. It is very simple, as employees answer predefined questions and the managers can view the results represented in the histograms so they just look at the areas of KM they are struggling with and focus on improving them.

The study has shown that there is definitely a need within Naval Marine to focus on improving the way that knowledge is documented.

10.5 Issues with the Benchmarking technique

The results of the benchmarking may have been affected by the fact that the managers had nominated people within their teams to participate in the questionnaires. The team members may have been reluctant to be completely honestly as they were aware that their managers would see the overall business unit results. Even if this was the case, it would have only resulted in the employees giving a lower score but, as the score was relatively low anyway, it seems unlikely that this influence had a significant effect.
As the benchmarking exercise was conducted with managers and employees it may be found that the employees are more aware of the KM techniques being used within their roles as they may have been embedded into the processes that they are using. At a higher level the managers may not be aware of this.

When the area of KM that requires the most amount of attention has been established the decision then needs to be made on the most appropriate tools to satisfy the identified needs. This has been covered within Chapters Eight and Nine. Chapter Eight detailed which tools are best used for which type of knowledge requirement and Chapter Nine examined the successful use of each tool.

Once the tools have been selected the manager needs guidance as to the best way to implement the tools. This is explored within Section 10.6.
10.6 Implementing KM tools

Current research literature does not offer a step-by-step guide to implementing KM tools and therefore a meeting was conducted with Mike Moss, who is a team member of the corporate KM team within Roll-Royce to elicit and document the way Rolls-Royce Aero implemented their KM tools. Ten factors were agreed to be contributing factors to the successful take up of KM tools (taken from an interview – Appendix 23) as shown in the following list:

1. Need senior buy in
2. Strong publicity including the tools benefits
3. KM representatives are needed across the different business units
4. Clear methodology so that any issues are overcome quickly
5. People need to feel that they have gained a benefit from the tool (help them complete their jobs)
6. Immediate benefit is better, in the form of personal benefit, enjoyment or the helping of others.
7. Easy to use tool
8. Quick and easy to understand training available for those that request it
9. Bottom-up pull from the employees to use the tool
10. Time available to use/become familiar

These were then placed into a matrix and key people, identified by a senior manager in the company as being those who led the implementation of these tools within the business and who were involved within the implementation process for the KM tools. These employees were individually contacted via the telephone and asked to rate each of the ten factors as having a ‘High, Medium or Low’ impact on the way that specific tool was implemented, for example ‘At what level was the Senior Buy-in for Telephone Conferencing?’ The results are shown in Table 10.2.
By scoring the ‘High, Medium and Low’ options as three, two and one it was possible to rank the tools in the order of their use of the success factors in the implementation process as shown in Table 10.3.
Chapter 10

Establishing current KM activity

Table 10.3 - Implementation and successfulness scores

<table>
<thead>
<tr>
<th>Tool</th>
<th>Implementation Score</th>
<th>Successfulness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capability Intranet</td>
<td>25</td>
<td>46</td>
</tr>
<tr>
<td>DRED</td>
<td>25</td>
<td>1</td>
</tr>
<tr>
<td>KAMP</td>
<td>24</td>
<td>11</td>
</tr>
<tr>
<td>Telephone conferencing</td>
<td>24</td>
<td>41</td>
</tr>
<tr>
<td>Lessons Learnt Reviews</td>
<td>23</td>
<td>35</td>
</tr>
<tr>
<td>Communities of Practice</td>
<td>23</td>
<td>29</td>
</tr>
<tr>
<td>HIPL</td>
<td>23</td>
<td>29</td>
</tr>
<tr>
<td>Lessons Learnt Logs</td>
<td>21</td>
<td>37</td>
</tr>
<tr>
<td>TRIZ</td>
<td>21</td>
<td>11</td>
</tr>
<tr>
<td>SKA</td>
<td>20</td>
<td>18</td>
</tr>
<tr>
<td>Peer assist</td>
<td>19</td>
<td>17</td>
</tr>
<tr>
<td>Benchmarking</td>
<td>19</td>
<td>5</td>
</tr>
<tr>
<td>Email</td>
<td>18</td>
<td>41</td>
</tr>
<tr>
<td>People Pages</td>
<td>18</td>
<td>25</td>
</tr>
<tr>
<td>Story Telling</td>
<td>16</td>
<td>7</td>
</tr>
<tr>
<td>Company Intranet</td>
<td>15</td>
<td>45</td>
</tr>
</tbody>
</table>

There seemed to be no obvious correlation between the tools that had been implemented using many of the ten ‘best practice’ factors for success and those that hadn’t, except for the fact that Capability Intranet scored the highest in both. This result shows that not all success factors are of equal importance for example DRED had the highest score for its implementation method but scored the lowest in successfulness. It is therefore concluded that key success factors need to be selected.

By highlighting the tools that have been successful within the business such as Capability Intranet, Company Intranet, Telephone conferencing, Email and marking the ‘Highs’ that they received in the matrix shown in Table 10.2, it was then possible to pick the key success factors from the implementation process as listed below:

1. Clear Process and Method
2. Easy to use tool

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The next most popular implementation points in terms of their contribution to the successful use of KM tools are:

1. Senior Buy-in
2. Publicity of benefits
3. Immediate benefits either personal/other/enjoyment nature
4. Training available

10.7 Conclusion

This chapter has shown that the benchmarking tool has the ability to display the current status of KM activity within easy to understand graphical charts. It allows the KM practitioner to easily communicate the 'real KM issues' that may need assistance within a department to senior managers without them requiring previous knowledge. Ranking the results gives a further visual aid to managers to allow them to understand existing problems and areas for optimisation.

The implementation method discussed proposes a list of factors to consider when implementing a KM tool. These could be used as a guide for employees through the process of implementing KM tools. The list was constructed by speaking to KM experts within the company and asking them, what they believed was important, and assessing whether these had been fulfilled within the implementation of each tool. These results were then correlated with the questionnaire results found within Chapter Nine (KM tools successful use).

The checklist is useful in giving KM practitioners guidance for implementing KM tools (something that has not been covered within current literature). The six main factors for successful implementation listed below should be incorporated into a KM tool implementation within a company to try and increase its uptake and successful use.

1. Clear Process and Method
2. Easy to use tool
3. Senior Buy-in
4. Publicity of benefits
5. Immediate benefits either personal/other/enjoyment nature
6. Training available

10.8 Summary

The benchmarking tool is useful in determining which of the four areas of KM a business unit needs to focus its strengths in. It is also useful in establishing which business areas are doing well in KM allowing others to learn from their experiences and encouraging the sharing of KM best practices. The use of benchmarking is taken further as described in Chapter 11 were it is used to create a business case for KM.

Chapter Ten fulfils objective 7d with the successful deployment of the Aerospace benchmarking tool. The results were used to establish the current KM activity within the Marine business and provide a baseline to monitor future KM initiatives against.
Chapter Preface

The Naval Marine business has explored its KM activity and has established the knowledge requirements of the employees. These can then be used by a knowledge engineer/manager to create a KM strategy and roadmap. However, before this can be done approval of resources have to be sought from business manager(s). To do this a business case is usually produced to justify the benefits that can be gained by investing in the new business initiative. To fulfil objective 7e, the creation of a generic KM business case is developed within this chapter.

11.1 Introduction

In the 1990s companies recognised the benefit of KM and adopted different tools and techniques. Rolls-Royce Aero introduced KM with the development of a Capability Intranet in 1996 and have since lead the way in KM within the Rolls-Royce organisation.

Recently the Support department within Rolls-Royce Naval Marine considered whether to invest in a KM programme. As with any new business investment, companies have to make justifications to senior managers, usually in the form of a business case. After reviewing the literature it was possible to find successful examples of KM case studies, but there was little guidance on how to create a business case for a new KM initiative.
11.2 Creating a KM Business Case

Skyrme (2001) suggests that creating a business case for KM is ‘as simple as ABC’. Skyrme believes that there are three main planks that justify KM:

- Asset value - including market value of specific knowledge assets on the open market, cost, such as the training costs of new employees, replacement cost of getting to where you are now if everything was lost, and liability cost. Most companies have a hold on the value of their physical assets yet ignore those assets which are worth five to ten times the recorded balance sheet.

- Benefits potential - information and knowledge benefits, such as retrieving information faster, intermediate benefits, such as minimising duplication and sharing knowledge, organisational benefits, such as reducing costs and increasing productivity, and customer and stakeholder benefits which are better products and services. By tracing a company within the same field as your own, it should be possible to gain these potential benefits from their own KM activities.

- Cost effectiveness - people working more efficiently. Facility costs (office design/health & safety) are decreased by sharing best practice, the e-business opportunity and customers getting better services as solutions such as CRM systems are more focused.

Skyrme himself has highlighted a list of stumbling blocks with the proposed ‘ABC’ method:

- Lack of a baseline
- Costs are immediate and visible
- Lack of shared management vision
- Too heavily focused on financial measures rather than broader outcomes
- The link between cause and effect is complex
- There may be unanticipated benefits

Each of the Skyrme’s main planks holds justifications that would be difficult to quantify. For example, the ‘value of specific knowledge assets on the open market’
could include a 'group of experts'. It would be very difficult to attain the worth of experts on an open market without spending a substantial amount of time trying to create a guide. The 'benefits potential and cost effectiveness' sections details measurements that could show the advantages for 'retrieving information faster, minimising duplication, sharing knowledge and sharing best practice' but these are justifications that are only attainable when KM has been in place and the benefits measured, therefore it is unsuitable to form a business case.

A paper titled 'Making the case for knowledge management: the big picture' was written by Neef in 1999, to target company managers and give them an understanding into the importance of KM. The paper justified a case for KM by covering the following:

- **Knowledge based strategy** – 'It was this combination of global expansion and new communications technologies which led to the current focus on one of the most valuable tenets of knowledge management – mobilising organisational knowledge in such a way as to encourage sharing of lessons learnt and to prevent the recurrence of costly mistakes'.

- **A knowledge sharing culture** – 'what knowledge is needed by whom and when, on a global basis. With knowledge workers being encouraged to share productivity-enhancing leading practices, new techniques, and lessons learnt with colleagues worldwide'.

- **A technical support infrastructure** – 'dedicated resources for knowledge; including a chief knowledge officer, and clear methods for submitting, organising and retrieving information electronically'.

- **Business research and analysis** – 'More then ever before, employees at all levels or organisations need to know more, with more certainty more quickly. The need for customised business research and analysis will grow with the complexities of the global marketplace'.

Within the paper, Neef stats that his method is 'a critical set of polices and practices that will boost an organisations competitive position in a new knowledge based economy'. The previous quote was seen as a better title for the paper then 'making a case for KM; the bigger picture' as the paper is more focused towards an organisation
that has already agreed to a KM programme and set aside the required resources. This is evident within the paper as the section on 'Knowledge based strategy' details different organisational KM strategies, which is very useful if a business has already committed to a KM initiative, but otherwise this is not relevant in trying to gain management buy in.

The business case proposed by Neef included many qualitative measures such as 'corporate agility, learning lessons etc' but it did not detail how these could be used within a business case or how to justify qualitative KM benefits.

Through reviewing case study literature on KM business cases, the Chartered Institute of Building (CIRIA, 2003) offered evidence of a KM business case. CIRIA conducted a study and found that six of the 14 organisations studied had prepared a business case, but only one company completed a quantified business case. The business case included the following points:

- Employee time savings would equate to financial savings
- Investment made on the basis that KM supported their core business objectives
- Top management support was important
- Pressure from clients was common (questions asked on continuous improvement, sharing best practice).

CIRIA have found that there are 'few practical tools available for KM, even less on making a business case', so they proposed a number of measurements which could be used within a business case:

- Better corporate reputation
- Increased client satisfaction
- Staff learning, better morale leading to staff retention/recruitment
- Overall efficiency savings including time, money etc
- Improved quality assurance and speed of technical decisions
- Increased innovation due to knowledge sharing, and quicker and wider access to knowledge
- Improved risk management etc.
CIRIA’s measurements are useful but require baselines so that an organisation can establish its current status and have a set of measurements from which it can establish if any progress has been made. CIRIA’s measurement list only offers suggestions of a proposed list of measurements that lack any depth to tell the KM practitioner how to use them. Therefore neither CIRIA’s nor Neef’s papers offer enough detail to support the structure and creation of a KM business case.

A paper created by Owen (1999) stated that creating a business case for KM involves the following steps:

- Get your story straight – Create a white paper that starts to create your business case, using examples from similar industries. Propose a simple model that incorporates the key factors for successful KM implementation. Finally outline opportunities for quick payoffs
- Go visit – Meet with senior managers and discuss ideas.
- Rally supporters – Try to congregate those interested in knowledge creation and transfer. Establish a ‘strategic KM council’ to discuss KM issues and identify high pay-off initiatives.
- Use technology – Use internal websites to promote KM through articles, interviews and announcements etc.
- Take action – Set a good example by tackling KM issues in your own area first. Get involved in the company wide projects such as revision of a KM intranet site.
- Get Passionate – Use any opportunity to get your message across.

This paper is good in outlining the method of approaching KM within a company, but for a large company like Rolls-Royce a detailed business case would have to be produced and presented, detailing both tangible and intangible benefits. This will be the same for many companies as ‘several such initiatives end up competing for the same resources at a corporate level’ (Skyrme, 1998). KM would not be introduced based on the opinion of others, as a return on investment (ROI) would have to be justified to management and the risks associated reviewed, so that the management would be clear on the business benefit they would gain after their investment.
It was concluded that the current literature on KM business cases did not show how to create a ROI business case. The recommendations from the literature are useful but exclude financial costing.

11.3 Creating a Generic Business Case for KM

By analysing generic business cases, it was found that they are specific to individual companies and therefore tend to differ in their style and format. Rolls-Royce invests heavily in new initiatives and, therefore, uses the business case as the first stage to introduce a new concept. There was not found to be a generic structure for the use of business case as they are adapted depending on the target audience and the level of investment required. As the aim was to create a generic business case template for KM that could be used within RR, a wider review of business case literature was required. Wu (2001) has created a list of components that he believed, should be incorporated within a generic business case and could, therefore, be adapted as a template for the KM business case:

- Executive Summary
- Background
- Issue/Need
- Proposed Solution
- Industry Perspective
- Cost Justification
- Qualitative Benefits
- Conclusion and Reasoning
- Summary

Wu provides a comprehensive content that should serve to answer any initial queries a manager may ask. Therefore the basis of a KM business case could take this generic structure and add KM related content. This then becomes a generic business case for KM investment. Combining Wu's outline with the other literature specific to KM was carried out to create the following generic business case for KM:
11.3.1 Executive Summary

Executive summaries are created for most business reports and therefore familiar to those working in industry. The executive summary is the most important part of any business case. 'Most executives do not read beyond the executive summary because they just do not have the time' (Wu, 2001) therefore the creator must entice and retain the reader. An example of specific content is provided by the American Express Business Plan Writing Resources (2005).

11.3.2 Background

The background is used to set the scene for the reader. It should primarily include the 'Issue/need' of the proposed solution and be written in a tone that is without bias and simply states the facts (Wu, 2001). Examples taken from Awad, 2002 include:

- The pace of change has accelerated dramatically during the past decade and companies have to be innovative in ways to take on their competitors.
- Globalisation and geographic dispersion changes an organisation's scope. More companies are trying to learn from their past experiences to manage their global commitment in a timely and profitable fashion.
- Downsizing and reengineering result in staff attrition and knowledge drain so companies need to assess their knowledge core and make best use of it.
- Networking and data communications make it easier and faster to share knowledge.

Adapting examples to suit a company should not be difficult, as more examples will be given within the 'Qualitative Benefits' section.
11.3.3 Proposed Solution
There is a wide range of literature available on how to construct a KM programme (e.g. Sunassee & Sewry, 2002; Ruth et al, 1999). After reviewing this literature, the business case creator could create one or more proposals. The proposed solution/s will have to tackle any issues highlighted within the 'Issue/Needs' section of the business case and document any other advantages.

11.3.4 Industry Perspective
This will give a good opportunity to show industry advancements within KM and how other industries have benefited. Within this section it is also a good opportunity to highlight the use/plans of the company competitors to use KM. Literature of this type is widely available in general KM literature.

11.3.5 A Quantitative Cost Justification
This is the main area of the business case that is not documented within current KM business cases. Cost justification is extremely hard to justify in KM and therefore the combination of two current techniques is proposed to create a solution.

The proposed technique uses benchmarking as the first part, to establish if issues arising from the lack of KM are present within the company and the extent these issues are incurring a cost. Secondly, 'adopted costs' will be used by reviewing KM literature and collecting proven percentage benefits that other companies have established. The technique firstly highlights the issue and then displays the cost of that issue to the company.

This method would use few resources and also gives the managers a quantitative measure of the current KM situation within their business. The method can be carried out in depth with multiple managers/workers or with just one manager, depending on the amount of time and commitment available. To clarify how this difficult step of obtaining quantitative cost measures can be achieved, examples are given in Section 11.4.
11.3.6 Qualitative Benefits

“Cave dwellers froze to death on beds of coal. It was all around them, but they could not see it or use it. Today, we are in danger of making the same mistakes” Arthur C. Clarke (Kelleher, 2001).

Arthur C. Clark highlights an issue many companies face today. They are surrounded by knowledge giving them their current competitiveness, but what will happen in the future, when this knowledge leaves or people fail to learn from past mistakes? Cave dwellers were unaware of the value of coal, as many managers are unaware of the value of knowledge. Rolls-Royce is well established company and has a knowledgeable and experienced workforce. Many companies are now facing the problem that their knowledge base is aging and therefore looking to retire. ‘An aging workforce and a decline in the numbers of ‘tribal elders’ point to an imminent crisis in productivity and effectiveness for aerospace and defence companies’ (Shaw et al, 2000). When key experts leave, it can be very costly for a company as ‘the typical productivity cost of an employee leaving is 85% of their base salary due to their replacement mistakes, lost knowledge and lost skill’ (Beazley et al, 2002).

Current KM literature is awash with its importance and successful KM case studies (Chong et al, 2000; Awad, 2004). The literature can form part of the case to justify a new KM initiative and can help managers appreciate some of the benefits. Other qualitative benefits may be available from elsewhere within the company itself if it is a large organisation.

11.3.7 Gaining a competitive advantage from the company’s knowledge core

As shown in Figure 11.1, 50% - 95% of knowledge is in a tacit form (Awad, 2004), making companies very fragile and vulnerable to loosing their competitive advantage.

Making managers aware of the knowledge their staff hold, should encourage them to think about the consequences if people leave, or are otherwise absent from work. Lost knowledge can be damaging to a company as it has been estimated that $115 billion sits idle in lost knowledge affiliated with production technologies. An astounding example of this is the loss of the original computer source code, written in the 1950s...
that spawned the Y2K software crisis, costing businesses around the worldwide an estimated $1 trillion dollars (Petch, 1998).

![Diagram of tacit knowledge and explicit knowledge]

Figure 11.1 - Un-captured tacit knowledge (from Awad, 2004)

Companies need to be more proactive in capturing their tacit knowledge, it is clearly a significant advantage for the organisation if as much tacit knowledge as possible is captured and structured in a way that makes it easily accessible to others within the organisation. This should support companies in gaining an edge over their competitors as more knowledge will be retained, built upon and shared, hopefully increasing the lessons learnt by the organisation and proving to their customers that they are a continually learning and efficient.

### 11.3.8 Learning from past experiences

Offering 'support' as a service to its customers is a new direction that Naval Marine wishes to pursue and it is very important that lessons can be learnt from one contract to another. Contracts are worth large amounts of money and future business, so the Support department needs to make sure that they are minimising any risk of mistake. This will clearly be true for any company undertaking contract work. An illustration of the potential advantage that can be gained by KM helping companies learn from their own experiences is given by an oil company reporting that since 1993, refining operations has achieved cost reductions of more than US $150m which was saved by sharing ways of reducing electric power and fuel usage (Kelleher, 2001)
11.3.9 Network and data communication making it faster to share knowledge

The Information Map project described in Chapters 4, 5 and 6 is an example of how an electronic means can be used to facilitate the sharing of knowledge by making it much quicker and easier to locate. This knowledge of where information could be found was previously mostly held in tacit form and often a chain of enquiries were needed, with the enquirer being passed from one person to the next, to obtain the information that was needed. This was a slow and unreliable process which was very costly in terms of engineers’ time. This case study has been made available to the public through a paper in the proceedings of the 2004 European Conference on Knowledge Management (Ubhi et al, 2004) where it can be used as an example in any future company’s business case for KM.

11.3.10 Improving efficiency and making knowledge available

Awad (2004) suggested that knowledge is primarily available within four forms:

1. Customer knowledge - their needs, who to contact, their buying power
2. Product knowledge - products in the market place, who is buying them, what prices are they selling at, etc.
3. Financial knowledge - capital resources, where to acquire capital and at what cost and financial practices.
4. Personnel practices knowledge - expertise available, service provided, how to find the experts.

Can managers honestly say that they have the knowledge available on all four forms that is up-to-date and easily acquirable? The likelihood is that they do not as Fig. 11.1 shows that 95% of knowledge is tacit within a company. The importance of having this knowledge captured, maintained and easily accessible is fundamentally important to a business’s success. If possible a business case should break down the savings into the four knowledge categories available to emphasise the advantages of the different interest groups within the business. This should therefore widen the scope in engaging buy in from the different managers.
11.3.11 Conclusion and Reasoning
The conclusion within the business case allows for the manager to be reminded in a few sweeping statements why KM is needed within their business, re-enforced with a bringing together of the quantitative cost benefits and the other qualitative benefits identified in earlier sections to produce the most effective argument for the KM investment proposed.

11.3.12 Summary
The summary should recap the main points within the business case. This section resembles the Executive Summary section at the beginning of the business case, but the arguments are repeated here to drive the message home and leave the reader with no doubt about the essential features of the business case.

11.4 Examples of Quantification of Costs
Although cost quantification can be difficult, there are systematic, generally applicable ways of approaching the problem. Three questions from a benchmarking tool developed and used within Rolls-Royce are given in this section. Benchmarking works by asking key questions to managers and then asking them to rate their answers from, for example, one to six (as covered within Chapter Ten). Table 11.1 shows the question to the left and the adjacent rating examples in KM.

11.4.1 Example 1

<table>
<thead>
<tr>
<th>What plans do you have to cope with the loss of key experts?</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>None - recruit as needed.</td>
<td>Less formal knowledge capture or successor identification.</td>
<td>Systematically capture experience from experts near to their departure or have successors identified that work closely with the expert.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 11.1 - Example 1 of KM benchmarking question
As this is a business case for KM, it is unlikely that the manager would choose a high number such as 5 or 6 as that would illustrate they already have a robust plan to deal with the loss of key experts. It is therefore expected that the manager would choose option 1. This would then highlight a weakness that could be addressed by KM. The answer to example one is then cross referenced with the work (adopted method) of Beaszley et al (2002) who stated that ‘the typical productivity cost of an employee leaving is 85% of their base salary due to their replacement’s mistakes, lost knowledge and lost skill’. If the manager scores their department/business as three or less, it is assumed the loss will be 85% of an average wage of an ‘expert employee’. If they score four, five or six it is assumed that the 85% should be reduced, for example reducing the loss by 28% as the rating increases.

For example, if the manager chooses rating one and had two ‘expert’ employees who were each paid approximately £30,000 per year (attainable from HR), and those two employees retired within the coming year it would mean the department loosing £51,000 (£30,000*2 = £60,000. 85% of £60,000 = £51,000) if the leaving experts knowledge was not being captured and used efficiently. Viewing the experts that have left within the past year would give an indication of the knowledge that may have been recently lost and the incurred costs that could have been reduced.

11.4.2 Example 2

Table 11.2 - Example 2 of KM Benchmarking question

<table>
<thead>
<tr>
<th>How do you help people identify experts or contacts within your team?</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word of mouth</td>
<td>Organisational charts published and widely disseminated</td>
<td>Names of all experts published and disseminated to all operators of the process/team contacts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A study by the multinational firm, BAe Systems, discovered that 80% of their employees wasted an average of 30 minutes per day retrieving information (Martin – 2002). If an organisation employed 100 people, by using BAe Systems’ example, 80 out of those 100 employees would use 30 minutes of their time retrieving information. Within all roles, people have to retrieve information, but with the implementation of KM tools, information could be easier and quicker to retrieve. If those 30 minutes could be reduced to 15 minutes, this would give a daily saving of 20 hours a day or about 4,500 man-hours each year. This is approximately the time of three full time employees, which is likely to have a cost of the order of £100,000 a year. Such statistics should greatly increase a manager’s interest in KM!

### 11.4.3 Example 3

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What does your team do to learn from others when you start something new?</strong></td>
<td>Teams do not, or only rarely seek advice</td>
<td>Teams sometimes seek advice from those who have done it before</td>
<td>Teams Systematically seek advice as part of the process.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Reinventing the wheel is a problem for companies and the cost implication of this can be huge as ‘60% are spending an hour or more duplicating the work of others’ (Martin, 2002). Again, if managers choose options one and two it can be assumed that they too are reinventing the wheel. For 100 employees this will mean that 60 hours a day is wasted in duplicating the work of others, which could otherwise be spent making the working process more productive. This is equivalent to the work of 12 to 15 people in every 100 at a cost of £400,000 to £500,00 a year. A more systematic seeking of advice would also reduce the risk of making decisions that are based on incomplete or incorrect information.

By making the simple calculations above and adding up the amount of money or time that could potentially be saved with a KM programme in place, it is suggested that the
comparison with the amount invested in the KM implementation and operation would help in justifying a strong KM business case. Even if the plans for KM are on a large scale, such as at Hoffmann-Roche, the Swiss pharmaceutical company who invested $72 million, they still found that KM saved them over $1 million per day (Swanborg & Myers, 1997). The Schlumberger Corp found the same as they claimed that over a six-year period since it invested in KM, they achieved a ROI of 668% (Swanborg & Myers, 1997).

Teltech is a firm that specialises in aiding companies to implement KM programmes and they reported that their clients enjoy an average ROI of 12:1 for their efforts (Abramson, 1998). This should ensure that any KM investment is heavily rewarded with a large ROI regardless of the initial investment size. These examples can be used to help build a case for KM investment, but KM practitioners should also be aware that many KM initiatives fail and therefore they need to select their pilot project/s carefully. A small investment should be easily justifiable using the three examples above and by using the benchmarking exercise it can then offer a baseline measurement that can be reviewed using the benchmarking at a later date, to see if improvements have been made.

11.5 KM Business Case Verification

A KM business case was created to gain buy in for future work to continue within the Support business of Marine. To verify the KM Business Case it was presented to the Support department’s manager within Rolls-Royce. He highlighted a number of concerns he had within his business. This allowed him to establish his understanding of KM by relating some of his current concerns to the discussion and confirming that KM could help in resolving them:

- It takes a long time to get new starters up to a level where they are efficient within their roles.
- The department cannot sub-contract out work because those who know the requirements keep it to themselves and say that it is too costly. In the long run they retain their Knowledge (Knowledge is power principle) and when they leave the company that knowledge is lost.
• The skill level in younger people is more IT focused. They are capable of operating engineering systems on PCs but are unaware of the processes involved behind and have no real hands-on experience. The knowledge that is needed is unavailable as key experts from across the business with real ‘hands-on experience’ retire (a big problem for current British manufacturers). When they try to recreate the engineering processes problems are occurring as the new employees have the IT knowledge to make the processes but hold no ‘real’ submarine knowledge of actual issues/complexities.

The department manager was particularly interested to see the number of jobs/man hours that could be saved or the number of new contracts that would be awarded due to KM making people more effective. He was, therefore, particularly interested in the quantitative measures. Once he had been through the whole KM business case he highlighted a few points that he thought would be useful to include:

• Quantifiable figures like the annual Staff turnover which could justify knowledge lost and the amount of time it takes to train up new starters.
• Actual numbers need to be included, such as costs which may be incurred through IT systems being introduced.
• Current costs incurred by inexperienced new employees could be included. By interviewing managers an understanding could be gained into the length of time that is taken to bring new starters up to a level where they use their time as effectively as their more experienced colleagues. The next step would be to ask the managers if this time would be reduced with the implementation of specific KM systems.
• Could ask the quality people the reasons for the quality reducing and see if one of their answers would be because of the key people/skills leaving the company.

All of these concerns are effectively the same. The manager was saying not all cost savings had been identified. The points raised by the manager are more specific to his business and focus on resolving his current issues. However, based on the business case that the manger had seen, he was positive in his feedback in agreeing that
creating a KM strategy would be the best way forward. There are a number of aspects highlighted by this feedback:

- The identification and quantification of all possible the cost savings will clearly be difficult, especially as some of the savings will be very specific to individual case.

- It is useful for anyone creating a business case to talk to managers at a senior level and look into their current business concerns and then create the case focused towards tackling them. The more costs that can be included, the better the case will be, as it will increase the managers' awareness of the possible savings.

- However, despite the first two points, this feedback also shows that it will not necessarily be essential to identify all possible cost savings if sufficient savings can be identified to justify the investment. Some of the more difficult to quantify or more speculative cost savings could potentially be ignored for the cost justification, being referred to only in the qualitative argument only. This will simplify the task of preparing the business case.

11.5 A Test of the KM Business Case Outside of RR

To gain an understanding into the usefulness of the business case created to others outside of Rolls-Royce, a template was created (appendix 24) and presented to three managers that currently work within different organisations:

1. Shelly Hardcastle, Defence Science and Technology Laboratory (DSTL)
2. Isobel Brown, Scottish Enterprise
3. Anne Newman, Wates

A questionnaire (appendix 25) was produced and presented to the other three external business managers to try and gain there perspective on the business case template and to see if they think it would be useful. The questionnaire contained five questions, the results of which are given below.
1. Did you find the business case useful?
All three respondents said 'Yes' they did find it useful. They all agreed that they have struggled to justify KM and that a business case like the one presented would be useful.

2. Did you find the business case easy to follow?
Again all three respondents said 'Yes'. The business case presented has clear and concise headings and the appendix held all of the supporting information so that the main content was not cluttered.

3. Would you use the business case template within your own organisation?
Two of the respondents said that they would use the template within their own company. The other respondent said that they would not be allowed to use another template as they have company specific ones and it would be going against their internal policies.

4. If the business case was presented to your decision maker/s, do you believe it would lead to a positive decision?
All three of the respondents selected 'Maybe' if their reasoning was valid and was built into the template. One respondent said that the template was similar to business cases she had previously used but that the content would need to be more specific. This is a valid point but the creation of a KM business case is supposed to be a starting point for companies to build upon and adapt to their own requirements. The second respondent iterated that they have their own company template and it would therefore be difficult to comment. She did say that it would be possible to adapt some of the content into their own templates and it may be a good idea to do so.

5. Do you think anything is missing from the business case?
This feedback was invaluable as the points raised were fed back into the KM business case and the developed KM framework that is detailed within Chapter 12. The first respondent suggested enhancing the 'Executive Summary' to include:

- Overriding benefits
• To gain an understanding into the needs of the manager/s and to aim the report into tackling those.
• Make the examples personal so that they relate to the specific manager e.g. hobbies, story on Golf.
• Summarise the money aspect e.g. 'profit or loss'
• Highlight the risks that could be involved in not taking up KM

This respondent explained that, within their experience, managers often only read the executive summary so they have historically focused it to their needs and added as much information as possible. This has been the case even if that means summarising points from other sections. The points are all useful suggestions, but again the adoption of them depends on the type of organisation and management involved. The business case creator would need to use their own discretion to make that decision.

The second respondent commented that the risks within the different sections had not been highlighted enough. This could easily be done by grouping them or highlighting them within the text. It was also noted that the strategic rationale behind the approach suggested had not been given enough detail. The final respondent said that she would prefer more pictorial representations of figures for example a graph that displayed the current state to where we want to be.

Asking different company representatives to review the business case reinforce the structured that has been created and also highlighted the differences in approaches. The importance of focusing the business case to the individual needs of the business is clearly important. The overall KM framework will allow KM practitioners to take the framework and using it as a starting point when creating their own KM business case, by adapting and expanding it as necessary for their organisations.
11.5 Conclusions

Current literature on KM is vast and detailed, but for a company that is looking to embark on KM it can be very difficult to know whether there is a good business case for KM in their own circumstances. Those who value KM are aware of its importance but find it difficult to show its worth within industry.

The aim of this chapter was to analyse current literature into KM business cases and to create both quantitative (cost) and qualitative justifications that could be used within industry. The proposed method for justifying a KM investment provides an outline business case which can be adapted for a company's own circumstances, which should be an easy and efficient method producing a business case for KM investment. It does not include lengthy audits or large resource investment, but does produce quantitative figures that can be presented to managers. It is also directed at the people who matter, the managers that allocate resources ensuring a quick turnaround.

The feedback from the managers inside and outside of the Rolls-Royce company that were presented the business case was positive, but it has reinforced the fact that a business case needs to be focused on current issues faced by management with sufficient quantitative cost measures to provide a justified return on investment. It is envisaged that the generic business case for KM will be the starting point that can be adapted and extended for creating a solid business case for KM that is appropriate for any particular company environment.
CHAPTER 12

A KNOWLEDGE MANAGEMENT FRAMEWORK

Chapter Preface

The previous chapters have drawn on different areas of KM and tried to provide solutions to current issues being faced by KM practitioners. The aim of Chapter 12 is to draw upon these findings and create a KM framework for organisations to follow when embarking upon a KM initiative (objectives eight and nine). The framework is flexible enough so it can be used within other organisations.

12.1 Introduction

The literature review (Chapter Two) discussed many areas that had not yet been fully explored in the KM field, such as defining a KM business case, understanding employee's knowledge needs, understanding the usefulness of KM tools. Someone embarking on KM for the first time, may struggle to find a complete and comprehensive method to follow, that would provide them with enough detail to initially gain business buy-in, through to measuring the success of their KM initiative. The aim of this chapter is to draw upon the research detailed in the previous chapters to propose a KM framework that provides a list of 'action processes' to guide the implementation of KM.

The framework will also address the cultural issues between the different areas of Rolls-Royce, for example the Aerospace business and the Marine business. The Rolls-Royce Aerospace business embarked on KM in 1996 as detailed in section 1.1, Chapter 1. This was driven by a customer requirement on Rolls-Royce Aerospace to learn from their lessons and to not make the same mistakes. As the design of a typical aerospace engine is approximately two years, the employees are used to working at a fast pace and therefore
the culture is susceptible to change to ensure there competitive advantage within the market place.

This is the opposite to the culture within the Marine business with the extremist example shown in the Submarines business where the design of a nuclear steam raising plant is typically 10 years, therefore 5 times longer then within the Aerospace business. Due to the nature of the business, the employees are very reluctant to change. The competition within this business is less aggressive as there are very few Submarine manufacturers in the world. The framework will aim to address the cultural issues of an organisation and tailor its approach to fit in with the culture.

KM is reflected by the culture of an organisation as it is dependent on the engagement of the employees to be adopted successfully. Therefore it was seen useful to review the work conducted on Change Management to see what could be carried across to the implementation of KM. The link between the culture and the change process within an organisation is important; therefore the KM practitioners will need to be aware of the fundamental principles of Change Management. Jones et al in 2008 created a list of ten principles of Change Management. These are:

1. **Address the “human side” systematically** - any significant transformation creates “people issues” therefore management need to ensure they are communicating with the employees and, where possible, make these communication sessions personal.

2. **Start at the top** - the management need to ‘lead’ the change, embrace it and show a united front to all employees.

3. **Involve every layer** - the change process needs to involve employees from throughout the organisation and encourage them to share the responsibility for design and implementation.

4. **Make the formal case** - formalising the case for change is useful in outlining a standard document that can be used by all throughout the business to detail the changes as associated benefits.
5. **Create ownership** - leaders within the business need to feel ownership and responsibility for the change and its implementation.

6. **Communicate the message** - communication is important to insure the correct message is flown down the organisation correctly. It also has to feed up to ensure any issues and concerns arising are being dealt with efficiently.

7. **Assess the cultural landscape** - the culture of the organisation will change at different levels and, therefore, leaders need to understand the culture at their level of the organisation.

8. **Address culture explicitly** - leaders need to take the understanding of the culture and address the change to reflect the behaviours of the employees.

9. **Prepare for the unexpected** - leaders need to be ready for things not going as planned.

10. **Speak to the individual** - leaders need to engage their employees on a personal level and be as explicit and honest as possible.

During the research the author has embraced the principles of change management to support the adoption of new tools for example with the development of the Intranet site and the Information Map. Examples include the level of employee engagement and communication.

As discussed in Chapter 8, the Support department needs KM to assist in growing and strengthening their current business. In order to achieve this, the author created and proposed a ten-action-process framework which was presented to the Marine Process Council to aid the KM implementation.
12.2 Ten Action Processes Knowledge Management Framework

The research exploring the key stages of implementing KM explored within Chapter 2 and building them into an overall framework, should enable KM practitioners to support their implementation of KM and make KM more successful within their organisation. These stages have been split into ten action processes which are detailed in sections 12.2.1 to 12.2.10.

12.2.1 Action process 1 - Gain Senior buy-in and Support

The importance of senior buy-in and support is paramount. As with any new project undertaken by an organisation, the support from the top shows both the importance of the project and the business commitment to its success.

The first stage is to gain buy-in from management that KM is worth investing in. This is accomplished by using the KM business case that is detailed in Chapter 11. The structure of the business case was taken from the adaptation of generic business cases as detailed in Chapter 11, section 11.3. The aim of the business case was to create both quantitative (cost) justifications detailed in section 11.3.5 and qualitative justifications detailed 11.6.3 (both in Chapter 11) that could be used to support KM within industry. A detailed method to qualify costs is in section 11.4 and the approach created by this research takes the results of the benchmarking exercise detailed in Chapter 11 and describes a method that can be used to create actual costs to support a business case.

It has been established that the best way forward in KM is to make 'outline opportunities for quick pay-offs' (Owens, 1999). This will place managers at ease about the investment and should allow other employees to start viewing the advantages of KM and how it can work to help them.
The business case shows management the importance of capturing and reusing the knowledge they have in their company efficiently (section 11.3.7). It also attempts to show the cost of not having a KM initiative in place. The proposed method for justifying a KM investment is easy to follow and low in cost as it does not include lengthy audits or large resource investment. It still provides quantitative figures that can be presented to management. It is also directed at the employees who matter, the managers that allocate resources insuring a quick turnaround. To make sure the business case is directed in the most appropriate direction, it needs to be focused on current issues faced by management. An example business case can be found in appendix 26.

**Action process 1a) Engage Management**

As stated in the second lesson learned from the Information Map, it is important to engage with management to establish their current business concerns. By identifying and incorporating their needs within the business plan it will help to allay their concerns, build their confidence, enable them to engage into the project and see KM as a real solution to their current problems.

**Action process 1b) Business Case Format**

The first stage is to establish and assess any existing business case templates within the organisation. If an organisation does not have a template they could adopt the one provided within section 11.1.3. Obtaining an established business template from existing internal or external published sources is a means of adopting established best practice as advocated in the first lesson learned from the Information Map. By working through the template and filling in the sections, this should help focus the direction of the KM proposal.

**Action process 1c) Cost Justification**

This section is crucial and should combine the use of two methods; benchmarking and adopting costs. It works by displaying the current business issue(s) and then displaying the possible cost to the company. This method has two approaches depending on the time available. If time is restricted, then the information can be gathered from just one
manager. The preferred approach is to gather information from a number of managerial resources. A questionnaire, as advocated in the forth lesson learned from the Information Map, could be useful for this purpose. By working through the three different examples given in chapter 11, or adopting the examples to focus on specific issues, this approach will provide the user with quantitative figures which can be presented as potential savings.

The business case is unique as it describes, with detail, a structure that can be adopted by any company for the business case but, more importantly, it describes a detailed method that can be adopted by any company to demonstrate the value that can be gained through KM. Within Rolls-Royce Marine the author used the business case (section 11.5) and presented it to a manger who was considering the adoption of KM. To validate this feedback it was also presented to mangers working within other businesses (section 11.5). The feedback from the mangers inside and outside of Rolls-Royce that were presented the business case was positive, but it has reinforced the fact that a business case needs to be focused on current issues faced by management with sufficient quantitative cost measures to provide a justified return on investment.

12.2.2 Action process 2 - Define KM Strategy

The creation of a KM strategy has to be undertaken with the commitment of senior managers. The Aero business has devised a KM strategy that could be tailored to the Support department. The strategy was reviewed but it was felt that the creation of a new strategy for the Marine business would be more appropriate as it would be focused towards the exact KM needs of the Marine employees. These needs where gathered using both a benchmarking tool and focus groups as detailed in Chapters 8 and 10.

Any strategy created will have to be in-line with the current objectives at both a business and organisational level. The strategy should be concise and include the following:

- The KM vision
Chapter 12  
Knowledge Management Framework

- Identifying project stakeholders and establishing methods to capture their needs and involve them in the strategy decisions
- Resources available, including established best practices, and resources required with methods of building a business case for the acquisition of these resources
- The detailed plan for implementing KM and ensuring the effective operation and maintenance of the KM systems
- Documentation of the measurements techniques

Once the management have agreed to the business case and the concept of supporting a KM initiative, the business can detail what it would like to achieve through the implantation of KM. The strategy should be clear and concise in what will be achieved by KM. The main aim of the strategy is to enable the managers to review the proposed route forward and to grasp the types of initiatives a KM programme will entail. The presenter may wish to offer different options so that the manager/s reviewing the strategy can determine the most appropriate approach. Involving the managers in the strategy decisions in this way is in line with the fifth lesson learned from the Information Map. The options suggest in the KM strategy for the Support Department are detailed in Appendix 27.

12.2.3 Action process 3 - Secure funding

KM, like any other projects, need funding to provide resource to support the project. Once the strategy has been agreed the KM practitioner will need to establish the costs of implementing the strategy. They will have to include the creation/purchase of any KM software, the resource required to support a KM programme across a department/business. This will probably be an iterative process that will involve budget holders, management and KM strategist/s. The close collaboration with users and managers as advocated in the second and fifth lessons from the Information Map will prove invaluable here as unless the users and managers have bought-in to the strategy the funding for such a strategy will not be forthcoming. A KM practitioner should be aware that without funding in place the project will be difficult to achieve.
As found in initiatives that come under the bracket of business improvements, many find they are fighting for the same resource. Therefore, they are unlikely to get the full amount they request. The proposed framework focuses the knowledge needs of the employees and therefore through identifying and ranking the most useful tools it is possible to adopt the KM strategy given the financial resources available. People are required to manage the project and to act as KM representatives across the business. By having funding available to those who require it, the business commitment is shown and employees will be more willing to participate if they have a designated code for their timesheet.

12.2.4 Action process 4 - Identifying KM Representatives

If the KM strategy is being deployed across a large organisation or many departments, it is advisable that KM representatives are found for each area, location etc. This will help the KM practitioner manage large numbers of employees. Each of the Support Department geographical locations will need to nominate a representative (Similar to the Business improvement and Documentum representatives in Submarines) who will be the main contact point for KM issues and queries. Each KM representative needs to be a person who is enthusiastic, an excellent communicator and keen to improve the business. Most importantly, they must be supported by their managers. They will have to be well informed and support the KM strategy with a good understanding of the tools and techniques available. Regular meetings with teams within their area should be held to review opportunities for capturing, reusing or disseminating knowledge. This close collaboration with and involvement of the users is in line with the second and fifth lessons learned from the Information Map.

Middle management should be encouraged to support the KM representatives working towards the KM strategy. Even though middle management are losing resource time to the KM strategy, the overall long term gains of KM will benefit the organisation.
The KM representatives should be briefed on the strategy and given clear instructions from the main KM practitioner/team. This will help to ensure their activities are inline with the overall business KM strategy and that they are using the correct methods and tools.

12.2.5 Action process 5 - Establish Knowledge Needs
Businesses that are seeking to embark upon KM or want to check if their current tools are meeting the employee’s requirements could deploy the method used within the Naval Marine business. Chapter Eight established that, within the same company, employees’ knowledge needs differed. This is a new concept compared to the existing literature, as a new KM initiative should strive to meet the particular needs of the employees that will be using the system. As a bare minimum, the tacit or/and explicit knowledge requirements should be determined. The method to do this is with focus groups and is detailed within section 8.2 of this thesis. When the budget is defined, the knowledge practitioners can use the results from this exercise and ensure that the resource is being directed towards the tools and techniques that are most sought after by the employees involved.

If it is discovered that the requirement has an emphasis on explicit knowledge and its location, the business/department could use the methods deployed within the Support Department and Submarines Department by developing their intranet (to be used with a small number of people and documents) or the Information Map.
12.2.6 Action process 6 - Carry out benchmarking and establish a Balance scorecard

Benchmarking gives a more detailed examination of the current state of KM within a selected area. The results give an insight into how the available KM tools are currently being used within the company or if no tools are being used, the current level of KM activity. A detailed description that describes both the KM benchmarking tools and the way they were used within Naval Marine can be found in section 10.2.1. The results were recorded and analysed, leading to the conclusion that the Naval Marine business needed to concentrate its KM activity on documenting knowledge.

An alternative to benchmarking is a Balance Scorecard. If this approach is adopted possible measurements could include the number of times KM tools have been used, lesson learnt that have been recorded, innovative approaches explored, etc.

12.2.7 Action process 7 - Select and Implement KM Tools and Techniques

Based on the benchmarking, questionnaires and focus group activity, the knowledge practitioner should have an overview of the knowledge needs of their employees. By reviewing the tools presented in Chapter Nine the practitioner would be encouraged to:

- Establish whether the focus will be on explicit, tacit or both types of knowledge. The method to establish this can be found in Chapter 8, section 8.2.

- Rank the tools in order of success. This has already been completed as part of Chapter 9, section 9.4, as assessment of KM tools within the Aerospace business was completed. A table with the successful score against each KM tool can be found in Chapter 10, table 10.3.

- Establish the cost of developing and supporting each tool. This would have to be derived by the KM practitioner as it will be dependent on the amount of resource and capital they have available to them.
• Decide on the tools to implement. The tools that should be chosen will depend on the benchmarking and focus group results establishing the employee's knowledge needs as described in process steps 5 and 6. The KM practitioner can then use table 10.3 and implement the most successful tools aimed towards the specific knowledge needs. The tools focused towards each type of knowledge, such as tacit and explicit, are displayed in Chapter 8, table 8.1.

A proposed implementation technique is offered within Chapter Ten, Section 10.6 based on lessons learnt from the Aerospace business and their implementation methods deployed. The key to any change within an organisation is to uphold high levels of communication with all those involved.

The Support department provides an example of the implementation of this action process of the framework. It is part of Rolls-Royce which has a number of different KM tools that any department can utilise. In this particular case, human resources are the only cost that is required to introduce and support the tools within a new department. It was therefore suggested to the Support department that they gain enough funding to support the selected tools. Based on their employee needs it was decided that tacit tools would be the first to be implemented followed by the explicit tools. The following list shows the order in which it was recommended the tools should be implemented:

1. Telephone Conferencing
2. Lessons Learnt Reviews
3. Communities of Practice
4. People Pages
5. Peer Assist
6. Story Telling
7. Capability Intranet
8. Company Intranet
9. Email
10. Lessons Learnt Logs
11. Hazard Identification Prompt Lists
12. Structured Knowledge Audits
13. TRIZ
14. Knowledge Acquisition Modelling Process
15. Benchmarking
16. Design Rational Editor (DRED)

Some of the tools, such as telephone conferencing, intranet and email require less promotion as they are already known throughout the company. However, it would be productive to remind people of the cost savings and advantages of using these tools across the business.

The tools usefulness is shown in table 10.3 (Chapter 10) and this was derived by undertaking a questionnaire within the Aerospace business and determining the usefulness of each KM tool. This list was then split into the tools that are focused towards tacit and explicit knowledge as displayed in table 8.1 (Chapter 8). The list is extremely useful to KM practitioners as they are provided with a list of KM tools and how successful their uptake has been within industry. It is especially useful for those KM practitioners that have a limited budget and therefore need to ensure the tools they implement provide quick payoffs so that the benefits can be shown to management, furthering their support for an investment KM.
12.2.8 Action process 8 - Building KM into the Process

An example of how the Aerospace business has used KM to improve their business processes is the Lessons Learnt tool. Lessons are reviewed and used to update the current processes so mistakes are not repeated. This is extremely important for any business as it shows that, firstly lessons learnt are being captured by an organisation and secondly those lessons are being embedded with current processes to ensure that those employees using the process for the first time will not make the same mistakes again. This will save time and make the overall process run more efficiently as well as demonstrating to companies' customers that they are capable of learning from their mistakes.

This approach is adopted by the Support Department within its KM strategy which highlights ways of building KM into the current processes. Three areas suggested were:

- Entrance and exit processes
- PDR - Personnel development reviews
- Processes excellence as an implementation route

The benchmarking (Chapter 10) highlighted business processes that employees found inefficient including the 'Entrance and Exit processes'. Employees expressed their concerns about joining a team and finding no official process to tell them the basics of how things are done. By working with HR the Support department could create a process that all managers and HR staff follow when they have a new starter. This should make the new starters more productive at an earlier stage (this was a request by the previous Director of Support - Bill Simmons), gain their buy-in for KM tools and techniques, and introduced them to a knowledge sharing culture.

The exit interviews are also very important as a considerable amount of knowledge can be lost when people leave the business and it is very important that this knowledge is retained. The Support business has highlighted people that are at risk of leaving the company in the near future. Plans therefore need to be in place for the use of the structure knowledge audit tool to ensure that critical knowledge is retained.
KM principals need to be embedded into the Rolls-Royce personal development system to drive a clear link for line managers between the business/department objectives and the training, development and skill/knowledge sharing needs of their teams. This can then be re-enforced through the existing PDR (personal development review) process. By doing this, the Support department should achieve benefits within existing budgets and focus the training budget more effectively.

Process Excellence (a systematic approach to identifying weak processes for optimisation) has been rolled out across the whole business and KM techniques such as structured knowledge audits, lessons learnt reviews and peer assist can be incorporated to Process Excellence projects to assist in process definition and re-engineering.

Embedding KM into the working processes is also a means of paying attention to the maintenance of the systems, as advocated in the sixth lesson learned from the Information Map (section 6.5, Chapter 6), as once it is established how the processes and systems will operate, attention can be paid to the maintaining of the knowledge to keep it up to date. This should involve establishing the ownership of the knowledge captured and stored, as suggested in the seventh lesson learned from the Information Map, so that users know their responsibilities for maintaining the knowledge. This should become an important part of the overall working processes.

12.2.9 Action process 9 - Monitor and Evaluate

The benchmarking technique is an excellent way to assess the progression of a KM project. As it has already been carried out within the Support Department, the baseline has been already been established. Benchmarking should only be conducted annually or biannually to determine the success of KM techniques/tools. This review process is also in line with the tenth lesson learned from the Information Map.

Another method used by the Aerospace team is to analyse the use of each KM tool by recording its use e.g. User-sessions on the capability intranet. The use of the tools and techniques within the business should be monitored and any benefits collated so that the
KM investment can be supported. This capturing of this information will then become a source of best practice knowledge for future KM initiatives.

12.2.10 Action process 10 - Decommissioning the Central KM Project Team

Once the KM initiative has been successfully deployed within the organisation, it is the role of the KM representatives to support it at a local level and to champion KM across different departments. Therefore, the need for a central KM project may not be required and may be decommissioned. This is one approach that could be adopted by an organisation. Other organisations may decide to keep the central team and utilise their skills and experience to sustain the uptake of KM across the business. The KM team could also be useful in establishing new tools/techniques entering the KM market and evaluate their usefulness to the organisation.

If the organisation decides to decommission is KM central team then they need to ensure that all employees are fully aware of the KM tools and techniques available to them and any new tools should be filtered into the department through the KM representatives. New starters will be informed about KM and the use of it within the business as part of their induction process. A high-level champion (director) will still be required within the business to continually highlight the importance of KM and to act as a point of contact for the local KM representatives to give advice and expertise as necessary.

12.3 Conclusion

Implementing KM within the Support business is achievable even with a restricted budget. The main dependencies for successful deployment are:

1. Support at all levels of the business (including the executive level)
2. Excellent communication
3. Lessons learnt from others for example, Aero, Defence, and Submarines.
4. Direction based on the employees' needs
5. KM to be built into the existing business processes

The framework has been presented at the Marine Process Council for review. The Council members were from the Marine Executive Board (the highest level of management within the Marine business). The feedback from the meeting on the framework was positive and it was announced that the framework would be used within Rolls-Royce. The presentation of the framework "prompted a detailed discussion on the way forward, which we haven't been able to achieve before". It also made them evaluate "who would be the Marine Executive Champion" showing the actions being based on the first action processes of the framework; Gaining senior buy in and support. An email from Martin Gowdridge containing these quotes (who was then the newly appointed KM representative for Marine and present at the meeting), highlights the success of the framework (email shown in Appendix 28).

The Framework offers a KM guide that can be adapted to different budgets. By basing the KM programme around the employees' needs appropriate tools can be selected within the given budget. Incorporating KM into the existing business processes by using techniques such as the personal development review, exit interviews, the adoption of KM should become easier and more cost effective. The framework and supporting research detailed within this thesis provides a basis for the adoption of KM within organisations.
CHAPTER 13

CONCLUSION

Chapter Preface

This chapter concludes the thesis by relating the work to the aims and objectives set out in Chapter One. Conclusions and recommendations for further work are included to provide direction for future research work by Rolls-Royce and / or other interested persons.

13.1 Information Map

The first aim of the research was to establish whether a knowledge location tool for CM information could be implemented in a way that was functionally effective, cost effective and satisfied the user needs. An important aspect of this would be the acceptability to the users, as a tool is of no use unless the users are willing to use it in practice. In establishing if this aim was achieved each one of the relating objectives has been taken and assessed.

Objective 1 - To determine what guidelines exist for the implementation of KM tools though the examination of current literature and through interviews with consultants who give guidance to KM practitioners.

If a company chose to develop its own suite of KM tools it would need to make sure that the implementation method for those tools ensured successful adoption and use. It was concluded within Chapter Two that the issue was not as straight forward as understanding the best practice for the implementation of software, as some KM tools do not include any IT, for example reviewing project lessons.
Reviewing solutions such as the Analytical Hierarchy Process (Ngai and Chan, 2005) led to the conclusion that current literature into the implementation of KM tools did not provide a comprehensive guide that a KM practitioner could follow to help aid the successful implementation of KM tools.

Research conducted within Rolls-Royce Aerospace, covered in Chapter Ten, proposed a list that could be used to guide employees through the process of implementing KM tools. The list was created through interviews with KM experts within the organisation and established what they believed was important in the implementation of KM tools and assessed whether these had been fulfilled within the implementation of each tool. These results were then correlated against the questionnaire results found within Chapter Nine (KM tools successful use).

The checklist was found useful in providing KM practitioners guidance when implementing KM tools (something that has not been covered within current literature). The six main points listed below can be used before a KM tool is introduced within a company to try and increase its uptake and its success:

1. Clear process and method
2. Easy to use
3. Senior buy-in
4. Publicity - benefits
5. Immediate benefits either personal/other/enjoyment
6. Training available

Objective one has therefore been attained in both, reviewing current literature and, through the use of an interview, recommending guidance to KM practitioners that can be used when implementing KM tools.
Objective 2 - To establish though questionnaires the extent of the problem of locating information in the Submarines business.

Current research explored within Chapter Two established the extent of the ‘Information overload issue’, as companies struggle to keep track of the information they acquire, produce and maintain (LaPlante 1997, Farhoomand & Drury 2002). To understand if the issue existed within the Submarines business of Rolls-Royce and, if so, to what extent, a questionnaire was disseminated.

The questionnaire confirmed the need to help improve the efficiency of finding CM information within the business. On average each employee spent 51 minutes a day searching for information. This time could be significantly reduced, by implementing a suitable tool, as the employees believed that 18 minutes a day could be saved on their current search times if they knew where to look for the CM information they required.

The questionnaire highlighted that many of the employees are not aware of the location of information, which could explain the reason for the search time being so high and, consequently, why employees can recreate documents that have already been produced within the company. Due to a lack of a search facility, these documents are not being found and therefore people are unaware of their existence. This showed an inefficient process that could lead to negative feedback from the customer.

Objective two was meet by quantifiably establishing the extent of the issue within the Submarines business of Rolls-Royce.

Objective 3 - To determine the information needs of the users in the Submarines business though interviews and questionnaires.

The questions used to understand the extent of the problem of locating information in the Submarines business also asked about the information sources that the employees used. The questionnaire revealed over a hundred documents that had not been formally
recognised as sources of information by the business. It gave an understanding into the current issues within the business and gave an indication to the way forward.

Chapter Four has detailed the need to support company employees in their search for information. It also achieved objective three by establishing the current information needs of the employees within the Submarines business by collating a list of information sources that had been recognised as being useful to employees within their current roles.

Objective 4 - To implement a tool to satisfy the information needs captured in objective three.

In achieving objective four, Chapter Five describes the development of a system referred to as the Information Map (IM). It works by providing “signposts” to information and knowledge. By identifying owners and experts of information, the tool encouraged users to make contact with the people that could provide knowledge and expertise in their area of interest. To unlock the true potential of the knowledge in the company a tool was required to encourage person to person contact. By identifying owners and experts of information, the IM encouraged users to make contact with the people that can provide knowledge and expertise in their area of interest.

The IM answered the original question of ‘where is the information I am looking for within the company?’ and achieved this by providing different views of information and allowing employees to search for what they required. The IM was piloted using CM information within the Submarines business of Rolls-Royce.

Objective 5 - To establish the longer-term success by questionnaires.

To establish the IM’s success and what lessons could be learnt from the introduction of the KM tool an evaluation of the IM was carried out and this was described within Chapter Six.

The success of the IM was dependent on the users and how they perceived it. Initial indications from the questionnaire results appeared to show that the IM helped answer the
question, 'where is the information I am looking for within the company?' Although the
small sample size meant that the success of the IM couldn’t be statistically proven, the
results nevertheless give a healthy indication that this was the case. The potential saving
to the company ran into thousands of pounds. The IM was rolled out and used to locate
tacit as well as explicit information and to make the working process more efficient
throughout the company.

Objective 6 - To establish the lessons learnt from the first aim of the thesis to form
the basis for the development of the KM framework for the second aim of the thesis.
Chapter Six highlights the lessons that were learnt from the IM development. These
lessons are listed below:

1. Analysing the literature, both internal documentation and external publications,
allow developers to gain from others’ experience and helps identify best practice.
2. Close collaboration with the users is invaluable as it (1) enables a complete and
accurate set of requirements to be gathered, and (2) enables a clear set of targets
to be set for the project.
3. On going communication is important to keep the user population updated with
progress so they continue to feel involved
4. A well designed questionnaire which allows unstructured free-form input as well
as structured answers to questions is a useful source of data as it (1) allows
requirements to be gathered, (2) identifies potential problems, and therefore, (3)
enables priorities to be set. It also (4) sets a baseline against which improvement
can be measured.
5. Involving the users in design decisions helps ensure the users ownership of the
development and makes them feel responsible for the project. This user buy-in
then significantly contributes to the success.
6. Attention to the maintenance of a new system is important and needs to be
considered in the system design as keeping a system up-to-date has been shown to
be a major source of concern amongst users.
7. Allocating owners to information and knowledge sources is an effective way of (1) involving users in the maintenance of a system, and (2) ensuring it is carried out more effectively.

8. The population size of the users is important and the smaller the group the more likely the tool will be successful. When developing a tool for a larger group there should be members of the user community that join the stakeholders.

9. Access to information needs to be easily achieved so the user finds benefit in using the tool. This can either be done by providing a contact or allowing direct access via IT systems, depending on the type of information.

10. Finally, it is important to review a system after it has been implemented and, in particular obtain users’ opinions and measurements of use, as this helps identify any initial failings of the system so they can be put right. Measurement of the success of a system also helps obtain buy-in to the new system.

The importance of strong communication was recognised as being important both within the project and with the user population. Techniques used to encourage communication included department’s newsletters, presentations, meetings, news articles and posters.

Due to the large population the tool would serve, a stakeholder group was required to help create the specifications. It may have been more useful to select random people from within the business to also be on the panel so that a wider set of requirements could have been gained. Involving people from different levels within the business may have led to a wider acknowledgment of the tool.

13.2 Summary of Aim One

Aim one of the research was to establish whether a knowledge location tool for CM information could be implemented in a way that is functionally effective, cost effective and satisfied the user needs.

The IM proved to be a success in providing people within the Submarines business with the knowledge of the whereabouts of CM information. The concept of the IM is one that
can be adopted by any business as the stages in the tools development have been well documented within Chapters Four, Five and Six. Section 13.1 outlined each of the objectives and the work carried out to fulfil them. A summary of this can be found in Table 13.1.

Table 13.1 - Aim One Objectives

<table>
<thead>
<tr>
<th>Objective 1</th>
<th>Meeting the Objective</th>
</tr>
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<tbody>
<tr>
<td>To determine what guidelines exist for the implementation of KM tools though the examination of current literature and through interviews with consultants who give guidance to KM practitioners.</td>
<td>Current literature revealed that there were no guidelines available to help determine the best method of implementing KM tools. Through a number of interviews with Aerospace KM experts, patterns were established and guidance created.</td>
</tr>
<tr>
<td>Objective 2</td>
<td>Meeting the Objective</td>
</tr>
<tr>
<td>To establish though questionnaires the extent of the problem of locating information in the Submarines business.</td>
<td>The issue was captured in a rigorous way through the use of a questionnaire.</td>
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<tr>
<td>Objective 3</td>
<td>Meeting the Objective</td>
</tr>
<tr>
<td>To determine the information needs of the users in the Submarines business though interviews and questionnaires.</td>
<td>The requirements of the employees were gained via questionnaires, presentations and interviews.</td>
</tr>
<tr>
<td>Objective 4</td>
<td>Meeting the Objective</td>
</tr>
<tr>
<td>To implement a tool to satisfy the information needs captured in objective three.</td>
<td>The IM was created and placed onto the Submarines network.</td>
</tr>
<tr>
<td>Objective 5</td>
<td>Meeting the Objective</td>
</tr>
<tr>
<td>To establish the longer-term success by questionnaires.</td>
<td>A questionnaire was conducted after the IM was implemented.</td>
</tr>
<tr>
<td>Objective 6</td>
<td>Meeting the Objective</td>
</tr>
<tr>
<td>To establish the lessons learnt from the first aim of the thesis to form the basis for the development of the KM framework for the second aim of the thesis.</td>
<td>The lessons that were learnt from the IM project were documented. An overview can be found in Section 13.2.1.</td>
</tr>
</tbody>
</table>
Chapter 13

13.3 Aim One - Further Research

The development of the IM has highlighted a number of design considerations that require further research to determine the optimum solution. The decision needs to be made regarding the issues to give the optimum conditions for the success of the tool, and the sharing of knowledge within the company. Some of the more significant design decisions requiring further research are:

1. How do users search for information and what search facilities are required in different circumstances?
2. If a browse facility is provided, what refinement criteria will help find the necessary information quickly and efficiently?
3. What is the optimum size of a community to be served by a tool to be developed?
4. What feedback facilities are required for the Information Source and the IM itself, and how can users be encouraged to use the facilities to provide feedback?
5. How can information sources be rated for accuracy, availability and general usefulness?
6. Does information age in terms of its usefulness and need?
7. What level of regulation is required to (a) update existing information, (b) add new information? Should users have the freedom to add and update information themselves, should all such changes be controlled by an administrator, or is there some form of middle way?
8. Should information ever be deleted from the system?
9. Can information ever be regarded as redundant or is it always required for reference?

These are all research questions raised during the research into aim one. These require exploring within more detail to establish the criteria for an optimum system for knowledge provision. The long-term success for the IM will be dependent on the users and how they perceived it. Initial indications do appear to show that the IM has indeed helped answer the question, 'where is the information I am looking for within the company?'
Although the small sample size meant that the success of the IM could not be statistically proven, the results nevertheless give an indication that the tool was being successfully used within the Submarines business. The potential saving to the company runs into many thousands of pounds. The IM was rolled out and used to locate tacit as well as explicit information and make the working process more efficient throughout the Submarines business.

In fulfilling aim one, a better understanding has been gained into the issue of locating information and knowledge within a business. The method used can be replicated by anyone looking to see if there is an issue within his or her business. The development of the IM as a knowledge location tool for CM information has been developed in a way that means that the method can be adopted by others. Current literature did not provide a sufficient solution to this issue, nor did it detail a method or guide to tackle the issue.

13.4 Aim Two - Knowledge Management Framework

Chapters Seven, Eight, Nine, Ten, Eleven and Twelve have drawn on different areas of KM and have provided solutions to current issues being faced by KM practitioners. The second aim was to draw upon these findings from the research and create a KM framework for organisations to follow when embarking upon a KM initiative.

In establishing if aim two was achieved, all of the Objectives have been reviewed and are detailed below.

Objective 7a - A second case study of the implementation of a KM tool using the lessons learnt from the first aim of the thesis.

Rolls-Royce has a very effective intranet site which delivers information to all employees at a corporate level. Smaller departments are using the advantages of intranets to allow them to share information, which is department specific. It is successful if the site contains the information the users require. The current literature available on intranets
detailed within Chapter Two, did not specify the importance of the information contained within the site and how this information should be collected.

An intranet site for the Support team was developed and the conclusions obtained were that the team were pleased with the site and will go on using it. It enabled the members to have all of their relevant information collated within an easily accessible central location. Why was it a success? Attention to the users’ needs played a big factor in the intranet’s success. The main lesson learnt from this case study, was that intranet sites are developed to provide people with the information they need to complete and do their jobs. If that information is not present then employees are wasting time looking at colourful HTML pages. This is both inefficient and costly, and will ultimately lead to the sites becoming out of date and unused. The same principle can therefore be applied to KM tools, as people will only use them if they can aid them within their tasks.

Within Rolls-Royce regular meetings were conducted with the users to ensure that the information within the site met their needs. This may have been made easier by the small size of the user group. For a larger group, attention must be paid to ensure there is adequate consultation with the users. For example, prototypes and plans for the site could be emailed to users to give them an opportunity to raise issues. Further research is required into the effect the size of the user group has on the success of an intranet.

This research established that a successful intranet site requires careful planning and consultation with the users. Above all, to avoid failure it is important to ensure the information is relevant and maintainable. A site would be better without an item of information if it cannot be kept up to date as this could potentially lead to the whole intranet loosing credibility. The understanding into employees needs was further explored by establishing the differences between teams as detailed in objective 7b.
Objective 7b - Focus groups to establish knowledge needs of employees.

The study allowed an insight into whether teams within Marine prefer to use tacit or explicit knowledge. The case study conducted did not provide any quantitative results that could be used to compare the two groups. Each group discussed the points highlighted in Chapter Eight and came to their own conclusions. This method was believed to be a better way of conducting the study because each group member expressed different experiences from across the business and, therefore, those experiences were discussed and placed in context. This gave a result achieved through consensus rather than of a group of extreme opinions represented in questionnaires. It also opened up other areas that may have otherwise been missed, such as the lack of company resource and the willingness of employees to take up KM.

After analysing the results from the two groups it was concluded that the Safety team regarded explicit knowledge to be more important whereas the Total Care Solutions team rated tacit knowledge higher. As there was only a small gap that existed between their results, further discussions became important in establishing which areas of KM required support.

This then opened up the exploration of the KM tools available and the different types of knowledge they supported. Businesses that are looking to embark on KM or wanting to check if their current tools are meeting the employee’s requirements could employ the exercise conducted within the Marine business. Research was taken a step further to try and aid the decision of which tools to implement by analysing the focus group notes. For example, within the safety team the emphasis was placed on explicit knowledge and it was made apparent that tools such as the Intranet and structured knowledge audits would be useful to the team. From a tacit perspective the use of peer assist, people pages and communities of practice would be useful for them to explore.

Chapter Eight established that within the same company employees’ knowledge needs differed. This is a new concept, not revealed from the current literature, and it is an area that requires further research as a new KM initiative should strive to meet its employee’s
needs. As a bare minimum, an investigation should be carried out to determine whether those knowledge needs are for tacit or explicit knowledge.

Many KM initiatives have a limited budget, so it is therefore very important to ensure that the most return is initially gained from the implementation of the KM tools. The next stage was to explore the different KM tools available within the company and try to establish the usefulness of the tools so that knowledge managers looking to implement KM tools can be aided with a guide as to which have proven to be the most successful. This should aid them in gaining support for their KM initiative and also provide 'quick wins' which could be used to prove the success of the initiative to management.

Objective 7c - A survey of KM tools across the Aerospace business to discover their perceived usefulness.

A questionnaire was disseminated to employees within the Aerospace business to establish the usefulness of KM tools. It was found that successful tools like the intranet, Capability intranet and email could offer important lessons that could be applied to different tools. Lessons need to be learnt into how these tools have been embedded into the working practices and how these tools provide the services requested of them. Email is the most highly accepted tool, and the reason why needs to be established. It seems that the sample used, displayed a lack of awareness of many of the tools.

In the short-term, Rolls-Royce needs to promote the current usage of the tools through the promotion of success stories and the benefits that have been gained. In the Long-term they need to look into embedding the tools into the process and also positively encourage those that are using the tools. The importance of the Company Intranet has been prominent in the survey and needs continued investment by the company to ensure that the information people require is available and easily accessible.
Very few of the tools need training and, therefore, could be made more available to the wider population. The research established that there were two main areas that required further exploration. The first step was to explore the current usage of KM tools within the Marine business to see if it reflected the use of tools within the Aero business. The second phase was to learn from the tools that are being successfully used and to try and apply the best practices across to the tools that are not being so well used. By learning from tools like Telephone conferencing were people believe it's the 'only way to do the job' and that 'it's better than the alternative method', the generic lessons learnt can be applied to the other tools.

Objective 7d - A benchmark of the current state of use of KM tools and techniques within the company to establish a baseline for the measurement of KM use.

A benchmarking tool was used within the Support business and was found useful in determining which of the four areas of KM a business unit needs to focus its strengths in. It is also useful in establishing which business areas are doing well in KM allowing others to learn from their experiences and encouraging the sharing of KM best practices.

The use of benchmarking was taken further as shown in Chapter Eleven were it was used to help create a business case for KM. The implementation method discussed proposes a list that could be used to guide people through the process of implementing KM tools.

Objective 7e - A construction of a business case template for the introduction of a programme of KM tools.

Current literature on KM is vast and detailed, but for a company that is looking to embark on KM it can be very difficult. Many managers are not aware of the importance of capturing and reusing the knowledge they have in their company efficiently. Those who value KM are aware of its importance but find it difficult to show its worth within industry.
Chapter 13

The aim of Chapter Eleven was to analyse current literature into KM business cases and to create both quantitative (cost) and qualitative justifications that could be used within industry. It was established that the best way forward in KM is to make 'outline opportunities for quick pay-offs' (Owens, 1999). This will place managers at ease about the investment and should allow other employees to start viewing the advantages of KM and how it can work to help them. This is a very good theory, but in practice it would very difficult, as the tools could not be placed within a company without having the money and resources in place.

The proposed method for justifying a KM investment is an easy and efficient method. It does not include lengthy audits or large resource investment, but does produce quantitative figures that can be presented to managers. It is also directed at the people who matter, the managers that allocate resources, ensuring a quick turnaround. The feedback from the managers that were presented with the business case was positive, but it reinforced the fact that a business case needs to be focused on current issues faced by management. It is hoped that this research will give the beginning of a solid business case for KM that can be adapted by different companies.

Objective 8 - To derive a full KM framework for the introduction of KM tools based on the findings of the above.

The framework developed in Chapter 12 offers a KM guide that can be adapted to different budgets by basing the KM program around the employees' needs and listing the tools that will best suite those needs. Each program manager can select tools that will support their business and employees. Incorporating KM into the existing business process and using vehicles like the personal development review and exit interviews for KM dissemination, the process of adoption will be easier and more cost effective. The framework and supporting research should provide everything that is needed to implement KM successfully.
Objective 9 - To test the KM framework through feedback from internal company managers.

The framework was presented at the Marine Process Council for review. The Council members were from the Marine Executive Board (the highest level of management within the Marine business). The feedback from the meeting on the framework was positive and it was announced that the framework would be used within Rolls-Royce.

The author would have liked to have taken the framework and used it as a case study within a company and use metrics to measure its success. This was not possible within the given timescales as the placement time for the author within the Support business came to an end.

13.5 Summary of Aim Two

Aim Two of the research was to create a KM framework that could be adapted by companies looking to invest in KM and provide them with a guide to use. The aim was broken down into three objectives, objectives 7, 8 and 9 with objective 7 being broken down into five parallel activities (a to f). How they were achieved has been detailed in Table 13.2.

The work conducted within the Support business tried to fill in gaps in current research by offering companies a new approach to KM which was based upon the way that industries work today. KM projects struggle for funding and therefore need to ensure that any tools/techniques adopted meet the needs of their employees. By firmly establishing these needs and analysing the successful use of the tools when placed within industry, the research tries to help those who are faced with real KM issues.

The creation of the KM framework simplifies the work conducted and offers practitioners an easy high-level approach to the adoption of KM by grouping the process into ten steps. It is hoped that this is presented in a fashion that is easy to follow and ultimately offers a guide to make the best use of the resources and budget available to KM practitioners.
### Table 13.2 - Aim Two Objectives

<table>
<thead>
<tr>
<th>Objective 7a</th>
<th>Meeting the Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>A second case study of the implementation of a KM tool using the lessons learnt from the first aim of the thesis.</td>
<td>A case study within the Support business documented the development of an intranet site.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Objective 7b</th>
<th>Meeting the Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus groups to establish knowledge needs of employees.</td>
<td>Focus groups were carried out with employees from the Support and Safety areas of the Marine business.</td>
</tr>
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<table>
<thead>
<tr>
<th>Objective 7c</th>
<th>Meeting the Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>A survey of KM tools across the Aerospace business to discover their perceived usefulness.</td>
<td>Employees from across the aerospace business were asked to complete a questionnaire.</td>
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<table>
<thead>
<tr>
<th>Objective 7d</th>
<th>Meeting the Objective</th>
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<tbody>
<tr>
<td>A benchmark of the current state of use of KM tools and techniques within the company to establish a baseline for the measurement of KM use.</td>
<td>A benchmarking exercise was conducted and established the usage of KM tools and techniques across different levels of employees from the Support business.</td>
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<thead>
<tr>
<th>Objective 7e</th>
<th>Meeting the Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>A construction of a business case template for the introduction of a programme of KM tools.</td>
<td>A generic business case for KM was created and presented to management both internal and external to Rolls-Royce.</td>
</tr>
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<tr>
<th>Objective 8</th>
<th>Meeting the Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>To derive a full KM framework for the introduction of KM tools based on the findings of the above.</td>
<td>A 10 step KM framework was created incorporating the research and work conducted.</td>
</tr>
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</table>

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<tr>
<th>Objective 9</th>
<th>Meeting the Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>To test the KM framework through feedback from internal company managers</td>
<td>The framework was presented to the Process Council within Marine.</td>
</tr>
</tbody>
</table>
13.6 Aim Two - Further Research

The research conducted achieved all of the objectives specified but there were a few areas that ideally were not developed within as much detail. This was due to the lack of time available. Therefore, the research conducted to fulfil aim two raised some additional research questions that are listed below.

_Do the knowledge needs of employees really differ within the same organisation?_ 
It would have been useful to conduct more focus group sessions to assess the differences between more groups across the business. Even though this was not possible, it is still advisable that this or a similar activity is conducted as KM is used to help retain and reuse knowledge by the employees, and it will only work successfully if it can be established what knowledge they require, what they struggle to access, or what they learn from etc.

_Do the user group size for a tool affect the implementation method used to deploy the tool?_
Further research is also required into the effect the size of the user group has on the successful deployment of KM tools, for example an intranet. The size of the group used within the Support group was fixed, but it would have been useful to use the same site development process with varying group sizes to establish any differences that may have existed in the site’s usage.

_Can the Knowledge Management framework be used by a KM practitioner successfully?_
The overall testing of the KM framework was an issue as it would have been useful to hand over evidence to support the framework to people looking into the adoption to KM and so they could better assess if it would have been useful in their case. Ideally, the opportunity to assess the successfulness of the approach presented within the framework would have allowed areas for development to be identified and, therefore, the framework to be strengthened.
Overall the research has tried to tackle the 'real' issues faced by KM practitioners such as limited budgets and knowing which tools/techniques to adopt within industry by offering practical solutions and guidance.

13.7 Research Constraints

Conducting the research within Rolls-Royce provided a rich environment that enhanced the research. The opportunity to complete the research within industry was invaluable but there were some research constraints highlighted. Firstly, as a sponsored student placed within industry, time can often be spent aiding the companies everyday activities and therefore the time available to conduct the research can be limited.

Secondly, with the author having no prior knowledge of the engineering associated with a submarine, it took some time initially, to understand the terminology and businesses practices of the organisation. Thirdly, when research is associated with any type of organisational change such as Knowledge Management it is not always easy to gain the support of every employee. Many of the employees within the Submarines business are ex-submariners and are used to working in a very controlled and autocratic way. When they are approached with a different way of doing things they can often be wary and not always willing to partake. This was generally very rarely seen and in the instances where it was seen the author would tailor the approach to the individuals needs and spend time with the employee to further their understanding.

Fourthly, with research projects there is often a time frame agreed at the beginning. The research time was extended by a few months from the agreed completion date and this was to support some key reporting documents required by Roll-Royce. If more time had been available at the end of the project then it would have been useful to test the proposed framework within the Support business and understand its strengths and weaknesses.

Finally, Roll-Royce out-sources its Information Technology services to an external company EDS. As EDS control the computer networks they approve the uploading of
software onto the network. This often held up areas of the research such as the development of the Information Map. It had to go through the reviews and gates placed by EDS before it was deployed onto the network and this consumed a considerable amount of time.

13.8 Contribution of Research

The research approach was action research and therefore the environment in which the research was conducted was rich with 'real' organisation issues. When approaching these issues the research has documented the additional considerations that have evolved whilst trying to embed KM within industry. These findings are therefore very useful to other researchers and KM practitioners.

The research contributes four major elements to the KM research domain. These are:

1. The Information Map
2. An Action research approach
3. Implementation of Knowledge Management tools to the users
4. The Framework as a guide for industry

This chapter has summarised the thesis, relating the work to the aims and objectives that were set out in Chapter One. Conclusions and recommendations for future work have been discussed to provide direction for further research work by Rolls-Royce and / or other interested persons. Overall all the aims and objectives have been achieved so this research project must be considered a success, and it should, therefore, be of benefit to others within or external to Rolls-Royce in their initiatives to implement KM in the future.
REFERENCES


References


References


References


References


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References


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## APPENDICES

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<td>CM Information Sources Matrix (Example of Class against Part)</td>
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<td>Appendix 26</td>
<td>Example Business case</td>
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<td>Appendix 27</td>
<td>Options available to the Support business detailed within their KM strategy</td>
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<td>Martin Gowdrige’s email</td>
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APPENDIX 1

INFORMATION MAP STAKEHOLDER PRESENTATION
Welcome to the Information Map Meeting
Friday 11th April 2003
Small lecture theatre

Information Map - Why
X Born out of an Improvement Project
X The Improvement Project found that there wasn't a clear visibility of NSRP related information system within the business.
X Some local people were found to hold lots of knowledge
X The map was seen as a tool to pass this knowledge on to people who required access.

About Me?
X I graduated from Sheffield with a BSc Hons Degree
X PhD which is with Loughborough University and sponsored by RR.
X Situated within Operation Support (Managed by Peter Hill)
X PhD is mentored by Heulwen Pearce.

Information Map - Development
MSc Student - Ross Bateman
• Outlined Project Requirements
• Created a 'Proof of Concept'

PhD Sponsorship - Hardev Ubhi
• Complete the list of requirements when producing the information map

Vision of the Future
"The Information Map will underpin the effective support of the fleet throughout their life cycles"
By Roger Higgins and Heulwen Pearce

Objective - Today
"To finally agree the functional requirements of the Information Map and how we expect to utilise it"
By Roger Higgins and Heulwen Pearce
Outcomes

Things to achieve today:-
- Finally agree on a map scope
- Finally agree the map functionality's
- Finally agree the typical profile of users
- Document potential issues

By Roger Higgins and Heulwen Pearce

Questionnaire Review

Question 1
What is your perception of an Information Map?

Question 5
Who do you think will use the Information Map?

Questionnaire Review

Question 6
How many regular users (approximately) do you think the Information Map will have?

Question 7
What do you think will encourage the use of the Information Map?

Questionnaire Review

Question 10
What criteria should determine the quality of information, which is placed on the Information Map, including experts, databases etc?

General Questions

Question 11
Who should be responsible for the quality of the information?

How are people finding information at the moment?

Are these people getting the Information that they want efficiently?
**General Questions**

- How many times a week do you get interrupted by people seeking information?
- How many hours do you think this collates to a week?
- If an Information Map was in place, how many hours do you think you would then spend dealing with helping others to search for Information?

**Finally...**

Thank you
APPENDIX 2

IUR - INTERPRETATION OF USER REQUIREMENTS
Interpretation of User Requirements

**Title**
Interpretation of User Requirements for the Development of an Information Map Website

**Identity N°**
IUR-IM-2003

**Issue**
1

**Issue Date**
11/04/2003

**DDR ref**
DDR-IM-2003

**Category**
- Principal Stakeholder

**Heulwen Pearce**

**Distribution**

**Background**
As part of an information rationalisation activity, RR has highlighted a requirement to document and portray RR Submarines business Master Records, as they pertain to Configuration Management (CM) NSRP data. A website to capture such information needs to be developed in line with the appropriate web design standards and methods will be applied. See Table 1 IUR, RRMP22021, Requirement No. 1 – Provide and maintain an information source map.

**Project Aim**
The research and development of an interactive information map for the Rolls-Royce Intranet. This is in support of Submarine Business process improvements. The resultant website needs to be capable of standing alone, but referencing various sites on the Rolls-Royce intranet and the Rolls-Royce Quality Management System.

### Functional Requirements

<table>
<thead>
<tr>
<th>No.</th>
<th>Requirement</th>
<th>Origin</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Utilise the product lifecycle as a base structure to the map</td>
<td>Meeting 27/06/02</td>
<td>M</td>
</tr>
<tr>
<td>2</td>
<td>The map must be fully useable and accessible by all RR submarine employees</td>
<td>Meeting 27/06/02</td>
<td>M</td>
</tr>
<tr>
<td>3</td>
<td>Utilise colour coding for ease of navigation</td>
<td>Meeting 27/06/02</td>
<td>D</td>
</tr>
<tr>
<td>4</td>
<td>Ability to link to other Rolls Royce Intranet sites.</td>
<td>Meeting 27/06/02</td>
<td>D</td>
</tr>
</tbody>
</table>

### Constraint

<table>
<thead>
<tr>
<th>No.</th>
<th>Requirement</th>
<th>Origin</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Internet Server will be to the prevailing standard</td>
<td>Meeting 11/04/03</td>
<td>M</td>
</tr>
<tr>
<td>2</td>
<td>Covers Submarines Business</td>
<td>Pearce comment 25/7/02</td>
<td>M</td>
</tr>
</tbody>
</table>

### Delivery Requirements

<table>
<thead>
<tr>
<th>No.</th>
<th>Requirement</th>
<th>Origin</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Implementation Program for project delivery</td>
<td>Pearce 11/04/2003</td>
<td>M</td>
</tr>
<tr>
<td>2</td>
<td>Prototype Information map</td>
<td>Pearce 11/04/2003</td>
<td>D</td>
</tr>
<tr>
<td>3</td>
<td>Production of Information map with documentation</td>
<td>Pearce 11/04/2003</td>
<td>M</td>
</tr>
<tr>
<td>4</td>
<td>Measurements of the Information Map Project</td>
<td>Pearce 11/04/2003</td>
<td>M</td>
</tr>
</tbody>
</table>

**Authorising Signature**

**Name**
Heulwen Pearce

**Date**
11/04/2003
APPENDIX 3

DDR - DEFINITION OF DETAILED
REQUIREMENTS
# Definition of Detailed Requirements

**Title**: Definition of Detailed Requirements for the Development of an Information Map Website

**Identity N°**: DDR-IM-2003

**Issue**: 1

**Issue Date**: 11/04/2003

**IUR Ref**: IDR-IM-2003

**IUR-IM-2003**

**Category**: Principal Stakeholder

**Heulwen Pearce**

**Distribution**: Gary Wright, John Holbourn and Mark Baker.

---

**Background** – Table 1 IUR, RRMP22021

Requirement No. 1 – Provide and maintain an information source map.

<table>
<thead>
<tr>
<th>No.</th>
<th>FUNCTIONAL REQUIREMENT</th>
<th>ORIGIN</th>
<th>CLASS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Data Types to be represented – Databases, Spreadsheets, Microfilm, Drawings, Images, CAD Drawings, E documents, Hard documents.</td>
<td>Meeting 10/07/02</td>
<td>M</td>
</tr>
<tr>
<td>1.2</td>
<td>Assign, utilise and maintain fixed generic telephone numbers for the functionally responsible areas.</td>
<td>Meeting 10/07/02</td>
<td>D</td>
</tr>
<tr>
<td>1.3</td>
<td>Information map shall be updateable and expandable.</td>
<td>Meeting 10/07/02</td>
<td>M</td>
</tr>
<tr>
<td>1.4</td>
<td>Information map must be maintained.</td>
<td>Meeting 10/07/02</td>
<td>M</td>
</tr>
<tr>
<td>1.5</td>
<td>Information is to be navigated across as well as down through the product life cycle.</td>
<td>Meeting 10/07/02</td>
<td>M</td>
</tr>
<tr>
<td>1.6</td>
<td>Information can be located by different options, not by a single route.</td>
<td>Meeting 10/07/02</td>
<td>M</td>
</tr>
<tr>
<td>1.7</td>
<td>High-level word search can be used to give options of information location, at all levels of the map.</td>
<td>Meeting 10/07/02</td>
<td>M</td>
</tr>
<tr>
<td>1.8</td>
<td>Unrecognised words can be captured for central review and valid approved words updated into system.</td>
<td>Meeting 10/07/02</td>
<td>M</td>
</tr>
<tr>
<td>1.9</td>
<td>Output of search can be printed, with traceability of the search path used.</td>
<td>Meeting 10/07/02</td>
<td>M</td>
</tr>
<tr>
<td>1.10</td>
<td>User feedback can be captured for the updating of the map, whilst in the map application.</td>
<td>Meeting 10/07/02</td>
<td>M</td>
</tr>
<tr>
<td>1.11</td>
<td>Attributes (functional responsibility) added into RR corporate telephone directory.</td>
<td>Meeting 10/07/02</td>
<td>M</td>
</tr>
<tr>
<td>1.12</td>
<td>Relationships and commonality between available information shall be defined</td>
<td>Meeting 10/07/02</td>
<td>M</td>
</tr>
<tr>
<td>1.13</td>
<td>Ability to link to the capability and knowledge management system.</td>
<td>Meeting 10/07/02</td>
<td>M</td>
</tr>
<tr>
<td>1.14</td>
<td>Indicate to the user when a search is being performed, and report on the findings of the search to the user, (for example - no data evident for type searched).</td>
<td>John Holbourn email 15/07/02</td>
<td>M</td>
</tr>
<tr>
<td>1.15</td>
<td>A print option shall be provided on all screens (views).</td>
<td>Alan Baker email 12/07/02</td>
<td>M</td>
</tr>
<tr>
<td>1.16</td>
<td>All printed reports shall be in an easily readable format, with a date and time stamp.</td>
<td>Alan Baker email 12/07/02</td>
<td>M</td>
</tr>
<tr>
<td>1.17</td>
<td>The search facility shall have efficient response time, if this is unachievable the user shall be advised of the expected waiting time.</td>
<td>Alan Baker email 12/07/02</td>
<td>M</td>
</tr>
</tbody>
</table>

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PO Box 2000, Raynesway, Derby DE21 7XX Telephone: 01332 661461 Fax: 01332 661630

Page 1
Interpretation of User Requirements for

<table>
<thead>
<tr>
<th>No.</th>
<th>FUNCTIONAL REQUIREMENT</th>
<th>ORIGIN</th>
<th>CLASS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.18</td>
<td>Each phase of the product life cycle is to be colour coded (taking into account colour blindness), and this colour will flow through all levels of any particular search associated with that life cycle phase. The colours also need to be viewable/readable, once printed.</td>
<td>Meeting 08/08/02</td>
<td>M</td>
</tr>
<tr>
<td>1.19</td>
<td>A feedback form shall be automatically produced if a word search does not locate any information. This should have the functionality to disable at anytime.</td>
<td>Meeting 08/08/02</td>
<td>M</td>
</tr>
<tr>
<td>1.20</td>
<td>Title screen shall state the title “Product Information Map”.</td>
<td>Meeting 08/08/02</td>
<td>M</td>
</tr>
<tr>
<td>1.21</td>
<td>The user shall be advised that any feedback they have provided has been reviewed and the outcome of that review.</td>
<td>Meeting 08/08/02</td>
<td>M</td>
</tr>
<tr>
<td>1.22</td>
<td>Each information site should have a designated owner.</td>
<td>Meeting 11/04/03</td>
<td>M</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No.</th>
<th>CONSTRAINT</th>
<th>ORIGIN</th>
<th>CLASS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Produce and document in accordance with Rolls-Royce's Website Design and the Software Quality Management processes/requirements.</td>
<td>Heulwen Pearce 11/04/03</td>
<td>M</td>
</tr>
<tr>
<td>2.2</td>
<td>Apply with the required security regulations</td>
<td>Meeting 11/04/03</td>
<td>M</td>
</tr>
<tr>
<td>2.3</td>
<td>Internet Server will be to the prevailing standard</td>
<td>Meeting 11/04/03</td>
<td>M</td>
</tr>
<tr>
<td>2.4</td>
<td>Covers Submarines Business</td>
<td>H Pearce comment 25/7/02</td>
<td>M</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No.</th>
<th>DELIVERY REQUIREMENTS</th>
<th>ORIGIN</th>
<th>CLASS</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>Produce an Information map capable of maintenance of data plus enhancement/expansion of functionality in the future</td>
<td>Heulwen Pearce 11/04/03</td>
<td>M</td>
</tr>
</tbody>
</table>

Authorising Signature | Name | Date |
----------------------|------|------|
|                      | Heulwen Pearce | 11/04/2003 |
APPENDIX 4

CAM (CONTROL ACCOUNT MANAGERS)
PRESENTATION
**Information Map**

By Hardev Ubhi

**Managers Meeting**

- Born out of an Improvement Project
- The Improvement Project found that there wasn't a clear visibility of NSRP related Configuration Management (CM) information within the business.
- The map is seen as a tool which will collate this information.

**Personal Information**

- I graduated from Sheffield with a BSc Hons Degree
- PhD which is with Loughborough University and sponsored by Rolls Royce
- Situated within Infrastructure Operation Support (Managed by Peter Hill)
- PhD is Mentored by Heulwen Pearce

**Information Map - History**

**Information Map Development**

- MSc Student - Ross Bateman
  - Outlined Project Requirements
  - Created a 'Proof of Concept'

- PhD Sponsorship - Hardev Ubhi
  - Analysing and designing a solution to meet the list of requirements

**Today's Objective**

'To gain the agreement from yourself and your team, to help in the creation of the CM Information Map'

**Outcomes**

Things to achieve from today's meeting

- To gain understanding about;
  - Configuration Management Information
  - The uses for the Information Map
  - How the information Map will benefit your area
  - What information is required from yourself and your team
  - What is needed to be done next
  - And for me to document any concerns
- To agree to support the creation of the information Map
Configuration Management

CM has been recognised as a key enabler for the Submarines business both to excel with its current business commitment and also to move into new areas such as reliability management, commodity management and contracting for availability.

As referenced by DEF STAN 05-57 Annex A (Issue 4), Configuration Management (CM) is defined as:

“A management system for establishing a product’s functional and physical characteristics and for maintaining consistency with its changing requirements through the life cycle.”

What is an Information Map

The Information Map is:

• An interactive web-site
• It will allow users to find the route to CM Information Sources quickly and efficiently
• The user will have the ability to search the Information Map and identify the location of the specific CM Information Sources

Information Map - Benefits

• Allow the user to find Configuration Management related information sources at a click of a button.
• It should save time searching for information.
• It will direct people to the correct Information experts
• Should encourage a more productive working process
• The executive sources of information will be clearly identified.

What Information we need from you

We are looking to identify all CM Information Sources, which you either refer to produce/maintain CM related information. This Information Source could be a database, a suite of documents or an expert within a particular field.
What is needed to be done next

- To provide a list of key people within your area that can be contacted.
- I will then contact these people and provide them with an electronic version of a questionnaire, which they can distribute accordingly.
- We need your continued support to ensure that the questionnaires are filled out and returned within a timely manner to help with the success of the Information Map.

Are you happy?

"To gain agreement from yourself and your team to support the creation of a CM IM"
Configuration Management Information Map Questionnaire

General Information
1. Name
2. Business area
3. If the answer to question 2 is 'Other' then please specify within the space provided
4. How long have you worked within your current job role?
5. How long have you worked for Rolls-Royce?

Search
6. Presently, how easy do you find it to search for CM information?
7. In an average day, how much time is spent looking for CM information/advice?
8. How much of this time could be saved if you knew where to look for this information/advice?
9. Within the past year, how much time do you think you have wasted as a direct result of not knowing about information that was available within the company? E.g. recreating documents - please specify a time in the box below
10. In relation to question 9, please state any examples within the box below?
11. How often have you successfully found relevant CM information?
12. Please state below what type of CM information you find difficult to retrieve?
13. Please state below the circumstances under which you would use the Information Map?
14. Could your current search time be reduced with the use of an Information Map?
15. If you think that you would not access the Information Map then please state why in the space provided below?
16. If you were presented with an Information Map, how would you prefer to search for your required CM information? (Please select all that apply)
   - By the Product Life Cycle Phase
   - By Submarine
   - By Class
   - By System
   - By Part/Product
   - By File
   - Other
   - Free text word search
17. If the answer to question 11 is 'Other' then please specify within the box below?
18. What Information Source/s (if any) do you provide for others to use, which you are unlikely to use yourself? e.g. DAFAR
19. Do you have any other comments concerning the Information Map?
The following questions will relate to different levels of C3A information which you reference.
Please respond to each question answering the different questions in relation to the information source.

<table>
<thead>
<tr>
<th>26. What is the information source (if any)?</th>
<th>27. If answer to 26 is &quot;Other&quot; then please describe the information source.</th>
<th>28. How easy is it to extract information from the information source?</th>
<th>29. Non-essential is the information source?</th>
<th>30. What level do you perceive the reliability of information?</th>
<th>31. Any additional comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other</td>
<td></td>
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</table>
APPENDIX 6

CM INFORMATION SOURCES MATRIX
(EXAMPLE OF CLASS AGAINST PART)
APPENDIX 7

QUESTIONNAIRE 2 - INFORMATION MAP
Information Map Questionnaire for Information Source Owners

General Information

1. Name
2a) IPT
2b) Other option

3a) Are you within the RR Phone book?
   □ Yes  □ No

3b) Is the information about yourself in the RR phone book up to date?
   □ Yes  □ No

4a) Do you have a RR People Page?
   □ Yes  □ No

4b) Is the information on your RR people pages up to date?
   □ Yes  □ No

Information Sources which has been related to yourself

The Data Source referenced is

5. How does the Information Source relate to you? I.e. owner, expert

6. If you are not the owner then who do you think is?

7a) Please confirm that the Information Source is available within the following formats;

   - □ Database
   - □ Spreadsheet
   - □ Hard Documents
   - □ Images
   - □ CAD Drawings
   - □ Other...Please specify in the box below
   - □ Person
   - □ Drawing
   - □ E Documents

7b) If 'Other' Then please specify;

Agreement to question 7 or the specification of any changes

8a). What format do you believe is the master?
8b) Other option

9. Are you the owner of all the formats of Information Sources?

10a). Which Submarine Parts does the information Source reference?

   - □ Pumps
   - □ Valves
   - □ Fittings
   - □ Instrumentation
   - □ Piping
   - □ Pressure Vessels
   - □ Transducer
   - □ All
   - □ Other, Please specify below

10b) Other option

11. Which classes of Submarine does the Data Source relate to?

   - □ Trafalgar
   - □ Vanguard
   - □ Svifsure
   - □ Astute
   - □ STF

12a) Which plant system does the information source relate to?

   - □ RC Fresh-Water Cooling
   - □ Coolant Discharge/Drains
   - □ Primary Shied
   - □ Primary circuit
   - □ Pressurising
   - □ Coolant Treatment
   - □ All
   - □ Coolant Make-up/Valve operating
   - □ Emergency Cooling/HPDHR
   - □ Low Pressure Decay Heat Removal
   - □ Main steam
   - □ Pressure Relief
   - □ Miscellaneous
   - □ Other
   - □ Rod Control
   - □ Feedwater Control
   - □ LPS and ECCS
   - □ Neutron Flux
   - □ Reactor Air/Valve Operating and Gass
   - □ Collant Sampling

12b) Please specify 'Other'

13. The below headings are the six RR Product Life Cycle Phases. By looking at the low level lists please specify which documents the information Source references

   - □ Concept
   - □ Definition

   - □ REQUIREMENTS & ASSESSMENT CRITERIA
   - □ CONCEPT CREATION & ASSESSMENT TECHNICAL OPTIONS
   - □ BASIS FOR DECISION
   - □ EVIDENCE OF CUSTOMER AGREEMENT
   - □ ASSUMPTIONS
   - □ REQUIREMENTS SPECIFICATION
   - □ ARM STRATEGY
   - □ ILS STRATEGY
   - □ DEVELOPMENT TEST REPORTS
   - □ DEVELOPMENT & VERIFICATION OF CHOSEN CONCEPT
   - □ SAFETY REPORTS
### Realisation
- APPLICABILITY STATEMENT
- MRI
- SUPPORT DOCUMENTATION REQUIREMENTS (AR, BR, IPC's, SC's, SOP's, O'I's, SSP45)
- PROTOTYPE TEST VALIDATION
- COMMITMENT TO CREATION
- SYSTEM DEFINITIONS INCLUDING CONFIGURATION ID
- DESIGN INTERFACE SPECS
- MAINTENANCE/KEEP TRIALS REQS
- MANUFACTURING SPECS (EQUIP OR TECH SPECS)
- PRODUCTION/ACCEPTANCE TEST SPECS
- INSTALLATION REQUIREMENT
- LIVE FILE REFERENCE
- DRAWINGS & SCHEMES
- NSN INTERFACE SPECS
- DESIGN CERTIFICATES
- DESIGN CHANGE REQUESTS
- VRM
- ASSOCIATED PRODUCTS

### Production
- ORDER NO
- TX206 NO
- UNIQUE SERIAL NO
- MANUFACTURING CONCESSIONS
- CONTAINER PART TO CONTAINED PART
- DETAIL PRODUCTION TEST RESULTS
- REPAIR STATUS
- MANUFACTURING INFORMATION (year of manufacture)
- COMMISSIONING REPORTS
- TEST PROCEDURES
- RAMPS
- RAPS
- BUILD AS FITTED STATUS AT PAD
- RRADAR
- SHIPBUILDER CONCESSIONS
- RRADAR (Installation & Commissioning)

### Disposal
- MAINTENANCE PMS
- AS FITTED EQUIPMENT CHANGES (Decommissioning & Disposal) (INCLUDING SERIAL NO & DESIGN STATES
- DDLP DAR
- ARCHIVE REQUIREMENTS
- EQUIPMENT STATUS (date scrapped)
- TX Form
- RRADAR (Decommission & Disposal)

14. If Other then please specify?

15. Please write a brief description of the information source that will be sufficient to enable an electronic search?

16. At what level do you perceive the quality of Information?

17. Any additional comments?
APPENDIX 8

INFORMATION SOURCE OWNERS CONSENT FORM
**Information Map**

**What is Configuration Management (CM)?**

CM is related to the Engineers and Technical people who work within the Submarines business. It is only successful if all these people contribute/retrieve to the process, as shown within the following diagram,

![Diagram](image)

CM has been recognised as a key enabler for the Submarines business both to excel with its current business commitment and also to move into new areas such as Reliability management, Commodity management and Contracting for availability.

As referenced by DEF STAN 05-57 Annex A (Issue 4), Configuration Management (CM) is defined as;

"A management system for establishing a product's functional and physical characteristics and for maintaining consistency with its changing requirements through the life cycle"

**What is the Information Map?**

The Information Map will be an interactive web site, which will allow users to find the route to CM Information Sources quickly and efficiently. The user will have the ability to search the Information Map and identify the location of the specific CM
Information Sources. The image below is an initial concept of the Information Map which displays how the information might be represented (The red circles on the grid represent Information Sources which matched the search criteria).

What is an Information Source?
We are looking to identify all CM Information Sources, which you either refer to produce/maintain CM related information. This Information Source could be a database, a suite of documents or an expert within a particular field.

Why have I got to fill out the questionnaire?
You have been highlighted as an owner/expert of an Information Source within the Submarines business. The use of this questionnaire is to clarify the information, which has been provided to us.

Additional Information
The Configuration management Information Map has evolved out of a Rationalisation activity, which found that there was not a clear visibility of NSRP related CM information within the Submarines Business. It was established that a large number of people held vast amounts of knowledge locally and the map is seen as a tool to pass this Knowledge on to people who require it. Rolls Royce has sponsored me as a student doing a PhD in Knowledge Management. My mandate is to complete the design, implementation and population of the Configuration Management Information Map. Your privacy will be respected and any information you provide will be treated with confidence. Thank you for your co-operation,

Hardev Ubhi (Ext 52379).
Configuration Management Information Map Agreement

Name: 

Information Source: 

Agreement:
I agree that the information which has been provided is correct and that if any changes do occur, I will inform the nominated Map owner as soon as possible. I will ensure that the Information Map is reviewed and maintained on a basis to be agreed, and that if my responsibilities change, I will inform the next person within the role.

Signed ____________________________

Date ______________________________
APPENDIX 9

INFORMATION MAP DEVELOP
DOCUMENTATION
ROLLS-ROYCE

CONFIGURATION MANAGEMENT INFORMATION MAP

PHASE ONE IMPLEMENTATION

GROUP ONE

FEBRUARY 2004

LOUGHBOROUGH UNIVERSITY

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1. DESIGN OF ASP FILES

1.1. addAuthor.asp

This page is a pop-up window responsible for enabling the user to add an author to an information source from the Edit page (page 1).

When the page is called from itself using the 'search' button it queries the database for persons matching the search terms the user provided (forename and/or surname). It populates a list with these people, from which the user can select one.

When the page is called from itself using the 'select' button (with a person from the list selected), the selected author is then added to the session variable array 'Authors'. The window then refreshes the Edit page and closes.

Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>errorlevel</td>
<td>- Used to determine the error status of the page</td>
</tr>
<tr>
<td>came/fromMyself</td>
<td>- Used to determine whether the page has submitted itself</td>
</tr>
<tr>
<td>surname</td>
<td>- Used to hold the surname entered by the user</td>
</tr>
<tr>
<td>authorID</td>
<td>- Used to hold the ID of the selected author</td>
</tr>
<tr>
<td>arraySize</td>
<td>- Used to hold the size of the Session 'Authors' array</td>
</tr>
<tr>
<td>new/Array</td>
<td>- New array used to update the Session 'Authors' array</td>
</tr>
<tr>
<td>sql</td>
<td>- Used to hold the SQL query for execution</td>
</tr>
<tr>
<td>name</td>
<td>- Used to hold the full name of the selected author</td>
</tr>
</tbody>
</table>

Session variables

AddAuthorToAddAuthor

Authors

Hidden fields

origin - Used to establish where the page has been called from

Database tables queried

Person Table

1.2. addOwner.asp

This page is a pop-up window responsible for enabling the user to add an owner to an information source from the Edit page (page 1).

When the page is called from itself using the 'search' button it queries the database for persons matching the search terms the user provided (forename and/or surname). It populates a list with these people, from which the user can select one.

When the page is called from itself using the 'select' button (with a person from the list selected), the Owner ID and Owner Name Session Variables are populated with the details from the database. The window then refreshes the Edit page and closes.

Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>errorlevel</td>
<td>- Used to determine the error status of the page</td>
</tr>
<tr>
<td>errprivilege</td>
<td>- Used to determine whether the selected owner has the required privilege</td>
</tr>
<tr>
<td>forename</td>
<td>- Used to hold the forename entered by the user</td>
</tr>
<tr>
<td>surname</td>
<td>- Used to hold the surname entered by the user</td>
</tr>
<tr>
<td>ownerID</td>
<td>- Used to hold the ID of the selected owner</td>
</tr>
<tr>
<td>sql</td>
<td>- Used to hold the SQL query for execution</td>
</tr>
</tbody>
</table>
1.3. advSearch.asp

This file is responsible for displaying the advanced search page. This page does not undertake any of the searching functionality, but is responsible for passing the search parameters to search.asp, which then executes the search and displays the results.

When advanced search is called from anywhere but itself, the session variables for the search are cleared, in order to prepare for a new search. The levels and hierarchy lists are populated from the database as the page is displayed.

Variables

- classArray
  - newClassArray2D
    - modelArray
    - newModelArray2D
    - systemArray
    - newSystemArray2D
    - componentTypeArray
    - newComponentTypeArray2D
    - typeArray
    - newTypeArray2D
    - levelArray
    - newLevelArray2D
  - Array used to hold the specified classes
  - Array used to update the classArray
  - Array used to hold the specified models
  - Array used to update the modelArray
  - Array used to hold the specified systems
  - Array used to update the systemArray
  - Array used to hold the specified components
  - Array used to update the componentArray
  - Array used to hold the specified types
  - Array used to update the typeArray
  - Array used to hold the specified levels
  - Array used to update the levelArray

Session variables

- advSearch Clear All Fields
- advSearch Keywords
- advSearch Stages
- advSearch All stages
- advSearch day_created_from
  - advSearch month_created_from
  - advSearch year_created_from
- advSearch day_created_to
  - advSearch month_created_to
  - advSearch year_created_to
- advSearch day_published_from
  - advSearch month_published_from
  - advSearch year_published_from
- advSearch day_published_to
  - advSearch month_published_to
  - advSearch year_published_to

1.4. browse.asp

This file defines the frameset for the Explore page. The main two panes in the frameset contain browseMenu.asp (left-hand pane) and browseSearch (right-hand pane).

As this page is simply a frameset, no variables or hidden fields are used and no database queries are performed.

1.5. browseMenu.asp

This file builds the hierarchical menu for the Explore page. The menu is based upon open-source Javascript menu code, freely available from www.treemenu.com. The Javascript builds the Stage/Level/Component type hierarchy by querying the database, thereby ensuring that the Explore menu reflects the current state of the database. The ASP consists of three functions: buildMenu, buildStage and buildLevel. These functions are called recursively to build the menu dynamically each time the page is loaded. The database queries are designed so that menu items will only be created when information sources exist that will be retrieved when that menu item is clicked. This eliminates redundant menu items, thereby making it easier for the user to navigate the hierarchy.

When a menu item is clicked, a Javascript function 'doSearch' is called with two parameters: a string containing the name of the selected menu item, and a comma-separated list of integers containing the stage number, level number and component type number to search for. If a stage is clicked, this list will only contain the stage number, e.g. "3". If a level is clicked, the list will contain the parent stage and the level, e.g. "3,2". If a component type is clicked, the list will contain the parent stage, parent level, and component type number, e.g. "3,2,4". On receipt of these parameters, the doSearch function causes a "Please wait, searching..." message to appear, places the values of the two parameters into the browseSearch page (on the right-hand side), and causes browseSearch to refresh itself.

The menu code is handled by external Javascript files: mmcode.js, mmtrack.js and right-click.js. Details of these files can be found at the Treemenu website as described above.

Variables

- stage1D
- stageName
- levelID
- levelName

Session variables

- advSearch Authors
- advSearch Owners
- advSearch Classes
- advSearch Systems
- advSearch Models
- advSearch Components
- advSearch Levels
- advSearch Types
- search Origin
- stageList
- origin
- authorIDremove
- ownerIDremove
- ownerID
1.6. browseSearch.asp

This file is responsible for returning search results according to search terms selected on browseMenu. When browseMenu causes this page to refresh, the values of variables 'hs' (hidden search) and 'has' (hidden search string) are used to build the results page. The value of 'has' is simply used to display the search term as the top of the search results, while 'hs' is parsed to discover the stage number, level number and component type number being searched for. The database is queried accordingly to display the title and stage of the matching information sources. An 'I' is presented next to each information source title, which opens a popup details window (fullInfoPopup.asp), presenting the same information as the details page obtained from the main Search page.

Variables

resultsFound - Boolean used to determine whether any results were returned
keywordsEntered - Boolean used to determine if keywords have been entered
searchterm - String used to hold the search term
searchterms - Array of strings used to hold the IDs of the stage, level and component type being searched for
displayterm - String used to hold the term to display at the top of the search results

Session variables

Session.Content("FullInfo popup Source ID")

Database tables queried

Stage Table
Level Name
Component Table
Stage/Level R Table
InfoStage R Table
InfoLevel R Table
InfoComponent R Table
Information Source

1.7. editasp

This page allows the owner of an information source to make changes to its details. When the 'Next' button is selected, the page calls itself and checks each field for changes by comparing each field with the relevant field in the database. If changes are found, the relevant session variables are populated with the new information, and then the page redirects to EditInfoSourcePage2.asp. If the 'Reset' button is selected, the session variables are cleared such that the information displayed is reset to that stored in the database.

Variables

keywordsarray - Array used to hold the specified keywords
oldstring - String used to hold the original keyword string
newstring - String used to hold the changed keyword string
keywords - String used to hold the keywords
stagechanged - Boolean used to determine if the selected stages have changed
direct - Boolean used to determine if a redirect can occur
authID - Integer used to hold the ID number of the source authors
name - String used to hold the full name of the source authors
datecreated - Boolean used to determine if the date created fields have changed
datecreated - Boolean used to determine if the date created fields have changed
datecreated - Boolean used to determine if the date created fields have changed
datepublished - Boolean used to determine if the date published fields have changed
datepublished - Boolean used to determine if the date published fields have changed
datepublished - Boolean used to determine if the date published fields have changed
noRecords - Array used to hold the separated date created elements
origKeywords - Array used to hold the separator date created elements
keywordCount - Integer used to hold the number of authors records associated with the source
modifierCount - String used in parsing the keyword string
ptr - Integer used in parsing the keyword string
token - Integer used in parsing the keyword string
right - Integer used in parsing the keyword string
brace - Integer used in parsing the keyword string
quotes - Boolean used in parsing the keyword string
colons - Boolean used in parsing the keyword string
modifier - Boolean used in parsing the keyword string
argument - String used in parsing the keyword string

eTitle - String used in parsing the keyword string
eType - String used in parsing the keyword string
eLocation - String used in parsing the keyword string

eKeywords.

Session variables

erTitle
erKeywords
editTitle
editDescription
eType
erLocation

1.8. editInfoSourcePage2.asp

This page is responsible for enabling the user to make changes to the class, model, system and component types associated with the document. If changes have been made to the links determined by the edit Links changed flag then the page displays the contents of the Class, Model, System, and Component session variable arrays, otherwise the page displays the links stored in the database. The page is responsible for removing items from the Session Variable arrays when a 'remove' button is selected, however, additions are made by the LinkClass, LinkModel, LinkSystem, and LinkComponent pop-up windows called when an 'Add' button is selected.

Variables

sourceID - Integer used to hold the ID number of the source being edited
IDToRemove - Integer used to hold the ID of the class, model, system or component type to remove

Session variables

New Source ID
dateChanged
Class array
Model array
System array
Component array
linkClass came from self
linkModel came from self
linkSystem came from self
linkComponent came from self

1.9. editInfoSourcePage3.asp

This page is responsible for updating the database with any changes specified on the Edit pages 1 and 2. As the Session Variables are only set by the first two edit pages when changes have been made this page can simply check if the Session Variables contain information and only make changes to the database if so. The page then logs the change in the Change Log Table.

Variables

IDDummy - Array used to hold the ID numbers of keywords.

Session variables

New source ID
dateEdited
dateCreated
datePublished
dateLastUpdated
editAuthors
editClass
editModel
eidType
eidLocation
eidKeywords
eidName
eidSystem
eidComponent
eidArray

database tables queried

Information Source
InfoAuthor Table
InfoOwner R Table
InfoLevel R Table
InfoLocation R Table
InfoStage R Table
InfoModel R Table
InfoSystem R Table
InfoComponent R Table
Keyword Table
1.10. fullinfo.asp

This page is responsible for displaying the full details concerning an Information Source. The page is passed an Information Source ID from the page that called it and simply reads in the information from the database and displays it. The page also provides functionality for adding comments to the Information Source.

Variables

- sourceID - Integer used to hold the ID of the information source
- concept - Boolean used for displaying the stage images
- definition - Boolean used for displaying the stage images
- realisation - Boolean used for displaying the stage images
- production - Boolean used for displaying the stage images
- service - Boolean used for displaying the stage images
- disposal - Boolean used for displaying the stage images
- comment - Boolean used for displaying the author details
- keyword - String used for displaying the keywords

Session variables

- Comment - String used for holding comments
- cComment - Integer flag used to check validity of comments

Hidden fields

- origin - Used to determine where the page was called from
- hiddenID - Used to hold the ID of the information source

Database tables queried

- Info/Keyword Table
- Info/Source
- Type Table
- Info/Owner R Table
- Person Table
- Info/Level R Table
- Level Table
- Info/Location R Table
- Location Table
- Stage Table
- Info/Stage R Table
- Info/Author Table
- Person Table
- Keyword Table
- Info/Keyword R Table

1.11. fullinfopopup.asp

This page is responsible for displaying the full details concerning an Information Source in a popup window and is called from the Browse page. The page is passed an Information Source ID from the Browse page and simply reads in the information from the database and displays it. The page also provides functionality for adding comments to the Information Source.

Variables

- sourceID - Integer used to hold the ID of the information source
- concept - Boolean used for displaying the stage images
- definition - Boolean used for displaying the stage images
- realisation - Boolean used for displaying the stage images
- production - Boolean used for displaying the stage images
- service - Boolean used for displaying the stage images
- disposal - Boolean used for displaying the stage images
- comment - Boolean used for displaying the author details
- keyword - String used for displaying the keywords

Session variables

- Comment - String used for holding comments
- cComment - Integer flag used to check validity of comments

Hidden fields

- origin - Used to determine where the page was called from
- hiddenID - Used to hold the ID of the information source

Database tables queried

- Info/Comment Table
- Info/Source
- Type Table
- Info/Owner R Table
- Person Table
- Info/Level R Table
- Level Table
- Info/Location R Table
- Location Table
- Stage Table
- Info/Stage R Table
- Info/Author Table
- Person Table
- Keyword Table
- Info/Keyword R Table
OwnerName - String used to hold Owner names
eTitle - Integer used to hold the error flag
eDescription - Integer used to hold the error flag
eProductionDate - Integer used to hold the error flag
ePublicationDate - Integer used to hold the error flag
nAuthor - Integer used to hold the error flag
eAuthor - Integer used to hold the error flag
eStage - Integer used to hold the error flag
eLevel - Integer used to hold the error flag
eType - Integer used to hold the error flag
Location - Integer used to hold the error flag
Keywords - Integer used to hold the error flag
LevelPopupFlag - Flag used for establishing where pages have been called from
AddAuthorToAddAuthor - Flag used for establishing where pages have been called from
Class - Integer used for holding class IDs
Model - Integer used for holding model IDs
System - Integer used for holding system IDs
Component - Integer used for holding component type IDs
linkError - Integer used to hold the error flag
existError - Integer used to hold the error flag
New source ID - Integer used for holding the source ID to be edited
linkClass came from self - Flag used to establish whether the linkClass page called itself
linkModel came from self - Flag used to establish whether the linkModel page called itself
linkSystem came from self - Flag used to establish whether the linkSystem page called itself
linkComponent came from self - Flag used to establish whether the linkComponent page called itself
Class array - Array used to hold the changed classes
Model array - Array used to hold the changed models
System array - Array used to hold the changed systems
Component array - Array used to hold the changed component types
Fullinfo popup Source ID - Integer used to hold the source ID of the required source
Page - Integer used to hold the current page number on the search page and the edit documents page
BrowseRefine Stages - Used to refine Explore search results (no longer used)
BrowseRefine All stages - Used to refine Explore search results (no longer used)
BrowseRefine Component type - Used to refine Explore search results (no longer used)
advSearch Clear All Fields - Boolean used to indicate that fields should be cleared in advanced search
advSearch Keywords - String used to hold keywords for advanced searching
advSearch Stages - String used to hold stages for advanced searching
advSearch All stages - Boolean used to indicate all stages should be included in advanced searching
advSearch day_created_from - Integer used to hold dates for advanced searching (no longer used)
advSearch month_created_from - Integer used to hold dates for advanced searching (no longer used)
advSearch year_created_from - Integer used to hold dates for advanced searching (no longer used)
advSearch day_created_to - Integer used to hold dates for advanced searching (no longer used)
advSearch month_created_to - Integer used to hold dates for advanced searching (no longer used)
advSearch year_created_to - Integer used to hold dates for advanced searching (no longer used)
advSearch created_from - Integer used to hold dates for advanced searching (no longer used)
advSearch created_to - Integer used to hold dates for advanced searching (no longer used)
advSearch published_from - Integer used to hold dates for advanced searching (no longer used)
advSearch published_to - Integer used to hold dates for advanced searching (no longer used)
advSearch years - Array used to hold authors specified for advanced searching
advSearch Authors - Array used to hold authors specified for advanced searching
advSearch Owners - Array used to hold owners specified for advanced searching
advSearch Classes - Array used to hold classes specified for advanced searching
advSearch Systems - Array used to hold systems specified for advanced searching
advSearch Models - Array used to hold models specified for advanced searching
advSearch Components - Array used to hold component types for advanced searching
advSearch Levels - Array used to hold levels specified for advanced searching
advSearch Types - Array used to hold types specified for advanced searching
editTitle - String used to hold the changed title when editing
editDescription - String used to hold the changed description when editing
editAuthors - Boolean used to determine if the authors have changed when editing
editOwners - Array used to hold the changed authors when editing
eEditOwner - Integer used to hold the changed owner name when editing
editStage - String used to hold the changed stages when editing
editType - Integer used to hold the changed type ID when editing
editLocation - Integer used to hold the changed location when editing
editKeywords - String used to hold the changed keywords when editing
eEditQuality - Integer used to hold the changed quality level when editing
editQualityComment - String used to hold the changed comment when editing
editLinkchanged - Boolean used to determine if the links on Edit Page 2 have been changed

1.13. linkClass.asp

This page is called from EditInfoSourcePage2 and is responsible for enabling the user to add a specified class to the Class Array session variable ready for updating in the database. The page sets the 'edit Linkchanged' flag to true before refreshing the EditInfoSourcePage2 page and closing.

Variables
errorlevel - Integer used to identify errors
classID - Integer used to hold the ID number of the specified class
className - String used to hold the name of the specified class

Session variables

Class array
editLinkchanged

Database tables queried
Class Table

1.14. linkComponent.asp

This page is called from EditInfoSourcePage2 and is responsible for enabling the user to add a specified component to the Component Array Session Variable ready for updating in the database. The page sets the 'edit Linkchanged' flag to true before refreshing the EditInfoSourcePage2 page and closing.

Variables
errorlevel - Integer used to identify errors
componentID - Integer used to hold the ID number of the specified component
componentName - String used to hold the name of the specified component
1.15. linkModel.asp

This page is called from EditInfoSourcePage2 and is responsible for enabling the user to add a specified model to the Model Array Session Variable ready for updating in the database. The page sets the 'edit Linkschanged' flag to true before refreshing the EditInfoSourcePage2 page and closing.

Variables

errorlevel - Integer used to identify errors
modelID - Integer used to hold the ID number of the specified model
modelName - String used to hold the name of the specified model
Session variables

Model array
edit Linkschanged
Database tables queried

Model Table

1.16. linkSystem.asp

This page is called from EditInfoSourcePage2 and is responsible for enabling the user to add a specified system to the System Array Session Variable ready for updating in the database. The page sets the 'edit Linkschanged' flag to true before refreshing the EditInfoSourcePage2 page and closing.

Variables

errolevel - Integer used to identify errors
systemID - Integer used to hold the ID number of the specified system
systemName - String used to hold the name of the specified system
Session variables

System array
edit Linkschanged
Database tables queried

System Table

1.17. myDocuments.asp

This page (now titled Edit Documents) is responsible for displaying all of the documents that the current user has permissions to edit. The page provides links to the FullInfo and Edit pages for each source displayed.

Variables

PublishedDateFrom
PublishedDateTo
AuthorArray
OwnerArray
ClassArray
SystemArray
ModelArray
LevelArray
typeArray
ComponentTypeArray
nRecords
Origin
Page
Start
NewSQL
Concept
Definition
Realisation
Production
InService
Disposal
Session variables

User ID
AdvSearch All Fields
AdvSearch Keywords
AdvSearch Stages
AdvSearch All stages
AdvSearch Day Created from
AdvSearch Month Created from
AdvSearch Year Created from
AdvSearch Day Created to
AdvSearch Month Created to
AdvSearch Year Created to
AdvSearch Day Published from
AdvSearch Month Published from
AdvSearch Year Published from
AdvSearch Day Published to
AdvSearch Month Published to
AdvSearch Year Published to

AdvSearch Authors
AdvSearch Owners
AdvSearch Classes
AdvSearch Systems
AdvSearch Models
AdvSearch Component types
AdvSearch Levels
AdvSearch Types
AdvSearch Keywords
Current keywords

Database tables queried
Information Source
InfoStage R Table
InfoAuthor Table
InfoOwner R Table

InfoClass R Table
InfoSystem R Table
InfoModel R Table
InfoComponent R Table
Component Table
InfoLocation R Table
Keyword Table
TypeInfo R Table
InfoStage R Table

Hidden fields
hiddenPageNo
origin
stageList
hiddenList
currentID
- Used to hold the page number
- Used to indicate where the page was called from
- Used to hold the list of selected stages
- Used to hold the selected source ID to pass to fulinfo.asp
- Used to hold the selected source ID to pass to edit.asp
2. TESTING

2.1. Approach

During development of the Configuration Management Information Map, the functionality of each page was extensively tested in an attempt to fix as many bugs as possible early in the project. Many errors were discovered and fixed at this stage, resulting in less effort being spent on bug fixing later in the project. However, it was appreciated that bugs would be likely to exist in the final system, regardless of the level of care taken during modular testing. As an additional factor, the specification of the system changed significantly before final delivery, with large amounts of functionality being removed. It was therefore necessary to perform a full system test once development of the system was complete.

In order to perform the system test, the team was restructured to accommodate the change of function. It was decided that one person would write test scripts, another person would perform the tests, and the remaining two team members would perform any necessary code fixes. A test script template (section 2.2) was then drafted and reviewed by the team for correctness and completeness. To facilitate transfer of information between the team members, several documents were created. These were: blank test scripts, completed test scripts (section 2.3), an error log spreadsheet (section 2.4) and a remedial action document (section 2.5).

The pipelined approach to system testing adopted by our team allowed the whole testing phase, including bug fixing, to be completed within 3 days. Individual roles within the team were well defined, preventing situations experienced in previous projects where everyone in the team would become involved in fixing each bug as it arose.

2.2. Test script template

<table>
<thead>
<tr>
<th>Test name:</th>
<th>Purpose:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of test:</td>
<td></td>
</tr>
<tr>
<td>Expected output:</td>
<td></td>
</tr>
<tr>
<td>Actual output:</td>
<td></td>
</tr>
<tr>
<td>Comment:</td>
<td></td>
</tr>
</tbody>
</table>

2.3. Completed test scripts

2.3.1. Database tests with empty database

<table>
<thead>
<tr>
<th>Test name:</th>
<th>Purpose:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of test:</td>
<td></td>
</tr>
<tr>
<td>Expected output:</td>
<td></td>
</tr>
<tr>
<td>Actual output:</td>
<td></td>
</tr>
<tr>
<td>Comment:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
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<tr>
<td>Expected output:</td>
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<tr>
<td>Actual output:</td>
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<td>Comment:</td>
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<table>
<thead>
<tr>
<th>Test name:</th>
<th>Purpose:</th>
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<tbody>
<tr>
<td>Description of test:</td>
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<tr>
<td>Expected output:</td>
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<td>Actual output:</td>
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<td>Description of test:</td>
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<td>Actual output:</td>
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<td>Description of test:</td>
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<tbody>
<tr>
<td>Description of test:</td>
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<td>Expected output:</td>
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<td>Actual output:</td>
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<tr>
<td>Description of test:</td>
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<tr>
<td>Expected output:</td>
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<tr>
<td>Actual output:</td>
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<td>Comment:</td>
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<thead>
<tr>
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<tbody>
<tr>
<td>Description of test:</td>
<td></td>
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<tr>
<td>Expected output:</td>
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<tr>
<td>Actual output:</td>
<td></td>
</tr>
<tr>
<td>Comment:</td>
<td></td>
</tr>
</tbody>
</table>
### 2.3.3. Home page tests

<table>
<thead>
<tr>
<th>Test name:</th>
<th>HM001</th>
<th>Purpose:</th>
<th>Ensure home page is accessible from the menu at all times</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of test:</td>
<td>View each page in the site, ensuring that home can always be accessed from the menu.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected output:</td>
<td>Home should always be accessible</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual output:</td>
<td>As expected</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test name:</th>
<th>HM002</th>
<th>Purpose:</th>
<th>Ensure breadcrumb is correct</th>
</tr>
</thead>
</table>
| Description of test: | Check that breadcrumb appears correct  
Check that each link in the breadcrumb text links to the correct page. |
| Expected output: |Breadcrumb should be complete and link to the correct pages |
| Actual output: | As expected |

### 2.3.4. Sitemap tests

<table>
<thead>
<tr>
<th>Test name:</th>
<th>SM001</th>
<th>Purpose:</th>
<th>Ensure sitemap is accessible from the menu at all times</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of test:</td>
<td>View each page in the site, ensuring that Sitemap can always be accessed from the menu.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected output:</td>
<td>Sitemap should always be accessible</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual output:</td>
<td>As expected</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test name:</th>
<th>SM002</th>
<th>Purpose:</th>
<th>Ensure breadcrumb is correct</th>
</tr>
</thead>
</table>
| Description of test: | Check that breadcrumb appears correct  
Check that each link in the breadcrumb text links to the correct page. |
| Expected output: |Breadcrumb should be complete and link to the correct pages |
| Actual output: | As expected |

<table>
<thead>
<tr>
<th>Test name:</th>
<th>SM003</th>
<th>Purpose:</th>
<th>Ensure all links on the Sitemap link to the correct pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of test:</td>
<td>Click each link in turn, ensuring that the destination page is correct.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected output:</td>
<td>Sitemap should link to the correct pages</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 2.3.5. Search tests

<table>
<thead>
<tr>
<th>Test name:</th>
<th>SE001</th>
<th>Purpose:</th>
<th>Ensure search is accessible from the menu at all times</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of test:</td>
<td>View each page in the site, ensuring that Search can always be accessed from the menu.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected output:</td>
<td>Search should always be accessible</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual output:</td>
<td>As expected</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test name:</th>
<th>SE002</th>
<th>Purpose:</th>
<th>Ensure breadcrumb is correct</th>
</tr>
</thead>
</table>
| Description of test: | Check that breadcrumb appears correct  
Check that each link in the breadcrumb text links to the correct page. |
| Expected output: |Breadcrumb should be complete and link to the correct pages |
| Actual output: | As expected |

<table>
<thead>
<tr>
<th>Test name:</th>
<th>SE003</th>
<th>Purpose:</th>
<th>Check correct display of information message when no keywords entered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of test:</td>
<td>Click 'Search' without typing any keywords</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected output:</td>
<td>Search page should display no results, and show message &quot;Sorry, no records were found, please feel free to send feedback.&quot; This should be hyperlinked, so that the user can generate an email to the site owner</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual output:</td>
<td>As expected</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Actual output: | Home page link is broken  
Feedback link should be a mailto  
User Guide link is broken |
| Comment: | Page changes caused the links to break (ERR004) |
| Test name: | SM004 | Purpose: | Ensure that the Edit link is displayed/hide according to privilege level |
| Description of test: | Log in as a user with privilege level 1  
Ensure that the Edit link appears on the sitemap  
Log in as a user with privilege level 2  
Ensure that the Edit link appears on the sitemap  
Log in as a user who is not in the database  
Ensure that the Edit link does not appear on the sitemap. |
<p>| Expected output: | Sitemap should show/hide Edit link according to privilege level |
| Actual output: | As expected |</p>
<table>
<thead>
<tr>
<th>Test name:</th>
<th>SE004</th>
<th>Purpose:</th>
<th>Check simple keyword search when keyword returns results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of test:</td>
<td>Enter a keyword that exists in the database, and click ‘Search’</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected output:</td>
<td>Records should be returned that are linked to that keyword. Details displayed should be: Title, Description, Owner, Stages</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual output:</td>
<td>Outputs Expert instead of Owner</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comment:</td>
<td>ERR009</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test name:</th>
<th>SE005</th>
<th>Purpose:</th>
<th>Check simple keyword search when keyword does not return results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of test:</td>
<td>Enter a keyword that does not exist in the database, and click ‘Search’ (AS SE004) Search page should display no results, and show message “Sorry, no records were found, please feel free to send feedback.” This should be hyperlinked, so that the user can generate an email to the site owner</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected output:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual output:</td>
<td>As expected</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comment:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test name:</th>
<th>SE006</th>
<th>Purpose:</th>
<th>Check searching for multiple keywords</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of test:</td>
<td>Enter two keywords that exist in the database, and click ‘Search’ (AS SE004) Records should be returned that are linked to both keywords. Details displayed should be: Title, Description, Owner, Stages</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected output:</td>
<td>Outputs Expert instead of Owner</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual output:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comment:</td>
<td>ERR009</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test name:</th>
<th>SE007</th>
<th>Purpose:</th>
<th>Check operation of autocomplete keyboard text box</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of test:</td>
<td>Begin typing a keyword that exists in the database, and check that the rest of the keyword is autocompleted as the keyword is typed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected output:</td>
<td>The remainder of the keyword should be placed after the cursor, and highlighted so that the user can choose to accept or ignore the suggestion. The keyword should also appear as being selected in the dropdown.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual output:</td>
<td>As expected</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comment:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test name:</th>
<th>SE008</th>
<th>Purpose:</th>
<th>Check operation of automatic keyboard adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of test:</td>
<td>Type a keyword, then press Up and Down cursor keys</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected output:</td>
<td>The keyword nearest to the cursor should be automatically replaced with the keyword to the previous or next keyword in the list, allowing the user to scroll through the keyboard list</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual output:</td>
<td>As expected</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comment:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test name:</th>
<th>SE009</th>
<th>Purpose:</th>
<th>Check operation of keyboard dropdown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of test:</td>
<td>Click within the keyword textbox, then click one of the keywords in the dropdown</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected output:</td>
<td>When the keyword textbox is clicked, the dropdown should appear just below it. When a keyword is clicked in the dropdown, the keyword should be inserted into the textbox</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual output:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comment:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test name:</th>
<th>SE010</th>
<th>Purpose:</th>
<th>Check enabling and disabling of stage icons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of test:</td>
<td>Click the icons to ensure that the appropriate box becomes hollowed and associated text label is greyed out. Ensure that the Select/Deselct All icon selects and deselects all stages</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected output:</td>
<td>All stages should be initially enabled. When an icon is clicked, it should become hollowed and its associated text label should be greyed out. If clicked again, the icon should become filled and the text should become black again. When clicked, the Select/Deselct All icon should select and deselect all stages as if they were each clicked manually.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual output:</td>
<td>As expected</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comment:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test name:</th>
<th>SE011</th>
<th>Purpose:</th>
<th>Check stage filtering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of test:</td>
<td>Use the keyword search to find some results, then deselect some of the stages and click Refine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected output:</td>
<td>The returned results should be filtered according to the stages selected. Information sources should be retrieved that are linked to any of the enabled stages</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual output:</td>
<td>As expected</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comment:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test name:</th>
<th>SE012</th>
<th>Purpose:</th>
<th>Check pagination of results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of test:</td>
<td>Perform a search that brings back a significant number of results, and then change the ‘Results per page’ dropdown. Check that the ‘Forward’, ‘Back’ and page number links at the bottom of the page function correctly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected output:</td>
<td>The number of results shown on the page should reflect the newly selected number in the dropdown. The text next to the dropdown (“Results x to y of e”) should reflect the change. If the number of pages exceeds the number of results per page, page numbers should appear at the bottom of the page, along with a ‘Forward’ and/or ‘Back’ button. When clicked, these should change the results displayed as appropriate.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual output:</td>
<td>When you change the desired results the page performs a search and finds no records which should not happen unless there is a search string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comment:</td>
<td>This is just a minor error and does not affect the way the page runs or cause any breakages (ERR005)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test name:</th>
<th>SE013</th>
<th>Purpose:</th>
<th>Check wildcard searching</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of test:</td>
<td>Search for a partial keyword with a wildcard, e.g. &quot;sub*&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected output:</td>
<td>Information sources should be returned that are linked to any keyword that matches the wildcard string, e.g. &quot;submarine&quot; or &quot;substance&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual output:</td>
<td>As expected</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comment:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test name:</th>
<th>SE014</th>
<th>Purpose:</th>
<th>Check detailed information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test name:</td>
<td>SE015</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purpose:</td>
<td>Check commenting information sources</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Description of test:</td>
<td>Perform a search that returns results, then click the 'i' next to one of the information sources to retrieve the full information for that source. Type a comment into the text area and click Submit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected output:</td>
<td>The page should be refreshed, showing the newly added comment along with a user ID and timestamp. These should reflect the current user ID and current date in English format (dd/mm/yyyy)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual output:</td>
<td>As expected</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comments:</td>
<td>The page was manually refreshed pressing &lt;F5&gt; (ERR006)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Test name: | SE016 |
| Purpose: | Check electronic information source hyperlinks |
| Description of test: | Perform a search that returns results that are stored electronically, then click the hyperlinked title. Next, click the 'i' next to the information source title, and click the hyperlinked title on the full information page |
| Expected output: | A new window should be opened in both cases, with the electronic information source opened within it |
| Actual output: | As expected |
| Comments: |

| Test name: | SE017 |
| Purpose: | Check owner/expert hyperlinks |
| Description of test: | Perform a search that returns results, then click the 'i' next to the information source title. Click the name of the owner, then click the name of one of the experts |
| Expected output: | When a name is clicked, a new window should be opened with the person's homepage opened within it |
| Actual output: | As expected |
| Comments: | The projected Hyperlink will work on the ER servers |

### 2.3.6. Advanced search tests

| Test name: | AS001 |
| Purpose: | Check default values of fields |
| Description of test: | Navigate to the Advanced search page by clicking 'Advanced search' on the Search page |
| Expected output: | Initially the keyword textbox should be empty, all of the stages should be enabled, and the Level and Hierarchy multiselect boxes should be deselected |
| Actual output: | As expected |
| Comments: |

| Test name: | AS002 |
| Purpose: | Ensure breadcrumb is correct |
| Description of test: | Check that breadcrumb appears correct |
| Expected output: | Breadcrumb should be complete and link to the correct page |
| Actual output: | As expected |
| Comments: |

| Test name: | AS003 |
| Purpose: | Check correct display of information message when no keywords entered |
| Description of test: | Click 'Search' without typing any keywords |
| Expected output: | Search page should display no results, and show message “Sorry, no records were found, please feel free to send feedback.” This should be hyperlinked, so that the user can generate an email to the site owner |
| Actual output: | As expected |
| Comments: |

| Test name: | AS004 |
| Purpose: | Check simple keyword search when keyword returns results |
| Description of test: | Enter a keyword that exists in the database, and click 'Search' |
| Expected output: | Records should be returned that are linked to that keyword. Details displayed should be: Title, Description, Owner, Stage |
| Actual output: | Output Expert instead of Owner |
| Comments: | ERR010 |

| Test name: | AS005 |
| Purpose: | Check simple keyword search when keyword does not return results |
| Description of test: | Enter a keyword that does not exist in the database, and click 'Search' |
| Expected output: | (As AS003) Search page should display no results, and show message “Sorry, no records were found, please feel free to send feedback.” This should be hyperlinked, so that the user can generate an email to the site owner |
| Actual output: | As expected |
| Comments: |

| Test name: | AS006 |
| Purpose: | Check enabling and disabling of stage icons |
| Description of test: | Click the icons to ensure that the appropriate box becomes hollowed and associated text label is greyed out. Ensure that the Select/De-select All Icon selects and deselects all stages |
| Expected output: | All stages should be initially enabled. When an icon is clicked, it should become hollowed and its associated text label should be greyed out. If clicked again, the icon should become filled and the text should become black again. When clicked, the Select/De-select All Icon should select and deselect all stages, as if they were each clicked manually |
| Actual output: | As expected |
| Comments: |

| Test name: | AS007 |
| Purpose: | Check stage filtering |
| Description of test: | Use the keyword search to find some results, then deselect some of the stages and click 'Search'
<table>
<thead>
<tr>
<th>Test name:</th>
<th>AS008</th>
<th>Purpose:</th>
<th>Check population of Level field</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of test:</td>
<td>View the options in the Level multisect listbox.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected output:</td>
<td>The options presented in the Level listbox should match those present in the database.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual output:</td>
<td>As expected</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comment:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test name:</th>
<th>AS009</th>
<th>Purpose:</th>
<th>Check searching by Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of test:</td>
<td>Select a number of levels from the Level multisect box (using Ctrl-click), enter a keyword into the keyword textbox, and click Search</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected output:</td>
<td>Only the information sources that match both the keyword and selected levels should be displayed. An information source matches levels in a similar way to matching stages, i.e. the source matches if it is linked to at least one of the selected levels.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual output:</td>
<td>As expected</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comment:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test name:</th>
<th>AS010</th>
<th>Purpose:</th>
<th>Check population of Hierarchy fields</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of test:</td>
<td>View the options in the Class, Model, System and Component type multisect listboxes.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected output:</td>
<td>The options presented in the Class, Model, System and Component type listboxes should match the respective data in the database.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual output:</td>
<td>As expected</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comment:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test name:</th>
<th>AS011</th>
<th>Purpose:</th>
<th>Check searching by Hierarchy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of test:</td>
<td>Select a number of Classes, Models, Systems and Component types from the multisect listboxes, and click Search</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected output:</td>
<td>Only the information sources that match at least one of each of the Classes, Models, Systems and Component types should be displayed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual output:</td>
<td>As expected</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comment:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 2.3.7. Explorer tests

<table>
<thead>
<tr>
<th>Test name:</th>
<th>EX002</th>
<th>Purpose:</th>
<th>Ensure breadcrumb is correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of test:</td>
<td>Check that breadcrumb appears correct.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected output:</td>
<td>Breadcrumb should be complete and link to the correct pages.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual output:</td>
<td>As expected</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comment:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test name:</th>
<th>EX003</th>
<th>Purpose:</th>
<th>Check default display when Explorer page is viewed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of test:</td>
<td>Click 'Explore' on the menu and observe the resulting page.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected output:</td>
<td>Whilst loading, the tree pane should display a 'Please wait, searching...’ message, which should be replaced with the tree after no more than a few seconds. Initially, the results pane should display a message to inform the user to select a node from the tree on the left.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual output:</td>
<td>As expected</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comment:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test name:</th>
<th>EX004</th>
<th>Purpose:</th>
<th>Check correct tree structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of test:</td>
<td>Expand the tree, observing the stages, levels and component types.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected output:</td>
<td>At the top level, the tree should show the six life cycle stages. Upon expansion, each stage should show levels associated with that stage. Each level should be displayed only if there are information sources associated with that level and the parent stage in the tree. Likewise, levels can be expanded to show component types, which are only displayed if there are information sources linked to that component type, stage and level.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual output:</td>
<td>As expected</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comment:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test name:</th>
<th>EX005</th>
<th>Purpose:</th>
<th>Check explore functionality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of test:</td>
<td>Click a stage on the tree and observe the results on the right-hand side. Similarly, click a level then a component type on the tree.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected output:</td>
<td>When a node on the tree is clicked, the results pane on the right-hand side should display information sources that are linked to that node (stage, level, or component type). Only results that are linked should be returned.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual output:</td>
<td>As expected</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comment:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test name:</th>
<th>EX006</th>
<th>Purpose:</th>
<th>Check detailed information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of test:</td>
<td>Click the 'Y' next to one of the information sources to retrieve the full information for that source.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected output:</td>
<td>A new window should be opened, containing detailed information for the information source. The title and description should be displayed, with a hyperlinked title if the information source is held electronically. The page should also show the owner and expert(s) as hyperlinked names that link to the person’s homepage. The page should also show the available formats, keywords, and any comments that have been made</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual output:</td>
<td>As expected</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comment:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2.3.8. Edit tests

Test name: ED001
Purpose: Ensure edit is accessible from the menu at all times, subject to privilege level.

Description of test: Log in as a user with privilege level 1
View each page in the site, ensuring that Edit can always be accessed from the menu.
Log in as a user with privilege level 2
View each page in the site, ensuring that Edit can always be accessed from the menu.
Log in as a user who is not in the database
View each page in the site, ensuring that Edit never appears on the menu.

Expected output: Edit should always be accessible if the user has sufficient privileges (i.e. level 1 or 2), but never accessible otherwise (i.e. if the user is not in the database).

Actual output: As expected.

Test name: ED002
Purpose: Ensure breadcrumb is correct.

Description of test: Check that breadcrumb appears correct
Check that each link in the breadcrumb text links to the correct page.

Expected output:Breadcrumb should be complete and link to the correct pages.

Actual output: As expected.

Test name: ED003
Purpose: Check default display when Edit page is viewed.

Description of test: Click 'Edit' on the menu and observe the resulting page.

Expected output: The first page that is observed when Edit is clicked should be titled 'Edit Document'. The page should list the titles of all of the information sources that the current user owns. If the user has privilege level 1 (administrators), then all of the information sources in the database should appear on this page, as the administrator has edit access to all documents.

Actual output: As expected.

Test name: ED004
Purpose: Check detailed information.

Test name: ED005
Purpose: Check commenting information sources.

Description of test: Click the 'T' next to one of the information sources to retrieve the full information for that source. Type a comment into the text area and click 'Submit'.

Expected output: The page should be refreshed, showing the newly added comment along with the user ID and datestamp. These should reflect the current user ID and current date in English format (dd/mm/yyyy).

Actual output: As expected.

Comment: 

Test name: ED006
Purpose: Check default display when 'Edit Information Source Page 1' is viewed.

Description of test: Click 'Edit' on the menu, then click the 't' next to one of the information sources.

Expected output: Page 1 should show textboxes for the Information Source name and Description, pre-filled with the current values from the database. Drop downs for Creation date and Publication date should be pre-selected also. A list of Experts should appear, along with the Owner of the Information source. The experts and owners should be editable. The life cycle stages and levels currently associated with the information source should be pre-selected in multiselect listboxes. Type should be available as a dropdown, again pre-selected with data from the database. Location and Keywords should be free-form text fields.

Actual output: The date created and date published fields are not viewed anywhere so should not be in the edit page. Also the two author texts should be changed to Experts.

Comment: ERO007, ERO008.

Test name: ED007
Purpose: Change information source name.

Description of test: Click the 'e' next to one of the information sources, change the name of the information source, save the change by navigating through the Edit page flow, then verify the change by searching for the information source using a keyword search.

Expected output: When the name has been changed using Edit, the change should be reflected in the search results.

Actual output: As expected.

Comment: 

Test name: ED008
Purpose: Change information source description.

Comment: 
| Description of test: | Click the 'e' next to one of the information sources, change the selected levels in the Level multi-select listbox using Ctrl-click, save the change by navigating through the Edit page flow, then verify the change by finding the information source using Explore. |
| Expected output: | When the levels have been changed using Edit, the change should be reflected in the Explore results. |
| Actual output: | As expected |
| Comments: | |

| Description of test: | Change the levels |

| Description of test: | Click the 'e' next to one of the information sources, change the description of the information source, save the change by navigating through the Edit page flow, then verify the change by searching for the information source using a keyword search. |
| Expected output: | When the description has been changed using Edit, the change should be reflected in the search results. |
| Actual output: | As expected |
| Comments: | |

| Test name: | ED009 |
| Purpose: | Add an expert |
| Description of test: | Click the 'e' next to one of the information sources, click the "Add another expert" button below the list of experts, use the pop-up form to find the expert, save the change by navigating through the Edit page flow, then verify the change by searching for the information source using a keyword search and viewing its full information. |
| Expected output: | When the list of experts has been changed using Edit, the change should be reflected in the search results. |
| Actual output: | As expected |
| Comments: | |

| Description of test: | Change the type |

| Description of test: | Click the 'e' next to one of the information sources, change the selected type in the dropdown, save the change by navigating through the Edit page flow, then verify the change by finding the information source using a keyword search and viewing its full information. |
| Expected output: | When the levels have been changed using Edit, the change should be reflected in the Explore results. |
| Actual output: | As expected |
| Comments: | |

| Description of test: | Change the keywords |

| Description of test: | Click the 'e' next to one of the information sources, change the keywords in the textbox, save the change by navigating through the Edit page flow, then verify the change by finding the information source using a keyword search. |
| Expected output: | When the keywords have been changed using Edit, the change should be reflected in the search results returned for the related keywords and the keyword list in the autocomplete dropdown on Search. |
| Actual output: | As expected |
| Comments: | |

| Description of test: | Change the owner |

| Description of test: | Click the 'e' next to one of the information sources, click the 'Remove expertname' button next to one of the experts (leaving at least one expert), save the change by navigating through the Edit page flow, then verify the change by searching for the information source using a keyword search and viewing its full information. |
| Expected output: | When the list of experts has been changed using Edit, the change should be reflected in the search results. |
| Actual output: | As expected |
| Comments: | |

| Description of test: | Check field-level validation |

| Description of test: | Click the 'e' next to one of the information sources, delete the data from mandatory fields (marked with a *), and attempt to save the changes. Then re-enter the data field-by-field, ensuring that the correct validation messages are presented. |
| Expected output: | When a mandatory field is not entered, a validation message should appear beneath the field when the user attempts to save the changes. Each mandatory field should have its own unique error message. |
| Actual output: | When you deselect the level field so that it is blank and submit the form the type field is wiped and both fields are flagged as empty After this if you then reselect a new stage you get a javascript runtime error on line 487 saying "Object Expected" |
| Comments: | ERR011, ERR012 |

| Description of test: | Check reset |

| Description of test: | Click the 'e' next to one of the information sources, change the data for each field, and click 'Reset'. |
| Expected output: | When the Reset button is clicked, all of the fields should revert back to their original values. |
| Actual output: | As expected |
| Comments: | |
### 2.3.9. Help tests

**Test name:** HL001  
**Purpose:** Ensure Help is accessible from the menu at all times  
**Description of test:** View each page in the site, ensuring that Help can always be accessed from the menu  
**Expected output:** Help should always be accessible  
**Actual output:** As expected  
**Comment:**

**Test name:** HL002  
**Purpose:** Ensure breadcrumbs is correct  
**Description of test:** Check that breadcrumbs appear correct  
**Expected output:** Breadcrumbs should be complete and link to the correct pages  
**Actual output:** As expected  
**Comment:**

**Test name:** HL003  
**Purpose:** Check default display when Help page is viewed  
**Description of test:** Click 'Help' on the menu and observe the resulting page  
**Expected output:** Help page should display the email address of the site owner, with a link to the User Guide  
**Actual output:** As expected  
**Comment:**

### 2.3.10. Feedback tests

**Test name:** FB001  
**Purpose:** Check feedback links at bottom of page  
**Description of test:** Click the Feedback link at the bottom of each page of the site  
**Expected output:** In each instance, clicking the Feedback link should cause the user's email client to open a new email with the site owner's email address as the recipient (as stored in the database)  
**Actual output:** As expected  
**Comment:**

**Test name:** FB002  
**Purpose:** Check feedback link when no search results are obtained from Search  
**Description of test:** Click 'Search' on the menu, then click 'Search' button without entering any keywords. Click the feedback link that appears  
**Expected output:** Clicking the Feedback link should cause the user's email client to open a new email with the site owner's email address as the recipient (as stored in the database)  
**Actual output:** As expected  
**Comment:**

**Test name:** FB003
2.5. Remedial action

<table>
<thead>
<tr>
<th>Error code</th>
<th>Cause of Error</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERR001</td>
<td>Error caused by code attempting to access an empty recordset using Recordset.MoveFirst</td>
<td>Error checking for empty Recordset introduced.</td>
</tr>
<tr>
<td>ERR002</td>
<td>Error caused by code attempting to access an empty recordset using Recordset.MoveFirst</td>
<td>Error checking for empty Recordset introduced.</td>
</tr>
<tr>
<td>ERR003</td>
<td>The message was only displayed when the 'site owner email address' could be retrieved from the database due to an IF statement.</td>
<td>An ELSE condition was introduced such that an alternative message (i.e. one not including the &quot;mail-to&quot; hyperlink) displayed in the instance of the 'site owner email address' database table being empty.</td>
</tr>
<tr>
<td>ERR004</td>
<td>Outdated hyperlinks.</td>
<td>Hyperlinks updated. Mail-to-link added to 'Feedback' link.</td>
</tr>
<tr>
<td>ERR005</td>
<td>The 'No documents found' message was being displayed by the system even if no keywords were specified.</td>
<td>Checking was introduced such that the 'No documents found' message was only displayed if keywords are specified.</td>
</tr>
<tr>
<td>ERR006</td>
<td>No error checking was in place to ensure that multiple identical comments could not be added to the database.</td>
<td>Error checking was introduced to ensure that a comment record cannot be added to the database if there is an existing record with the same username and comment fields.</td>
</tr>
<tr>
<td>ERR007</td>
<td>Production and publication dates were included in the Edit page (page 1).</td>
<td>Production and publication dates were removed from the Edit page (page 1).</td>
</tr>
<tr>
<td>ERR008</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.4. Error logs

<table>
<thead>
<tr>
<th>Error code</th>
<th>Related test script</th>
<th>Description of error</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERR001</td>
<td>D8003</td>
<td>On load of Search page a runtime error occurred. 'document.images.inserticons' is null or not an object</td>
<td></td>
</tr>
<tr>
<td>ERR002</td>
<td>D8005</td>
<td>On load of the Advanced Search page a runtime error occurred. 'document.images.inserticons' is null or not an object</td>
<td></td>
</tr>
<tr>
<td>ERR003</td>
<td>D8005</td>
<td>When a search is performed with an empty database the message no records have been found is not displayed</td>
<td></td>
</tr>
<tr>
<td>ERR004</td>
<td>SM002</td>
<td>The links are broken on the sitemap page</td>
<td></td>
</tr>
<tr>
<td>ERR005</td>
<td>SE012</td>
<td>When the number of results is changed without a search string the page performs a search and returns no results found</td>
<td></td>
</tr>
</tbody>
</table>

2.3. Remedial action

<table>
<thead>
<tr>
<th>Error code</th>
<th>Cause of Error</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERR001</td>
<td>Error caused by code attempting to access an empty recordset using Recordset.MoveFirst</td>
<td>Error checking for empty Recordset introduced.</td>
</tr>
<tr>
<td>ERR002</td>
<td>Error caused by code attempting to access an empty recordset using Recordset.MoveFirst</td>
<td>Error checking for empty Recordset introduced.</td>
</tr>
<tr>
<td>ERR003</td>
<td>The message was only displayed when the 'site owner email address' could be retrieved from the database due to an IF statement.</td>
<td>An ELSE condition was introduced such that an alternative message (i.e. one not including the &quot;mail-to&quot; hyperlink) displayed in the instance of the 'site owner email address' database table being empty.</td>
</tr>
<tr>
<td>ERR004</td>
<td>Outdated hyperlinks.</td>
<td>Hyperlinks updated. Mail-to-link added to 'Feedback' link.</td>
</tr>
<tr>
<td>ERR005</td>
<td>The 'No documents found' message was being displayed by the system even if no keywords were specified.</td>
<td>Checking was introduced such that the 'No documents found' message was only displayed if keywords are specified.</td>
</tr>
<tr>
<td>ERR006</td>
<td>No error checking was in place to ensure that multiple identical comments could not be added to the database.</td>
<td>Error checking was introduced to ensure that a comment record cannot be added to the database if there is an existing record with the same username and comment fields.</td>
</tr>
<tr>
<td>ERR007</td>
<td>Production and publication dates were included in the Edit page (page 1).</td>
<td>Production and publication dates were removed from the Edit page (page 1).</td>
</tr>
<tr>
<td>ERR008</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3. DATABASE TABLES

3.1. Main Tables

This section contains a description of each of the main tables within the database. Each description includes field names and types, in addition to a brief explanation of the usage of the table.

3.1.1. Change Log Table

This table is responsible for holding logs of changes made to information sources.

<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Source ID</td>
<td>Number (Unique)</td>
</tr>
<tr>
<td>Date</td>
<td>Date</td>
</tr>
<tr>
<td>User Name</td>
<td>Text</td>
</tr>
</tbody>
</table>

3.1.2. Class Table

This table is responsible for holding all of the classes.

<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class ID</td>
<td>Number (Unique)</td>
</tr>
<tr>
<td>Class Name</td>
<td>Text</td>
</tr>
</tbody>
</table>

3.1.3. Component Table

This table is responsible for holding all of the component types.

<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Component ID</td>
<td>Number (Unique)</td>
</tr>
<tr>
<td>Component Name</td>
<td>Text</td>
</tr>
</tbody>
</table>

3.1.4. Information Source

This table is the main database table and is responsible for holding information relevant to each information source. Each Information Source has a Type, which is a reference to the Type Table.

<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Source ID</td>
<td>Number (Unique)</td>
</tr>
<tr>
<td>Production Date</td>
<td>Date</td>
</tr>
<tr>
<td>Publication Date</td>
<td>Date</td>
</tr>
<tr>
<td>Title</td>
<td>Text</td>
</tr>
<tr>
<td>Description</td>
<td>Text</td>
</tr>
<tr>
<td>Type ID</td>
<td>Number (Reference)</td>
</tr>
<tr>
<td>Quality</td>
<td>Text</td>
</tr>
<tr>
<td>QualityComment</td>
<td>Text</td>
</tr>
</tbody>
</table>

3.1.5. Keyword Table

This table is responsible for holding all of the keywords in the system.

<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keyword ID</td>
<td>Number (Unique)</td>
</tr>
<tr>
<td>Keyword</td>
<td>Text</td>
</tr>
</tbody>
</table>
### 3.1.6. Level Name
This table is responsible for holding all of the levels in the system.

<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level ID</td>
<td>Number (Unique)</td>
</tr>
<tr>
<td>Level Name</td>
<td>Text</td>
</tr>
</tbody>
</table>

### 3.1.7. Location Table
This table is responsible for holding all of the locations in the system.

<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location ID</td>
<td>Number (Unique)</td>
</tr>
<tr>
<td>Location Description</td>
<td>Text</td>
</tr>
</tbody>
</table>

### 3.1.8. Model Table
This table is responsible for holding all of the models in the system. Each Model is part of a class, and thus has a Class ID which is a reference to the Class Table.

<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model ID</td>
<td>Number (Unique)</td>
</tr>
<tr>
<td>Model Name</td>
<td>Text</td>
</tr>
<tr>
<td>Class ID</td>
<td>Number (Reference)</td>
</tr>
</tbody>
</table>

### 3.1.9. Person Table
This table is responsible for holding all the information related to persons known to the system. The features users are allowed to access within the system are dependent on the Privilege Level field of this table.

<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person ID</td>
<td>Number (Unique)</td>
</tr>
<tr>
<td>Surname</td>
<td>Text</td>
</tr>
<tr>
<td>Forename</td>
<td>Text</td>
</tr>
<tr>
<td>Homepage</td>
<td>Text</td>
</tr>
<tr>
<td>Login ID</td>
<td>Text</td>
</tr>
<tr>
<td>Privilege Level</td>
<td>Number</td>
</tr>
</tbody>
</table>

### 3.1.10. Site Owner Email Address
This table is responsible for holding the email address of the system administrator so that it may be changed easily without having to alter the system code.

<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Email</td>
<td>Text</td>
</tr>
</tbody>
</table>

### 3.1.11. Stage Table
This table is responsible for holding all of the stages in the system.

<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage ID</td>
<td>Number (Unique)</td>
</tr>
<tr>
<td>Stage Name</td>
<td>Text</td>
</tr>
</tbody>
</table>

### 3.1.12. System Table
This table is responsible for holding all of the systems.

<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>System ID</td>
<td>Number (Unique)</td>
</tr>
<tr>
<td>System Name</td>
<td>Text</td>
</tr>
</tbody>
</table>

### 3.1.13. Type Table
This table is responsible for holding all of the information source types in the system.

<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type ID</td>
<td>Number (Unique)</td>
</tr>
<tr>
<td>Type Description</td>
<td>Text</td>
</tr>
</tbody>
</table>

### 3.2. Relationship Tables
This section contains a description of each of the relationship (link) tables within the database. Each description includes field names and types, in addition to a brief explanation of the usage of the table.

#### 3.2.1. Info/Author Table
This table is responsible for providing the many-to-many link between Information Sources and authors. Authors are now referred to as 'experts' within the system.

<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source ID</td>
<td>Number (Reference)</td>
</tr>
<tr>
<td>Person ID</td>
<td>Number (Reference)</td>
</tr>
</tbody>
</table>

#### 3.2.2. Info/Class R Table
This table is responsible for providing the many-to-many link between Information Sources and classes.

<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source ID</td>
<td>Number (Reference)</td>
</tr>
<tr>
<td>Class ID</td>
<td>Number (Reference)</td>
</tr>
</tbody>
</table>

#### 3.2.3. Info/Comment Table
This table is responsible for providing the link between an Information Source and users' comments.

<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Source ID</td>
<td>Number (Reference)</td>
</tr>
<tr>
<td>Date-Added</td>
<td>Date</td>
</tr>
<tr>
<td>Username</td>
<td>Text</td>
</tr>
<tr>
<td>Comment</td>
<td>Text</td>
</tr>
</tbody>
</table>

#### 3.2.4. Info/Component R Table
This table is responsible for providing the many-to-many link between Information Sources and components.

<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source ID</td>
<td>Number (Reference)</td>
</tr>
<tr>
<td>Component ID</td>
<td>Number (Reference)</td>
</tr>
</tbody>
</table>
### 3.2.5. Info/Keyword R Table
This table is responsible for providing the many-to-many link between Information Sources and keywords.

<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Source ID</td>
<td>Number (Reference)</td>
</tr>
<tr>
<td>Keyword ID</td>
<td>Number (Reference)</td>
</tr>
</tbody>
</table>

### 3.2.6. Info/Level R Table
This table is responsible for providing the many-to-many link between Information Sources and levels.

<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source ID</td>
<td>Number (Reference)</td>
</tr>
<tr>
<td>Level ID</td>
<td>Number (Reference)</td>
</tr>
</tbody>
</table>

### 3.2.7. Info/Location R Table
This table is responsible for providing the many-to-many link between Information Sources and locations.

<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source ID</td>
<td>Number (Reference)</td>
</tr>
<tr>
<td>Location ID</td>
<td>Number (Reference)</td>
</tr>
</tbody>
</table>

### 3.2.8. Info/Model R Table
This table is responsible for providing the many-to-many link between Information Sources and models.

<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source ID</td>
<td>Number (Reference)</td>
</tr>
<tr>
<td>Model ID</td>
<td>Number (Reference)</td>
</tr>
</tbody>
</table>

### 3.2.9. Info/Owner R Table
This table is responsible for providing the link between Information Sources and owners.

<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source ID</td>
<td>Number (Reference)</td>
</tr>
<tr>
<td>Person ID</td>
<td>Number (Reference)</td>
</tr>
</tbody>
</table>

### 3.2.10. Info/Stage R Table
This table is responsible for providing the many-to-many link between Information Sources and stages.

<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source ID</td>
<td>Number (Reference)</td>
</tr>
<tr>
<td>Stage ID</td>
<td>Number (Reference)</td>
</tr>
</tbody>
</table>

### 3.2.11. Info/System R Table
This table is responsible for providing the many-to-many link between Information Sources and systems.

<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source ID</td>
<td>Number (Reference)</td>
</tr>
<tr>
<td>System ID</td>
<td>Number (Reference)</td>
</tr>
</tbody>
</table>

### 3.2.12. Model/System R Table
This table is responsible for providing the many-to-many link between Models and Systems.

<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model ID</td>
<td>Number (Reference)</td>
</tr>
<tr>
<td>System ID</td>
<td>Number (Reference)</td>
</tr>
</tbody>
</table>

### 3.2.13. System/Component R Table
This table is responsible for providing the many-to-many link between Systems and Components.

<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>System ID</td>
<td>Number (Reference)</td>
</tr>
<tr>
<td>Component ID</td>
<td>Number (Reference)</td>
</tr>
</tbody>
</table>

### 3.2.14. Stage/Level R Table
This table is responsible for providing the many-to-many link between Stages and Levels.

<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage ID</td>
<td>Number (Reference)</td>
</tr>
<tr>
<td>Level ID</td>
<td>Number (Reference)</td>
</tr>
</tbody>
</table>
4. ENTITY RELATIONSHIP DIAGRAM

5. DATABASE STRUCTURE
6. Adding Information Sources to the Database

6.1. Functionality during additions to the database

While adding information sources to the database, the search and explore functions of the system may cease to function. This is the result of the information source having incomplete attributes during its creation. Similarly, if an information source is left incomplete, any search or explore including that source will cause an error. It is therefore very important that any adding of information sources be completed quickly and carefully to ensure the integrity of the database.

6.2. Procedure

The first step is to create a new record in the Information Source Table. Each information source will have a number of attributes. The list below details the attributes and any restrictions that apply when creating the information source:

- Title: Free text (optional)
- Description: Free text (optional)
- Life Cycle Phase: (must have at least one)
- Level: (Must have one only)
- Owner: (Must have one only)
- Expert: (Must have at least one)
- Associated Classes: (May have many or none)
- Associated Models: (May have many or none)
- Associated Systems: (May have many or none)
- Keywords: (May have many or none. NOTE: an information source with no keywords not return in any keyword search)

A number of attributes for information sources use link tables to map information sources to their attributes. Example: To add an author to an information source:

- Find the Info Source ID from the Information Source Table.
- Find the Person ID for the new author from the Person Table (creating a new record if necessary)
- Create a new record in the link table (in this case Info/Author Table) using the Info Source ID and the Person ID.

The person is now defined as an author for that information source.

6.3. Relevant tables

The following table shows the database tables and corresponding link table used for each attribute.

<table>
<thead>
<tr>
<th>Function/Attribute</th>
<th>Link Table</th>
<th>Attribute Table</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authors</td>
<td>Info/Author Table</td>
<td>Person Table</td>
</tr>
<tr>
<td>Keywords</td>
<td>Info/Keyword</td>
<td>Keyword Table</td>
</tr>
<tr>
<td>Associate Classes</td>
<td>Info/Class &amp; R Table</td>
<td>Class Table</td>
</tr>
<tr>
<td>Associate Models</td>
<td>Info/Model &amp; R Table</td>
<td>Model Table</td>
</tr>
<tr>
<td>Associate Systems</td>
<td>Info/System &amp; R Table</td>
<td>System Table</td>
</tr>
<tr>
<td>Associate Component Types</td>
<td>Info/Component &amp; R Table</td>
<td>Component Table</td>
</tr>
<tr>
<td>Life Cycle Phases</td>
<td>Info/Stage &amp; R Table</td>
<td>Stage Table</td>
</tr>
<tr>
<td>Owner (one per source)</td>
<td>Info/Level &amp; R Table</td>
<td>Level Table</td>
</tr>
<tr>
<td>Level</td>
<td>Info/Level &amp; R Table</td>
<td>Level Table</td>
</tr>
<tr>
<td>Type (one per source)</td>
<td>None (link included in Information Source Table)</td>
<td>Type Table</td>
</tr>
</tbody>
</table>
7. SYSTEM CONSTRAINTS

The system has a number of inherent limitations and restrictions:

7.1. Browsers

The Configuration Management Information Map must be viewed in Microsoft Internet Explorer version 5 or above. Different versions of Internet Explorer may display elements differently (most notably the Explore function). The system does not display correctly under Netscape Navigator.

Javascript must be enabled on the user’s browser, as much of the functionality depends upon Javascript.

7.2. Web server and permissions

The web server on which the system is installed requires Microsoft Internet Information Services, with the ability to utilize a Microsoft Access database.

The code is initially configured to utilise the database called ‘codgo.mdb’. In order for a differently named database to be used, the name must be changed in the openDatabase.asp file.

For the Configuration Management Information Map to function correctly, the folder containing the site must have restricted web access, i.e. not permitting anonymous web access.

Due to a documented bug in Microsoft Internet Information Services the security on the global.asa file must be given anonymous web access. This does not compromise the security of the site.

For more details on this see: (http://support.microsoft.com/default.aspx?scid=kb;EN-US;173742)

All users who are permitted access to the site must be granted permission to do so at the server level.

7.3. General

When adding information sources to the database it is essential that all fields (except the Comment field in the Information Source table) and all link tables are completed fully and correctly. Any empty fields, incorrect types or missing links may cause unpredictable behaviour.

The limit on the size of titles, description, person names, and any other free-text fields is 255 characters (including spaces). This limit is imposed by Microsoft Access, not by the site itself.

Information sources may only be assigned a single level. Assigning multiple levels when creating an information source in the database may cause unpredictable behaviour.

8. ASSUMPTIONS MADE

As with development of any system, it has been necessary to make a number of assumptions during development of the Configuration Management Information Map.

8.1. Users

The site is presented in English. It is assumed that users will be familiar with the language.

Certain concessions are made for users with colour deficient vision. The life-cycle phase colours have been selected with the most common form of red/green colour deficiency in mind. Where colour is used, textual backups are used to enable even a user with complete colour deficiency to operate the site with minimal impairment.

8.2. Editors

Administrators and Information source creators will need to have a level of competence in populating and maintaining the database.

8.3. Security

The database must be secured from being altered by anyone other than the administrator/Information source creator.

8.4. Information sources

It is assumed that a Western alphabet will be required. No support has been built in for foreign characters.

8.5. Population of the database

It is assumed that all additions and deletions of Information Sources will be conducted directly with the database via Microsoft Access. Thus no functionality has been provided for conducting these tasks. It is also assumed that all additions and deletions will be undertaken with due attention being paid to the warnings stated within this document.

8.6. Security access

It is assumed that all users who are to be allowed to utilise the Configuration Management Information Map will be granted access to the site on the server. It is also assumed that any persons who are required to have a privilege level other than that of a basic user will be added manually to the database with the required privilege level specified. In order for the site to correctly assign a privilege level to each user, the server login ID must exactly match that stored in the database. If this is not the case, the user will be able to access the site but will have no edit privileges.
APPENDIX 10

INFORMATION MAP USER GUIDE
7. Getting Help

The 'Help' link on the menu (see section 2.2) allows you to obtain online help with regards to the Configuration Management Information Map. The Help page contains readable and downloadable documentation for the Configuration Management Information Map along with a troubleshooting guide.

Help on searching can also be attained from the Search Tips page accessible from the Search and Advanced Search pages.

As well as the help pages there is also context sensitive help scattered around the site. An example of the context sensitive help is shown in Figure 21.

![Context Sensitive Help](image)

**Figure 21** – Context Sensitive Help.

When you see a question mark as is shown in Figure 21, if you hover the mouse over the question mark a small pop up box will appear with the help instructions in it. The above context sensitive help is with regards to the phase selection boxes found on the Search page.
2. Getting Started

Getting started explains how to use the basic functionality of the Configuration Management Information Map, and walks you through the initial stages required to get up and running.

2.1 Logging In

To obtain access to the Configuration Management Information Map Website it is necessary to enter your network username and password when prompted to do so. If you have already logged into the Rolls-Royce Intranet it is unlikely that you will prompted again for your username and password and may proceed with browsing the site.

2.2 The Menu System Overview

Navigation throughout the Configuration Management Information Map is accomplished using the menu bar, which is located at the top of the Website as shown in Figure 1.

![Menu Bar](image)

**Figure 1** – Menu Bar taken from the Home Page.

The ‘CMIM Home’ (Configuration Management Information Map Home) link on the menu allows you to link to the Home page for the Configuration Management Information Map Website. The home page contains details of the Configuration Management Information Map Website as well as providing links to other pages within the site and on the Rolls-Royce Intranet.

The ‘Sitemap’ link on the menu allows you to view all the pages within the Configuration Management Information Map Website that you are able to do so with the level of access that has been assigned to you. The Sitemap acts as an overview of the whole site, providing instant access to all the links and options available to you.

The ‘About’ link on the menu provides you with an introduction and general overview as to the purpose of the Configuration Management Information Map Website as well as the features that it provides and hence what it can be used for.

The ‘CMIM Feedback’ (Configuration Management Information Map Feedback) link allows you to submit your own feedback to the Configuration Management Information Map Website owner. For more information see section 6.

The ‘Search CMIM’ (Search Configuration Management Information Map) link on the menu provides a means to search for information sources contained within Rolls-Royce Marine Division. Various searching criteria are provided to make searching for information as easy as possible. For more information see section 3.

Similarly the ‘Explore CMIM’ (Explore Configuration Management Information Map) link on the menu provides a means of searching through the information sources available within Rolls-Royce Marine Division. The Explore function works differently to the search function as it uses a hierarchical structure rather than being keyword based. For more information see section 4.

The ‘Edit’ link on the menu allows information sources to be edited by their owners and by the system administrator.

NB: The ‘Edit’ link is only available to users that are assigned privilege levels of 1 or 2. If you cannot see the ‘Edit’ link on the menu and you are an owner of an information source please contact the system administrator.

The ‘Site Help’ link on the menu provides you with an online help repository to help you solve any problems that you may encounter whilst using the Configuration Management Information Map. The help pages contains HTML and PDF versions of the Configuration Management Information Map User Guide as well as a frequently asked questions page which allow you to quickly search for the answers to specific problems that you may be experiencing. For more information see section 7.
2.3 The Breadcrumbs Trail

The breadcrumb trail is situated underneath the menu bar on all pages, and is designed to allow you to know exactly where you are in the site in relation to the Configuration Management Information Map Home page. Figure 2 shows an example of the breadcrumb trail for the Search page. From Figure 2 it can be shown that the user is currently at the Search page, which hierarchically is one level down from the Configuration Management Information Map Home page.

![Breadcrumb trail of the Search page.](image)

3. Searching for Information

3.1 Searching For Information Sources

Searching for information sources can be done from the Search page, which is accessed from the ‘Search’ link on the menu bar (see section 2.2). The ‘Search’ link will display the Search screen as shown in Figure 3.

![Search Screen](image)

In order to perform a search, enter the required keywords into the ‘Search By Keyword’ field and click the **Search** button. Searches can also be filtered on the Product Life Cycle phases (Concept, Definition, Realisation, Production, In Service, Disposal) by selecting the required box or stage name then clicking ‘Refine’. If you select is filtered on the Product Life Cycle phases only those information sources that are members of the selected phases will be present in the search results.

To alter the number of results that are displayed in the resultant list use the drop down box situated below the Product Life Cycle phase selection boxes to your desired number (see Figure 3).
A feature of keyword searching is the auto-complete keyword function. When the keyword text field is given focus a drop down list of all the keywords that are available throughout all the information sources is displayed. When you type your keyword a parse is performed that will automatically highlight the possible keyword that you are attempting to type in. The function will also attempt to complete the word in the text field reducing the need to type in full keywords and ensuring that at least one result will be retrieved from the search.

The auto-complete keyword function can be used across multiple keywords and will operate in the same way as that of a single keyword with the drop down list displaying the keywords available. It will also automatically highlight the possible keyword that you are attempting to type in and attempt to complete the second word in the text field. For an example see Figure 4.

```
astute
astute
suede
demo
engine
```

**Figure 4** – Auto update keywords feature.

When the desired information source has been located, more detailed information can be viewed by selecting the button in addition to this if you are the owner of the information source you have located, an button will appear enabling you to edit the information source (see section 5).

The ‘Search Tips’ link provides details on how to search effectively. An example of a successful search is shown in Figure 5. The search keyword used for the search is “astute”.

**Figure 5** – A successful search with the search keyword “astute”.

If your search is not successful and does not return any search results you will be prompted that this is the case and given the opportunity to submit feedback to the Configuration Management Information Map Website owner. Figure 6 shows the screen displayed when no search results are returned.
3.2 Advanced Searching For Information Sources

Advanced searching is available by clicking the 'Advanced Search' link on the Search page. This page will display all of the available advanced searching options. Within the Advanced Search page any number of search criteria can be specified.

The keyword and stage filtering work in the same way as that of the normal search page (see section 3.1). In addition to these searching options a further five searching options are available (Level, Class, Model, System, Component Type) as shown in Figure 7.

Figure 6 – An unsuccessful search with the word “sub”.

It is possible to do wildcard searching to search for words that you are not entirely sure of. Using the wildcard character “*” you can perform wildcard searches. For example a search string of “van*” will pull back all the information sources which have the first three letters ‘van’ plus any other letters after that. The wildcard character can be put at the beginning or end of a search string e.g. “*van” or “van*” and even “*van*”.

Figure 7 – Advanced search options.

The advanced search options allow the search results to be narrowed down so that precise searching can be attained. In all the five fields (Level, Class, Model, System, Component Type) multiple values can be selected such that the search results will only include the information sources that belong to those values selected. Figure 8 shows an advanced search selection criteria with the class “Astute” and three models “Ambush”, “Astute” and “Ford” selected. The results produced from this advanced search will only belong to the class and models selected.

Figure 8 – Advanced search criteria.
Once the search criteria have been chosen click the **Search** button to perform the search and return all the information sources matching your criteria.

### 3.3 Viewing Information Sources

To view the details of an information source, once a search has been performed click on the **i** button next to the information source search result that you wish to view, as shown in Figure 9. In doing so a new page will be loaded, which will show the entire details of the information source as shown in Figure 10.

#### Search

**Search By Keyword:**

```plaintext
- Astute
```

**Search By R and R Product Life Cycle Phase:**

- [Radio buttons for Realisation, Design, Definition, Concept, Production, In Service, Disposal]

- [Select/De-select All radio buttons]

**Results per Page:** 10

**Results 1 to 2 of 2**

**Sonar 2076 Information**

- **Information on BAE Systems new Sonar 2076**
- **Owner:** Tom Hook
- **Keywords:** Astute Ballistic Submarine Sonar 2076
- **Last Review Date:** 12/2/2004 - eteh
- **Quality:** Medium
- **Comments:** [Click to enter a comment]

Please enter a comment on this Information Source in the box below:

```

Submit  Reset
```

**Figure 10** - Full details on an information source.

The information displayed contains the information sources title, description, owner, associated experts, available formats, keywords, last review date, quality and comments. It also shows the lifecycle stages that the information source falls under.
4. Exploring Information Sources

As an alternative to searching by keywords, information can be located by using the Explorer page. The Explorer page allows the information in the system to be browsed, in much the same way as Windows Explorer or My Computer in Windows™. The Explorer page can be accessed by clicking on the ‘Explore’ menu item (see section 2.2). The Explorer page can be seen in Figure 11.

The Explorer consists of two parts: the tree on the left-hand side and the information sources on the right-hand side.

The tree shows all of the product lifecycle phases within the Rolls-Royce Marine Division, and these phases can be expanded to show the levels and component types within that phase by clicking the ‘+’ next to the desired phase. In order to view the information sources related to a particular phase (or level), click the relevant ‘folder’ that represents the phase (or level) that you wish to view. This will display all related information sources on the right-hand side of the Explorer. This can be seen in Figure 11.

Explore

- Concept
- Definition
- Realisation
- Associated Products
- Design / Interface Specs
- Prototype Test Validation
- Production
- In-service
- Disposal

5 results found for 'Realisation':

- Configuration Management Information Map
- PWRR Design Schematics
- Testing Plan for PWRR reactor
- Test reactor service log
- Test reactor description test

Figure 11 – Explore page.

NB. When an item is clicked on the tree, the right-hand side shows only the information sources that are related to that item.

The rows displayed on the right-hand side contain the title of the information source, along with the life cycle stages that the information source relates to. Further information about an information source can be obtained by clicking the button. Clicking the button will cause a popup window to appear displaying the full information as described in section 3.3.
5. Editing Information Sources

In order to edit an information source you must have a privilege level of 1 or 2. These levels indicate that you are the owner of an information source or are the administrator of the Configuration Management Information Map Website.

If you feel that you should have edit access to one or many information sources that you believe to own, please contact the Configuration Management Information Map Website owner.

An information source may be edited wherever you see an icon. These are situated on the Search page and the Edit page as shown in Figure 12 and 13. You will only ever see this icon if you have sufficient privileges to own an information source.

![Image](image.png)

**Figure 12** – Search page showing edit icons.

**Edit Documents**

Documents 1 to 1 of 1

![Image](image.png)

**Figure 13** – Edit page showing editable documents.

The Edit page shows all the documents that you are able to edit. Clicking an icon will display the page as shown in Figure 14 with the details of the information source filled in.
To edit text fields and selection drop downs simply make the desired change by re-typing
the information as desired, or re-selecting a different option.

To add a new Owner or Expert click on the respective ‘Change Owner’ or ‘Add Another
Expert’ link. This will bring up a popup window as shown in Figure 15.

Please enter a Forename or Surname and press ‘Search’. Once
you have found the desired Author, select the author and press
‘Select’.

Figure 15 – Add new Expert window.

To add a new expert, type the forename or surname into the fields and click the Search
button. If the search is successful the names and details will be displayed in the text box field.

Select the desired expert from the names listed and click the Select button. The expert
should now be added to the list of experts for that information source. If you wish to cancel
the change at anytime click the Cancel button.

If the name you typed was not recognised it may be that you spelt it incorrectly or that simply
the name does not exist in the database of experts in which case contact the system
administrator.

To remove an expert, click on the button next to the Expert’s name that you wish to
remove. This will remove the expert from being associated with that information source.

To edit the Stage options hold down the <CTRL> button on the keyboard whilst selecting the
values with the mouse. This will allow multiple selections to be made.

Once you are happy with the edits click the Next button. If you make a mistake at
anytime and do not wish the change to be saved, click the Reset button.

Once the Next button has been clicked you will be taken to the second edit page as
shown in Figure 16.

Edit - Page 2 of 3

Associated Class(es):

Associated Model(s):

Associated System(s):

Associated Component Type(s):

Figure 16 – Edit page 2.

Edit page two allows edits to the hierarchy to be made. To change the associated Class,
Model, System or Component type click on the associated button next to the desired item. This
will bring up a popup window as shown in Figure 17.
6. Sending Feedback

6.1 Sending Feedback To The Website Owner

To send feedback to the Configuration Management Information Map Website owner, click on the ‘CMIM Feedback’ (Configuration Management Information Map Feedback) link situated at the bottom of the Website pages (see Figure 19), on the email address situated on the Help page, or the feedback link that appears on the search pages if no information sources are found that match your search criteria.

Figure 19 – Feedback link on the footer section of the Website.

Once a feedback link has been clicked your default mail client will load with the email address ‘To’ field already set to the Configuration Management Information Map Website owner. Enter your feedback comments into the text area and send the email as you would normally.

6.2 Comment On An Information Source

To comment on a particular information source first search for the information source using the Search or Explore function then click on the button (see section 3.3). Doing so will bring up the information source details page. At the bottom of this page there is a text area in which comments can be entered into. Once you have entered your comment click on the submit button as shown in Figure 20.
7. Getting Help

The ‘Help’ link on the menu (see section 2.2) allows you to obtain online help with regards to
the Configuration Management Information Map. The Help page contains readable and
downloadable documentation for the Configuration Management Information Map along with
a troubleshooting guide.

Help on searching can also be attained from the Search Tips page accessible from the Search
and Advanced Search pages.

As well as the help pages there is also context sensitive help scattered around the site. An
eexample of the context sensitive help is shown in Figure 21.

![Figure 21 – Context Sensitive Help.](image)

When you see a question mark as is shown in Figure 21, if you hover the mouse over the
question mark a small pop up box will appear with the help instructions in it. The above
context sensitive help is with regards to the phase selection boxes found on the Search page.
APPENDIX 11

INFORMATION MAP TEST SCHEDULE
Test Schedule for
Configuration Management Information Map

<table>
<thead>
<tr>
<th>Version to Test</th>
<th>Version 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authorised by</td>
<td></td>
</tr>
<tr>
<td>Signed</td>
<td></td>
</tr>
<tr>
<td>Test Date</td>
<td></td>
</tr>
<tr>
<td>Tester</td>
<td>Hardev Ubhi</td>
</tr>
<tr>
<td>Signed</td>
<td></td>
</tr>
</tbody>
</table>

Author
Name: Hardev Ubhi
Dept: Infrastructure – Operational Support
Signature Date:

Test Schedule Approval
Name: Heulwen Pearce
Dept: Infrastructure – Operational Support
Signature Date:

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1 Test Schedule

1.1 Test Environment

1.2 Generic System Requirements

2 Functional Testing

2.1 Functional and Field Format Testing for the Home page

2.2 Functional and Field Format Testing for the Site Map

2.3 Functional and Field Format Testing for the Search Page

2.4 Functional and Field Format Testing for the About Page

2.5 Functional and Field Format Testing for My Documents

2.6 Field Format Testing for the Explore function

2.7 Field Format Testing for the Feedback page

2.8 Testing Print option

2.9 Testing the Log out Function

3 CM Information Map Test Result Approval

Page No.

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17
## Configuration Management Information Map Test Schedule

### 1.1 Test Environment

The testing will be carried out on a standalone PC and therefore not connected to the R-R NNPI network. The laptop is working to refresh operating standards. The functions of Information Source owners and Administrators will be tested via the Intranet as this cannot be created on the standalone PC.

<table>
<thead>
<tr>
<th>Test No</th>
<th>Reference</th>
<th>Description</th>
<th>✓</th>
<th>X</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1.1</td>
<td></td>
<td>Ensure that the system can be navigated through links and behaves as expected.</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1.2</td>
<td></td>
<td>Confirm database is Access based Windows/Browser style</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>1.1.3</td>
<td></td>
<td>Confirm database has the correct links and relationships</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1.4</td>
<td></td>
<td>Confirm data is &quot;read only&quot; to all users except those with write permissions. Type data into fields to ensure data cannot be entered by those without permission. Attempt using the &quot;Save&quot; function to check.</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>1.1.5</td>
<td></td>
<td>Confirm Administrators or Information Source owner can write to fields. Type in a variety of words into different tables to ensure write access and then 'Save'.</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1.6</td>
<td></td>
<td>Confirm Super users can grant access permissions</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 1.2 Generic System Requirements

<table>
<thead>
<tr>
<th>Test No</th>
<th>Reference</th>
<th>Description</th>
<th>✓</th>
<th>X</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2.1</td>
<td></td>
<td>Check that the system is capable to move back from every page</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2.2</td>
<td></td>
<td>Check that the user can get back to the home page from every page</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>1.2.3</td>
<td></td>
<td>Check &quot;Site Help&quot; Function is operational from the Home page</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2.4</td>
<td></td>
<td>Check that all the pages look like the windows/browser</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>1.2.5</td>
<td></td>
<td>Ensure Upper and Lower case data entry is allowed for both read and write users. Data should be converted to correct format when writing to tables for all fields. – Enter data in lower case where upper case is required and check that it is changed to upper case.</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>1.2.6</td>
<td></td>
<td>The Feedback function should generate an email which can allow any comments to be fed-back</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2.7</td>
<td></td>
<td>Check that current date and time is displayed.</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Functional Testing

### 2.1 Functional and Field Format Testing for The Home Page

<table>
<thead>
<tr>
<th>Test No</th>
<th>Reference</th>
<th>Description</th>
<th>✓</th>
<th>×</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1.1</td>
<td></td>
<td>Open the application – user should be directed onto the home page</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1.2</td>
<td></td>
<td>Links to the other Pages on the site should appear and work</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Home</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Site Map</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- About</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Search CMIM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Explore CMIM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- My Documents</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Site Help</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- CMIM Feedback</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1.3</td>
<td></td>
<td>Standard R-R Template should appear</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1.4</td>
<td></td>
<td>Displays and Links to the other R-R sites (Standard Template)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Products</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Processes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Resources</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Organisation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Search</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Help</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Print</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 2.2 Functional and Field Format Testing for The Site Map

<table>
<thead>
<tr>
<th>Test No</th>
<th>Reference</th>
<th>Description</th>
<th>✓</th>
<th>×</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.2.1</td>
<td></td>
<td>Open the Site Map from the Home page</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.2.2</td>
<td></td>
<td>Check the R-R Template is in use</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>'Breadcrumbs' trail showing the depth of your menu/option selection should allow a link to the 'Home' page</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.2.3</td>
<td></td>
<td>The display should show the site structure and available pages to the user</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.2.4</td>
<td></td>
<td>Check that each link directs the user to the correct page</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- My Documents</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- About</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Search</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Search Tips</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Advanced search</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Explore</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Feedback</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Help</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- User guide</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Test Schedule – Configuration Management Information Map

### 2.3 Functional and Field Format Testing for Search Page

<table>
<thead>
<tr>
<th>Test No</th>
<th>Reference</th>
<th>Description</th>
<th>✓</th>
<th>x</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.3.1</td>
<td></td>
<td>Check that the page opens using the R-R Standard Template</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3.2</td>
<td></td>
<td>Within the search by the keyword box check that both Text (Caps/Lowercase) and Numerical digits can be typed in</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3.3</td>
<td></td>
<td>Check that the automation of words generated by the pick list are inline with the word typed E.g. Cal should show Calculate, Calculus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3.4</td>
<td></td>
<td>Check that the automatically generated word can be selected from the list provided</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3.5</td>
<td></td>
<td>Type in PIMS and Click on the ‘Search’ button this should return ‘4’ results</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3.6</td>
<td></td>
<td>Check that the information provided by each source is correct – This will validate the data</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3.7</td>
<td></td>
<td>Click on a source Information button (icon) to view more information – this should link you to the source information</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3.8</td>
<td></td>
<td>Click on the ‘Search Tips’ button. This should provide relevant search tips</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3.9</td>
<td></td>
<td>Try and deselect phases of the product life cycle individually.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3.10</td>
<td></td>
<td>Use the ‘Select/Deselect All’ button and see if that works to select all the phases and then deselect all of the phases.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3.11</td>
<td></td>
<td>Deselect the phases of the product life cycle, which ‘Ophis’ occurs in, and then type ‘Ophis’ into the search box and check to see if any results are returned</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3.12</td>
<td></td>
<td>Deselect two phases, which Ophis does occur in and check that they are excluded when the search has been performed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3.13</td>
<td></td>
<td>When the results per page are shown you need to check that the results page function works by testing that the number per page can be changed with the correct number of finds displayed and an option is given to view the next page.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3.14</td>
<td></td>
<td>Select the ‘Advanced Search’ option. It should open the advance search options on the screen below the ‘Product life cycle phase’</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3.15</td>
<td></td>
<td>Check that when the question mark symbol is selected it then displays the correct help message</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Functional and Field Format Testing for the Advanced Search Page

<table>
<thead>
<tr>
<th>Test No</th>
<th>Reference</th>
<th>Description</th>
<th>✓</th>
<th>×</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.4.1</td>
<td></td>
<td>Check that the page opens using the R-R Standard Template</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.4.2</td>
<td></td>
<td>Within the search by the keyword box check that both Text (Caps/Lowercase) and Numerical digits can be typed in</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.4.3</td>
<td></td>
<td>Check that the automation of words generated by the pick list are inline with the word typed E.g. Cal should show Calculate, Calculus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.4.4</td>
<td></td>
<td>Check that the automatically generated word can be selected from the list provided</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.4.5</td>
<td></td>
<td>Type in PIMS which should equal 4 results and Ophis should equal 1 result.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.4.6</td>
<td></td>
<td>Check that the information provided by each source is correct – This will validate the data.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.4.7</td>
<td></td>
<td>Click on a source (I icon) to view more information – this should link you to the source information.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.4.8</td>
<td></td>
<td>Click on the ‘Search Tips’ button. This should provide relevant search tips</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.4.9</td>
<td></td>
<td>Try and deselect phases of the product life cycle - individually.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.4.10</td>
<td></td>
<td>Use the ‘Select/Deselect All’ button and see if that works to select all the phases and then deselect all of the phases.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test No</th>
<th>Reference</th>
<th>Description</th>
<th>✓</th>
<th>×</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.4.11</td>
<td></td>
<td>Deselect the phases of the product life cycle, which ‘Ophis’ occurs in, and then type ‘Ophis’ into the search box and check to see if any results are returned.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.4.12</td>
<td></td>
<td>Deselect two phases, which Ophis does occur in and check that they are excluded when the search has been performed.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.4.13</td>
<td></td>
<td>When the results per page are shown you need to check that the results per page function works by testing that the number per page can be changed with the correct number of finds displayed and an option is given to view the next page.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.4.14</td>
<td></td>
<td>Select the ‘Advanced Search’ option, it should open the advance search options on the screen below the ‘Product life cycle phase’</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.4.15</td>
<td></td>
<td>Type in a keyword and select a ‘Class’ of submarine. Check that the results, which are returned, are referring to that class only.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.4.16</td>
<td></td>
<td>Type in a keyword and select a ‘Level’ of the PLC. Check that the results, which are returned, are referring to that PLC level only.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.4.17</td>
<td></td>
<td>Type in a keyword and select a PLC ‘Phase’. Check that the results, which are returned, are referring to that class only.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.4.18</td>
<td></td>
<td>Type in a keyword and select a ‘Model’ of submarine. Check that the results, which are returned, are referring to that Model only.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.4.19</td>
<td></td>
<td>Type in a keyword and select a ‘Components’ of submarine. Check that the results, which are returned, are referring to that component only.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.4.20</td>
<td></td>
<td>Type in a keyword and select a Class, Level, Phase, Model and Component and check that the results shown are relevant to the options selected.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 2.4.21 - Just select a Class, Level, Phase, Model and Component and see that the information sources relate to those fields only and that the function works without a keyword being used.

### 2.4.22 - Type in a Keyword and select two different types of Class, and then validate the results to see if they are correct.

### 2.4.23 - Type in a Keyword and select two different types of Level, and then validate the results to see if they are correct.

### 2.4.24 - Type in a Keyword and select two different types of Phase, and then validate the results to see if they are correct.

### 2.4.25 - Type in a Keyword and select two different types of Model, and then validate the results to see if they are correct.

### 2.4.26 - Type in a Keyword and select two different types of Component, and then validate the results to see if they are correct.

### 2.4.27 - Check that when the question mark symbol is selected it then displays the correct help message.

### 2.5 - Functional and Field Format Testing for About page

<table>
<thead>
<tr>
<th>Test No</th>
<th>Req. Reference</th>
<th>Description</th>
<th>✓</th>
<th>×</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5.1</td>
<td></td>
<td>Check that the correct R-R template is being used</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5.2</td>
<td></td>
<td>Check that the correct links are present on the template and work</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5.3</td>
<td></td>
<td>Check that the Information which is displayed is correct</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5.4</td>
<td></td>
<td>Edit the Information which is within the coding and see that the changes appear on the page.</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Field Format Testing for My Documents

<table>
<thead>
<tr>
<th>Test No</th>
<th>Req. Reference</th>
<th>Description</th>
<th>✓</th>
<th>×</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5.1</td>
<td></td>
<td>Check that the correct R-R template is being used</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5.2</td>
<td></td>
<td>Check that the correct links are present on the template and that they work</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5.3</td>
<td></td>
<td>Check that the items displayed are those that are owned by the Information Source owner</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5.4</td>
<td></td>
<td>Check that as a normal user without any privilege options you should find the 'My Documents' empty.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5.5</td>
<td></td>
<td>As a source owner the edit function should appear.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5.6</td>
<td></td>
<td>Click on the 'edit function' and check the source information is displayed correctly</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5.7</td>
<td></td>
<td>Check that an Administrator can change all of the fields within the Information Source, Check that the changes which have been made are stored</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5.8</td>
<td></td>
<td>Check that a Source owner can change all of the fields within the Information Source, Check that the changes which have been made are stored</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Field Format Testing for Explore function

<table>
<thead>
<tr>
<th>Test No</th>
<th>Req. Reference</th>
<th>Description</th>
<th>✓</th>
<th>×</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.6.1</td>
<td></td>
<td>Check that the explore page opens with the correct R-R template</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.6.2</td>
<td></td>
<td>Check that the navigation buttons work correctly.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.6.3</td>
<td></td>
<td>Check that the 6 stages of the Product life cycle are displayed.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.6.4</td>
<td></td>
<td>Check that by clicking on each phase of the Product Life cycle that the correct Levels are displayed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.6.5</td>
<td></td>
<td>Click on a phase and check that the correct Information Sources are present.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.6.6</td>
<td></td>
<td>Click on an Information source to view the detailed information</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.6.7</td>
<td></td>
<td>Click on the first phase 'Concept' check that the purple box is highlighted on all of the Information Sources displayed.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.6.8</td>
<td></td>
<td>Carry out the above test on every component type checking the deferent product life cycle colour.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.6.9</td>
<td></td>
<td>Within the concept phase look at an Information source which appears within more then one phase and check that it appears within that other phase.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test No</td>
<td>Req. Reference</td>
<td>Description</td>
<td>✓</td>
<td>✗</td>
<td>Comments</td>
</tr>
<tr>
<td>---------</td>
<td>----------------</td>
<td>------------------------------------------------------------------------------</td>
<td>---</td>
<td>---</td>
<td>----------</td>
</tr>
<tr>
<td>2.6.10</td>
<td></td>
<td>Repeat the above test for a number of Information sources.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.6.11</td>
<td></td>
<td>Check that the plus buttons next to each phase within the PLC represent the correct levels below</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.6.12</td>
<td></td>
<td>Check that this can then go down into components</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.6.13</td>
<td></td>
<td>Check that by clicking on the components the amount of relevant information sources are displayed.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.6.14</td>
<td></td>
<td>When you have selected an Information source from the icon (.), Write in a comment and check that the comment has been recorded onto that Information source.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.6.15</td>
<td></td>
<td>Check that you can close the Information Source description box by using the x button or by using the close sign.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 2.7 Field Format Testing for the Feedback page

<table>
<thead>
<tr>
<th>Test No</th>
<th>Req. Reference</th>
<th>Description</th>
<th>✓</th>
<th>✗</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.7.1</td>
<td></td>
<td>Check that the page format and Layout is within the R-R Template format.</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.7.2</td>
<td></td>
<td>Check that the required address is within the send box</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.7.3</td>
<td></td>
<td>Check that all of the relevant area's can be written into</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.7.4</td>
<td></td>
<td>Check that the 'Send' function works</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 2.9 Field Format Testing for Print option

<table>
<thead>
<tr>
<th>Test No</th>
<th>Req. Reference</th>
<th>Description</th>
<th>✓</th>
<th>✗</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.8.1</td>
<td></td>
<td>Check that every page can be printed out with the correct content.</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Test Result Approval

**Test Result Checked by:**

<table>
<thead>
<tr>
<th>Name</th>
<th>Signed</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardev Ubhi</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Test Result Approved by:**

<table>
<thead>
<tr>
<th>Name</th>
<th>Signed</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heulwen Pearce</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX 12

QUESTIONNAIRE 3 - INFORMATION MAP
The questionnaire attached has been designed to measure the effectiveness of the Submarines NSRP Information Map. The results of this questionnaire will be compared against the results of the initial questionnaire and then the findings will be published.

Your privacy will be respected and any information you provide will be treated in confidence.

Thank you for your co-operation - Heulwen Pearce, Christine Brady & Hardev Ubhi

### General Information

<table>
<thead>
<tr>
<th>1. Name</th>
<th>Please specify</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Business area</td>
<td>Please specify</td>
</tr>
</tbody>
</table>

3. If you answered question 2 as 'other' please specify within the space provided

4. How long have you worked for Rolls-Royce, Submarines?

5. How long have you worked within your current job/role?

### Search

6. In an average day, how much time is spent looking for Submarines NSRP information/advice?

7. How often have you successfully found relevant Submarines NSRP information?

### Submarines NSRP Information Map

8. Are you aware of the Submarines NSRP Information Map?

   - Yes
   - No

   If no, please review the Submarines NSRP Information Map (by clicking here) then resume completion of questionnaire

9. How many times a week do you use the Submarines NSRP Information Map?

   - <=1
   - 2-5
   - 6-15
   - 16-25
   - >=26

10. Do you believe that the Submarines NSRP Information Map has met your expectations?

    - Yes - Please explain why below
    - No - Please explain why below

11. Is the Submarines NSRP Information Map intuitive to use?

    - Yes - Please explain why below
    - No - Please explain why below

12. With the use of the Submarines NSRP Information Map, how easy do you find it to search for the whereabouts of Submarines NSRP information?

    Please specify

13. As a percentage, how much of your time do you believe has been saved with the use of the Submarines NSRP Information Map?

    Please specify

### At a PERSONAL level have the benefits (listed below) been achieved?

<table>
<thead>
<tr>
<th>1.</th>
<th>Confident that this is the authoritative source of information/expert who is committed to sharing knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
<td>Some</td>
</tr>
<tr>
<td>2.</td>
<td>Provides a good starting point for networking</td>
</tr>
<tr>
<td>3.</td>
<td>Information/expert searching becomes less hit and miss</td>
</tr>
<tr>
<td>4.</td>
<td>Provides incidental learning</td>
</tr>
<tr>
<td>5.</td>
<td>Identifies different information storage media</td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>
15. At a BUSINESS level have the benefits (listed below) been achieved?

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Not at all</th>
<th>Some</th>
<th>Reasonably</th>
<th>Completely</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encourages the use of authorised sources of information/experts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Promotes the sharing of expert knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Promotes greater efficiency in the workforce</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provides opportunity to build on past experience</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

16. What problems might the Submarines NSRP Information Map encounter?

<table>
<thead>
<tr>
<th>Possibility</th>
<th>Please specify</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

17. Suggested solution to problem

<table>
<thead>
<tr>
<th>Don't Know</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

18. What additional features would you like within the site, if funding were to become available?

<table>
<thead>
<tr>
<th>Feature</th>
<th>Useful</th>
<th>Important</th>
<th>Essential to users</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

19. Which search method do you find more successful?

<table>
<thead>
<tr>
<th>Search Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keyword</td>
</tr>
<tr>
<td>Structured hierarchical search</td>
</tr>
</tbody>
</table>

20. Is this your preferred search method?

<table>
<thead>
<tr>
<th>Search Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keyword</td>
</tr>
<tr>
<td>Structured hierarchical search</td>
</tr>
</tbody>
</table>

21. If you could choose to search via an additional method, what would that be?

<table>
<thead>
<tr>
<th>Additional Method</th>
</tr>
</thead>
</table>

22. Would you/ have you recommended the Submarines NSRP Information Map to colleagues?

<table>
<thead>
<tr>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
</tbody>
</table>

23. Do you consider the Submarines NSRP Information Map part of your 'Tool-kit' for obtaining product information?

<table>
<thead>
<tr>
<th>Consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
</tbody>
</table>

24. Please provide an example of using the Submarines NSRP Information Map successfully?


25. Please identify any new Submarines NSRP Information Map sources that we should follow up?
TCP Intranet Site

Site Owner: Stuart Wicks
Project Owner: Mark Goodson
Friday 23rd April 2004

Presentation by Hardev Ubhi

Meeting Objective

'To gain agreement with the team to help support the creation of the TCP Intranet site'

What are the benefits of the site?
- Resource availability
- Encourages Teamwork
- Communication - Time Saved
- Experts highlighted
- Online - Not just meetings
- Searching for Information becomes easier

What is the site Vision?

'The Intranet site's primary aim is to increase collaboration within the team and other business units within Rolls-Royce that are also developing (TCP) solutions'

Project Scope

Agree site structure - April 2004
Create and Populate site - May 2004
Launch Site - June 2004
Communities of Practice (CoPs)?

'Communities of Practice are groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis.'

Benefits of CoPs

- We need to solve problems once
  Problems should be solved by a single entity once and the solutions cascaded throughout the community
- Response times can be significantly reduced
- We need to encourage sharing of ideas and knowledge
  By sharing knowledge now, we can prepare for future learning and training skills, reducing learning curves for new starters and inexperienced personnel.

Thank you

Any Comments
Or
Questions
APPENDIX 14

TCP INTRANET SITE PRESENTATION - TO AGREE ON THE SITE CONTENT
TCP INTRANET SITE

27th May 2004
Sherwood Meeting room

The Next Steps...

- Issue TCP Intranet site to team to test initial prototype.
- Feedback will be required by a date to be specified.

Meeting Objective

To Review and Agree the proposed TCP Intranet Site Content.

Project Milestones

- Agree project requirements – March 2004
- Capture content – April 2004
- Identify and agree site structure – April 2004
- Create and populate site – May 2004
- Agree on site and structure – May 2004
- Launch site – June 2004

The Site Structure

- Strategy Pg
- Resources and Skills
- Calendar
- Projects and Prospects
- Feedback
- Finance

Home Page

Welcome to the TCP Home Page

TOTAL CARE PACKAGES (TCP)

- Strategy
- Projects and Prospects
- Feedback
- Finance
- Calendar
- Projects and Prospects

Home Pg

Social
Outlook Folder Structure

Maintenance

How do you think that the site should be maintained?

Questions/Comments
APPENDIX 15

TCP INTRANET SITE SCREEN SHOTS
TOTAL CARE PACKAGES (TCP)

WELCOME TO THE TCP HOME PAGE

- Strategy
- Resources and Skills
- Projects and Prospects
- Finance
- Calendar
- Social
- Feedback

Click here to view the Rolls-Royce Centenary Celebrations

Page information

Owner
Stuart Wicks

Web editor
Hardev Ubhi

Last updated
20/05/04

TCP - PROJECTS AND PROSPECTS

<table>
<thead>
<tr>
<th>PROJECT MATRIX TABLE</th>
<th>PROJECT DOCUMENTS</th>
<th>REPORTS &amp; CONTRACTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project Matrix Table</strong></td>
<td>The <strong>Capability Acquisition Monitor</strong> is a series of spreadsheets showing capability requirements against project prospects. The <strong>Projects Initial Process Chart</strong> is an overview giving the current status of individual projects.</td>
<td></td>
</tr>
<tr>
<td><strong>Project Documents</strong></td>
<td>The RR standard gated process and the Local operating procedures can be found by clicking here. The Good practice framework, holds valuable information so to access please click here.</td>
<td></td>
</tr>
</tbody>
</table>

[HOME]
TCP - Resources and Skills

<table>
<thead>
<tr>
<th>TEAM MEMBERS PROFILE</th>
<th>TEAM SKILLS AND CAPABILITIES</th>
<th>ORGANISATIONAL CHART</th>
<th>CONTACTS THROUGH CoP</th>
</tr>
</thead>
</table>

**Team Members Profile**
The TCP team consists of 10 members. By clicking on their names below you can view their People pages:

- Stuart Wicks
- Rachel Stock
- Steve Brotherhood
- Veronica Jurrison
- Sam Salt
- Adrian Gailey
- Mark Goodson
- Mark De Chazel
- Gillian Barlow
- Hardev Ubhi

**Team Skills and Capabilities**
The TCP Team is an experienced and multidisciplinary team of professionals from the Support business and other abilities.

TCP - Feedback

There are a number of people that you can contact with feedback about the site but to ensure that your comments are dealt with efficiently we would ask if you could target your comments to one of the people below. Thank you.

**Site Owner**
The site owner is **Stuart Wicks** who is the manager of the TCP team in Derby. If you would like to contact Stuart then please - Click here.

**Project Coordinator**
**Mark Goodson** is the coordinator for this site. If you have any suggestions or any queries about site content then please - Click here.

**Site Editor**
**Hardev Ubhi** is the site editor, so please direct any technical emails her way - Click here.

Page information

Owner
Stuart Wicks

Web editor
Hardev Ubhi

Last updated
13/05/04

review
APPENDIX 16

QUESTIONNAIRE 1 - TCP INTRANET SITE
Questionnaire 1 – TCP Intranet site

Questionnaire Purpose and additional information
The questionnaire attached has been designed to measure the success of the intranet site so that we can set a baseline for the perceived expectations.
The questionnaire will be conducted as a one to one interview with the results being recorded by myself and then validated on completion.
You will be given an attachment which will show the structure of the site and highlight the main functionality.
Your privacy will be respected and any information you provide will be treated with confidence.
Thank you for your co-operation - Hardev Ubhi 52653

Name -
Ext No -

1. How many times a week do you think that you will access the intranet site?
   - <=1
   - 2-5
   - 6-15
   - 16-25
   - >=26

2. How many hours of time do you feel that you have contributed to the site?
   - <=1
   - 2-3
   - 4-5
   - 6-7
   - 8-9
   - >=10

3. What benefits do you hope to get from the site and how confident are you that each benefit will be achieved?

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Not at all Confident</th>
<th>Some Confidence</th>
<th>Reasonably confident</th>
<th>Very confident</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

4. What benefits do you think the site will bring to the TCP group and how confident are you that each benefit will be achieved?

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Not at all Confident</th>
<th>Some Confidence</th>
<th>Reasonably confident</th>
<th>Very confident</th>
</tr>
</thead>
<tbody>
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</tr>
</tbody>
</table>

5. What benefits do you think the site will bring to the business and how confident are you that each benefit will be achieved?

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Not at all Confident</th>
<th>Some Confidence</th>
<th>Reasonably confident</th>
<th>Very confident</th>
</tr>
</thead>
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</tr>
</tbody>
</table>

6. What problems do you envisage the site may encounter and how probable do you think these will be?

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible but unlikely</th>
<th>May Happen</th>
<th>Probable</th>
<th>Almost certain</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
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<tr>
<td>3</td>
<td></td>
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</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
7. How do you think that your concerns could be dealt with? | Don't Know
---|---
1 | ☐
2 | ☐
3 | ☐
4 | ☐
5 | ☐

8. What additional features would you like within the site? | Useful | Important | Essential
to users
---|---|---|---
1 | ☐ | ☐ | ☐
2 | ☐ | ☐ | ☐
3 | ☐ | ☐ | ☐
4 | ☐ | ☐ | ☐

9. Additional comments?
APPENDIX 17

POSTER TO EXPLAIN EXPLICIT AND TACIT KNOWLEDGE
Explicit Knowledge
Things we know that we can write down, share with others e.g. Step-by-step sequence

Tacit Knowledge
What we do not know we know, including know how, rules of thumb, experience, insights and intuition.

E.g. your mum goes into cardiac arrest, who would you call????

Dr Jones - works in the cardiac ward

Mark - Reads about it
APPENDIX 18

ANSWERS TO THE FOCUS GROUPS OPEN QUESTIONS
Font style per group

1. TCP support team – Innovative and tacit based
2. Safety team – Work based on explicit knowledge

Do people working within NM prefer to use tacit or explicit knowledge?

- Personal preference
- You need them both – to use one you usually need the other
- Use half of each
- First stage within a task is tacit, but the task uses a lot of explicit knowledge as reference data

Which is more efficient?

- Tacit is easier if you know who to speak to
- You may need to use explicit as a person may not have the time to explain to you the whole thing in question
- A process may differ in real life to what is written down

Is tacit knowledge sharing encouraged?

- It is used within formal projects where experts are brought in
- Process encourages people to share knowledge e.g. HAZOP
- Depends on the area of work e.g. HR use tacit.
- People are mainly called in from Support areas to help e.g. EDS or Operational Support.

Issues with tacit knowledge?

- You have to reply on others
- Can be difficult to know who to speak to

Why do we like to use tacit knowledge?

- Its quick
- We like people contact
• When working with people they may not want to commit to things on paper so they prefer to talk about things - no commitment
• Often there is too much information to look through

_Do you think it would be a good idea to reward tacit knowledge sharing?_
• No, do not like the idea of rewards
• Some people do not like talking to others but should not be punished for it
• An issue arises with Specialists/Generalists as generalists would be rewarded more
• People under pressure may not help

_Company Culture?_
• Needs changing
• Managers need to be more visible and interactive with their staff
• New ideas within the company are done to tick boxes
• Executives should be involved within product support meetings
• Need to reduce boundaries
• Increase knowledge awareness
• People need to be encouraged to update their details so that it can be made more aware of who knows what (SAP)
• People may not share due to job security
• There needs to be more support for KM initiatives
• Lack of communication (Feedback) and visibility from the top
• Need to have more hard copies of documents available, better information on the intranet and more meeting rooms (Common rooms).
• Group socialising/team building days would be great = more productive staff
• Recognition from managers
• Knowledge transfer with external bodies e.g. attending conferences
APPENDIX 19

FOCUS GROUP QUESTIONNAIRE
(Frequency = Rarely, Occasionally, Frequently)

<table>
<thead>
<tr>
<th>Explicit knowledge tools</th>
<th>Are you aware of this tool within NM?</th>
<th>Have you used the tool?</th>
<th>Have you contributed to the use of the tool?</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lessons learnt logs/Best practices – sharing of new knowledge and experience</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structured Knowledge Audits – understanding knowledge needs and assets</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power packs – compilation of best proposals, presentations, models, work plans etc</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capability Intranets – online sharing of processes, technology and best practice.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benchmarking (Establishes strengths and weaknesses across KM issues = targets &amp; measurements)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRIZ – Theory of inventive problem solving (database holding patent designs = better quality ideas)</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Lessons Learnt Review – facilitated session held at the end of a key session.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hazard Identification Prompt Lists – Prompts lists for running risk identification</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tacit knowledge tools</td>
<td>Are you aware of this tool with NM?</td>
<td>Have you used the tool?</td>
<td>Have you contributed to the use of the tool?</td>
<td>Frequency</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------------</td>
<td>-------------------------------------</td>
<td>-------------------------</td>
<td>----------------------------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>Corporate yellow pages/People pages</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CoP - Communities of practice (facilitated network of people sharing knowledge)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Networking - people</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Telephone conference</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Video conferencing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peer assist (People from new projects to learn from experiences across the company)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Story telling</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social meeting places e.g. Cafe</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expert interviews/master classes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DRED - Design rational editor (Helps structure, present and review decision processes)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge Acquisition Modelling Process – capturing and publishing knowledge suitable for non-experts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX 20

BUSINESS ADVANTAGES AND DISADVANTAGES FOR BOTH TACIT AND EXPLICIT KNOWLEDGE
**Weighting** - The weights will range from 1 to 5 with 1 being Important and 5 being extremely important. The weighting was added after the meeting to establish the importance of each point.

**Frequency** – This will determine the likelihood that an event will occur. 1 is unlikely and 5 is most likely.

### Explicit knowledge

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Example</th>
<th>Importance</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explicit knowledge is auditable</td>
<td>Nuclear training is audited by Lloyds. Finances are audited by KPMG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explicit knowledge is accessible to everyone across the company/to many people at one time</td>
<td>QMS, documents held on the Intranet, shared drives.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explicit knowledge can be transferred quickly via PC’s</td>
<td>E-learning, emailing documents.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explicit knowledge can be stored and searched upon effectively</td>
<td>PIMS or any other database holding information</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explicit knowledge can be validated/quality checked</td>
<td>Ophis – The operational history is checked within detail. ETNA safety s/w</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explicit knowledge is readily identifiable</td>
<td>Intranet /library searches</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explicit knowledge is accredited</td>
<td>E-learning offers courses which have been accredited.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Disadvantages

<table>
<thead>
<tr>
<th>Example</th>
<th>Importance</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telephone lists and the Intranet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Configuration management problems (Wrong use of drawing (A used V))</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Live files</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simple example – booking a meeting room</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Tacit Knowledge**

**Assumptions:**
- People are willing to share knowledge
- They are available within the team, and still working within the area the information is requested in.
- The person is available to answer the query

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Example</th>
<th>Importance</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tacit knowledge can be JIT</td>
<td>All the time - for example one person offered tacit knowledge once in a five minute observation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The transfer of tacit knowledge can be rewarding/empowering</td>
<td>Teaching e.g. PFC, general offering of knowledge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tacit knowledge equals less emphasis/cost on IT</td>
<td>The CoP's are a cheap way and are successful, social areas include kitchens</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increases a knowledge sharing/team building environment</td>
<td>IPT's (Integrated Project teams) involving people external e.g. the MoD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tacit knowledge increases innovation through brainstorming</td>
<td>Best practice clubs, project brainstorming sessions</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Disadvantages</th>
<th>Example</th>
<th>Importance</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>If tacit knowledge is not formally captured then it could be misinterpreted</td>
<td>Meeting minutes are not always taken - meeting outputs can therefore be debatable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tacit knowledge could lead to some people having a competitive advantage over others, stopping them from sharing their knowledge</td>
<td>It does Occur</td>
<td></td>
<td></td>
</tr>
<tr>
<td>People may leave the company with important tacit knowledge</td>
<td>Key people have left during projects e.g. Nuclear engineers with experience in Stress/Electrical safety</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Questionnaire Purpose and additional information**

The questionnaire below has been designed to measure the usage of Knowledge Management tools.

*Your privacy will be respected and any information you provide will be treated in confidence.*

*Thank you for your co-operation - Hardev Ubhi (Ext 52653)*

1. Name

2. Which Business do you work for:
   - [ ] Submarines / Raynesway
   - [ ] Aerospace

3. Please name your current business unit?

The following section has a list of KM tools along the left hand side and a list of questions relating to each tool:

<table>
<thead>
<tr>
<th>Knowledge Management tools</th>
<th>4. On average, how often have you used the tool?</th>
<th>5. Why have/do you use the tool?</th>
<th>6. When did you first use the tool?</th>
<th>7. Why have you not used it?</th>
<th>8. Do you think that it may benefit others?</th>
<th>9. Do you think everyone who could benefit is using it?</th>
<th>10. How many other users, do you think other people use the tool?</th>
<th>11. Generally how often do you think other people use the tool?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lessons Learnt logs</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
</tr>
<tr>
<td>Structured Knowledge Audits</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
</tr>
<tr>
<td>Capability Intranets</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
</tr>
<tr>
<td>Benchmarking</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
</tr>
<tr>
<td>TRIZ</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
</tr>
<tr>
<td>Lessons Learnt Reviews</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
</tr>
<tr>
<td>Hazard Identification Prompt Lists</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
</tr>
<tr>
<td>People Pages</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
</tr>
<tr>
<td>Communities of Practice</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
</tr>
<tr>
<td>Telephone conferencing</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
</tr>
<tr>
<td>Peer assist</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
</tr>
<tr>
<td>Story Telling</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
</tr>
<tr>
<td>Design Rational Editor (DRED)</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
</tr>
<tr>
<td>Knowledge Acquisition Modelling Process</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
</tr>
<tr>
<td>Email</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
</tr>
<tr>
<td>Company Intranet</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
</tr>
<tr>
<td>Information Map</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
<td>Please Select</td>
</tr>
</tbody>
</table>

Any Additional Comments
APPENDIX 22

BENCHMARKING QUESTIONNAIRE
Most of these questions refer to people. Normally you should consider the people in your team or business unit (the group in question considered by the study).

In other cases, where you publish procedures or information outside this team, to be used by others, then you should consider the wider group, not just the members of the team. These questions are marked with an asterisk.*

Score each question with a score of 1-5 (or 6 if you have a practice better than the level 5 description). This can be done electronically or on paper.

You can enter the scores for several individuals or teams into the accompanying spreadsheet "km benchmark summary template.xls" - this gives some stats and tools for comparing across individuals, teams or business units.

<table>
<thead>
<tr>
<th>Questions</th>
<th>Enter level in this column</th>
<th>Description of level 1 practice</th>
<th>Between levels 1 and 3 practice</th>
<th>Description of level 3 practice</th>
<th>Between levels 3 and 5 practice</th>
<th>Description of level 5 practice</th>
<th>Even better practice: Please attach a description or provide a contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establish a Knowledge Sharing Environment</td>
<td>Is the need for knowledge sharing, communicated?</td>
<td>No communication on lessons learnt of knowledge sharing</td>
<td>Routinely describe need and identify how or with whom</td>
<td>Reward specific instances or put good examples forward for awards</td>
<td>Frequently identify specific opportunities and how knowledge should be shared</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Are you rewarded for knowledge sharing activities?</td>
<td>No recognition</td>
<td>Informal recognition</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Have you been involved in the development &amp; promotion of knowledge sharing?</td>
<td>Opportunities not explicitly identified</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Understanding of knowledge needs &amp; assets</td>
<td>Does your process/team have a knowledge sharing vision?</td>
<td>No explicit knowledge sharing vision</td>
<td>Occasionally communicate how knowledge should be shared?</td>
<td>Frequent communication on how knowledge should be shared. Team &amp; individual knowledge sharing metrics and targets are set.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>How well do you understand the knowledge needed to operate your business process/team?</td>
<td>Not at all</td>
<td>Good management awareness, but not documented</td>
<td>Structured Knowledge Audit Identified needs and sources</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>How are the risks to your knowledge resources (people, documentation and other systems) managed?</td>
<td>Not at all</td>
<td>Action plan based on management awareness</td>
<td>Management action plan in place following Structured Knowledge Audit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Are you aware of any plans to cope with the loss of key experts?</td>
<td>None, recruit as needed</td>
<td>Less formal knowledge capture OR Successor identified</td>
<td>Systematically capture key experience from experts near to their departure. OR Successor identified and works closely with expert prior to departure.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Sheet 1

<table>
<thead>
<tr>
<th>Questions</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Even better practice. Please attach a description or provide a contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are you aware of how to make expertise available to new recruits?</td>
<td>Description of level 1 practice</td>
<td>Description of level 3 practice</td>
<td>Description of level 5 practice</td>
<td>New recruits systematically capture/gather key knowledge from experts early in their career, and are made fully aware of relevant documents &amp; capability Intranet webs</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sharing experience between people</strong></td>
<td>Experience acquired on the job</td>
<td>Training needs identified, otherwise experience acquired 'on the job' from supervisor/mentor.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How do you help people identify experts or contacts within your team?</td>
<td>Experience acquired on the job</td>
<td>Training needs identified, otherwise experience acquired 'on the job' from supervisor/mentor.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Is the sharing of expert knowledge encouraged between people?</strong></td>
<td>Experience acquired on the job</td>
<td>Training needs identified, otherwise experience acquired 'on the job' from supervisor/mentor.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Names of all experts published and disseminated to all operators of the process/team contacts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No action, any networks are informal</td>
<td>Encouragement is given to participate in relevant networks (communities of Practice)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Communities of Practice</strong></td>
<td>Identify networks and publicise members names</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>People routinely seek advice from contacts across R-R globally</strong></td>
<td>Identify networks and publicise members names</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Teams do not, or only rarely, seek advice.</strong></td>
<td>Identify networks and publicise members names</td>
<td></td>
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</tr>
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</tr>
<tr>
<td><strong>Teams do not, or only rarely, seek advice.</strong></td>
<td>Identify networks and publicise members names</td>
<td></td>
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</tbody>
</table>

### Sheet 1

<table>
<thead>
<tr>
<th>Questions</th>
<th>Level Enter level in this column</th>
<th>Description of level 1 practice</th>
<th>Between levels 1 and 3</th>
<th>Description of level 3 practice</th>
<th>Between levels 3 and 5</th>
<th>Description of level 5 practice</th>
<th>Even better practice. Please attach a description or provide a contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are there any steps to encourage participation in communities of practice (common interest networks)?</td>
<td>None</td>
<td></td>
<td>Identify networks and publicise members names</td>
<td>Communities of Practice with a purpose are encouraged. These are supported by meetings, publication of members names, facilitators and discussion groups</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How extensive are the networks that the people in your process/team participate in?</td>
<td>When seeking advice the contacts people make are almost all local</td>
<td>People routinely seek advice from contacts across R-R globally</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What does your team do to learn from others when you start something new?</td>
<td>Teams do not, or only rarely, seek advice.</td>
<td>Seek advice from those who have done it before.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How does a team acquire experience from other parts of the organisation?</td>
<td>No structured process.</td>
<td>Teams hold formal meeting to seek opinions from peers on plans and concepts (a Peer Assist)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do teams identify lessons when a team completes an activity?</td>
<td>Teams do not, or only rarely, identify lessons.</td>
<td>Occasionally, informal identification of lessons by teams</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How does a team identify what it has learnt on an activity?</td>
<td>No structured process.</td>
<td>Teams routinely consider what lessons have been learnt.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How does a team identify what it has learnt on an activity?</td>
<td>No structured process.</td>
<td>Teams hold Lessons Learnt Review meetings. There trained people available to run these meetings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Page 3
<table>
<thead>
<tr>
<th>Questions</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
<th>Even better practice, Please attach a description or provide a contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is done when an individual completes a piece of work?</td>
<td>In this column</td>
<td>Description of level 1 practice</td>
<td>Between levels 1 and 3</td>
<td>Description of level 3 practice</td>
<td>Between levels 3 and 5</td>
<td>Description of level 5 practice</td>
</tr>
<tr>
<td>Lessons learnt not routinely identified and captured</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lessons are often identified and captured in project reports</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Individuals routinely prompted to identify and record lessons learnt</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If you publish information about experts then please complete questions 3.10 - 3.12. Otherwise please go to section 4.

Experts and people identification

<table>
<thead>
<tr>
<th>How are experts and contacts identified?</th>
<th>Experts and contacts not identified</th>
<th>Table of people with job title/role &amp; indication of area of expertise</th>
<th>Categorised list of people. Each person’s name is linked to a &quot;people page&quot; for that individual giving their expertise/photo/contact information.</th>
</tr>
</thead>
<tbody>
<tr>
<td>How are expert details maintained?</td>
<td>No systematic approach</td>
<td>People lists and pages are reviewed every 2 years to ensure that they are up-to-date</td>
<td>System/working practice operated which prompts page update when individuals move or change role</td>
</tr>
<tr>
<td>What facilities are available to help you search for experts or contacts?</td>
<td>No search of experts</td>
<td>Basic word search of experts</td>
<td>Word search plus Categorised lists</td>
</tr>
</tbody>
</table>

Documenting knowledge

<table>
<thead>
<tr>
<th>Questions</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
<th>Even better practice, Please attach a description or provide a contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>How are processes &amp; practices made available?</td>
<td>Not documented, or not sufficiently up-to-date to be useful</td>
<td>Documented, up-to-date and available at point of work AND use Quality System &amp; Capability Internet (where available)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ownership is established?</td>
<td>Ownership is delegated, but resources are not sufficient to keep the documentation up-to-date</td>
<td>Ownership is delegated to those who are subject matter experts, and these people have the time &amp; resources to keep their topics up-to-date</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How widely is the documented knowledge disseminated?</td>
<td>Local area/site only</td>
<td>Outside local area/site, but within own business group only</td>
<td>R-R globally, revenue sharing partner’s, suppliers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How well do you know your target audience?</td>
<td>Little understood</td>
<td>The organisation groups and their locations are known</td>
<td>The names and contact details of a high proportion of the people are known</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How do you inform your target audience of the content available?</td>
<td>Ad hoc. word of mouth</td>
<td>Targeted notification of updates. Maintain a &quot;What’s new&quot; section in the documentation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Questions

<table>
<thead>
<tr>
<th>Level</th>
<th>Enter level in the column</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Even better practice. Please attach a description or provide a contact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Description of level 1 practice</td>
<td>Description of level 3 practice</td>
<td>Description of level 5 practice</td>
<td>A formal route to provide feedback is given OR the Lessons Learnt Log process is used</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 1</td>
<td>Feedback is not actively encouraged</td>
<td>Feedback is requested, but no formal system exists</td>
<td>Yes, sufficient to prevent the web editor being a bottleneck slowing release of web pages.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 2</td>
<td>Yes, but time available creates a bottleneck.</td>
<td>Yes, but time available creates a bottleneck.</td>
<td>Yes, but time available creates a bottleneck.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 3</td>
<td>Word of mouth and publicity</td>
<td>Word of mouth and publicity</td>
<td>Word of mouth and publicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 4</td>
<td>Technical Reviews and Formal Audits; regular reviews are conducted by the process team leader/owner with all the users/groups associated with the process. Audits are less frequent (annual), formal reviews of the application of the procedures to selected tasks, where extensive use of the web-site is made</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 5</td>
<td>A formal route to provide feedback is given OR the Lessons Learnt Log process is used</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Capability Intranet & Lessons Learnt Log

| Have you a currently identified web editor? | No |
| Are you motivated to use the Capability Intranet & Lessons Learnt Log? | Word of mouth and publicity |

### Lessons Learnt Log

- **Are you motivated to follow the processes and lessons in the Capability Intranet & Lessons Learnt Log?**
  - Occasional communication
- **What triggers the identification of lessons learnt?**
  - No specific triggers
- **What steps have you taken to encourage submission of new lessons/feedback?**
  - No specific actions
- **How widely have you sought submission of new lessons/feedback?**
  - Local area/site only
- **Technical Reviews and Formal Audits; regular reviews are conducted by the process team leader/owner with all the users/groups associated with the process. Audits are less frequent (annual), formal reviews of the application of the procedures to selected tasks, where extensive use of the web-site is made**
- **Prompts made during reviews by some individuals, but not general practice.**
- **Identification of lessons routine as part of closeout of problems. Identified routinely in project and process reviews.**
- **Word of mouth and publicity building on a systematic briefing**
- **Outside local area/site, but within own business group only**
- **R-R globally, revenue sharing partners, suppliers...**
<table>
<thead>
<tr>
<th>Questions</th>
<th>Level Enter level in this column</th>
<th>1 Description of level 1 practice</th>
<th>2 Between levels 1 and 3 Description of level 3 practice</th>
<th>3 Between levels 3 and 5 Description of level 5 practice</th>
<th>4 Even better practice. Please attach a description or provide a contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>How frequently do you sentence/review submitted lessons?</td>
<td>Ad hoc.</td>
<td>Quarterly</td>
<td>Monthly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How do you track/progress the embedding of approved lessons?</td>
<td>No actions assigned</td>
<td>Actions assigned but no regular monitor of progress</td>
<td>Monthly monitor of actions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How do you encourage use of the approved lessons?</td>
<td>Word of mouth and publicity</td>
<td>Word of mouth and publicity building on a systematic briefing</td>
<td>As level 3, but additionally with specific prompts identified in procedures and practised.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What additional features (if any) are there in your Capability Intranet web &amp; or Lessons Learnt Log or in how you operate them that others should consider adopting?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What are the most important improvements which you believe need to be made to the Capability Intranet &amp; Lessons Learnt Log?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prompt Lists</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level Enter level in this column</th>
<th>1 Description of level 1 practice</th>
<th>2 Between levels 1 and 3 Description of level 3 practice</th>
<th>3 Between levels 3 and 5 Description of level 5 practice</th>
<th>4 Even better practice. Please attach a description or provide a contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you publish prompt lists such as Hazard Identification Prompt Lists (HIPLs)?</td>
<td>Not published via the Capability Intranet</td>
<td>Prompts published for most systems/components</td>
<td>Prompts published for all systems/components where relevant</td>
<td></td>
</tr>
<tr>
<td>When were the prompts last reviewed or updated?</td>
<td>None updated within the last two years</td>
<td>Some updated within the last year</td>
<td>All updated within the last year</td>
<td></td>
</tr>
<tr>
<td>What search or categorisation of approved lessons do you have?</td>
<td>Rely on text search</td>
<td>Categories identified. Categories can either be browsed or searched separately</td>
<td>Prompts produced at component level, categorised or searchable by controlled keywords</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX 23

INTERVIEW WITH MIKE MOSS - CONTRIBUTING FACTORS TO SUCCESSFUL UPTAKE OF KM TOOLS
Interview with Mike Moss

**Capability Intranet**

There was a very high level of top level Support. At the time there was a global national 'buzz' for the intranet. The aim of the Capability Intranet was to provide information that could help people do their jobs including procedures, as the current ones were out of date and inaccessible. People were supportive of the tool as the need was there and it was seen as something new and creative. All of the information came from the bottom so there were 100 web-editors from across the business. By establishing the roles and tools the web-editors came forth. Capability Intranet had central people in each area that promoted the tool and were the central point of contact, therefore reducing the level of resistance.

**Email**

The first messaging started in R-R in 1995 and was available on the Mainframe to the management only. Email was first used within Bristol and then it was made generally available in the mid to late 90's. It was found to be easy to use, but email training was still given to all employees. The need for it wasn’t paramount but the take up for it was very good.

**Telephone Conferencing**

Introduced within the company in the mid/late 90's. No training was offered but it could be picked up easily even without training.

**Lessons Learnt Reviews**

Local areas were encourages to have facilitators and in some cases it worked. People have come forward and nominated themselves for the training but in general it has not been so widely excepted and this could be due to a lack of senior drive. LLR is not a method that would not used daily. A lot of publicity.

**People Pages**

As part of the Capability Intranet, the people pages have been less consistent with regards to Senior Buy in. They are less visible and not compulsory. The IT involved in not easily accessible and the editing has to be done through a third party. The buy in has mainly be done through word of mouth.

**Communities of Practice (CoP)**

Like the LLR, the CoP have had a lot of publicity. The CoP have had a definite process like the LLR and the Capability Intranet. There was an initial pilot of 8 to 10 communities which gave good feedback, and encouraged more. The Capability Intranet and the CoP both had central people in each area that promoted the tool and were the central point of contact, therefore reducing the level of resistance.

**Peer Assist**

There has been more resistance for Peer assist as it has been difficult to sell due to the organisation. There is no paramount management buy in. People should consult through the official peer assist route, but don’t seem to be. A presentation is given across the business when they talk about both Peer assist and LLR’s but the LLR has taken off more. This could be due to it being cheaper and easier to follow.

**DreD**

Some senior buy in is present and presentations have been given to every design team in the UK. People understood it easily so accepted it and therefore found it easy to adopt.

**Knowledge Acquisition Modelling Process**

Senior people within the business went out and did the KAMP process within their own businesses. The process and method was defined from the centre leading to a successful pickup.
Knowledge Management within Support

1. Background

1.1 History

In the 1990's companies recognised the benefit of Knowledge Management (KM) and adopted different tools and techniques. RR Aero introduced KM with the development of a Capability Intranet in 1996 and have since led the way in KM with a successful ongoing programme. The first business area in Naval Marine to conduct KM was Submarines in 2003. MoD funding secured the program for KM, therefore allowing a dedicated team to offer benefits to both Government and Industry.

The aim of the report is to highlight the requirements and options available to Support in KM.

2. Requirements

2.1 Support to lead the effective use of KM.

2.2 To have an innovative knowledge sharing environment.

2.3 Utilise knowledge both within Support and in the rest of the business to support better decision-making.

2.4 To give Support a competitive advantage

2.5 As a key part of an efficient business and process excellence.

3. Issues

3.1 Knowledge is often lost when people leave the company and is difficult to locate.

3.2 Duplication of effort is a result of knowledge not being captured and accessible to those requiring it.

3.3 Reinventing the wheel occurs when knowledge is not shared efficiently.

3.4 Not learning from previous lessons is costly. As Support is a newly developing business, it cannot afford to make avoidable mistakes.

3.5 A high number of supporting tools and trained staff are not being utilised to their full capacity.

3.5 Potential benefits of key projects are not realised across R-R.

4. Fulfilment of Requirement

4.1 The options considered are:

1. Do nothing and allow the business to continue in their current form, loosing knowledge.

2. Allow different areas within Support to adopt their own KM tools and techniques.

3. Create a KM strategy incorporating all of Support.

4.2 Option 1 – Do Nothing

4.2.1 Support could stop its current investment into KM via a PhD student. This is the cheapest solution saving Support £20,000 per year but not the preferred option for the following reasons:

- A Structured Knowledge Audit was conducted on the different sectors within the Services business in November 2003. It highlighted that 10 key areas were at high risk and if they were not captured the knowledge would be lost as they require a high level of experience-based knowledge.

- A KM benchmarking exercise carried out across Naval Marine [Appendix 1] found that Support had the second to lowest score. By doing nothing Support will continue to fall behind rest of Naval Marine.

- Support has an objective to 'Improve customer satisfaction' [taken from the State of the nation presentation]. This will not be achievable in Support’s current state as Appendix 2 shows the negative comments made by a number of customers. KM could help provide the decision makers with the knowledge required to resolve customer queries effectively.

- A benchmarking study conducted across Support [Appendix 3] found that the weakest area for KM in Support was 'Documenting Knowledge'. The managers rated the efficiency of the teams to be between 5-12%. If knowledge is not being documented then issues such as reinventing the wheel, incomplete data equalling ineffective decisions and time being wasted searching for information become apparent.

4.3 Option 2 – Unstructured approach to KM in Support

4.3.1 Support could monitor the work being conducted within Submarines in KM and have updates given to staff. This option would be slightly more expensive then doing nothing, as an employee would have to monitor and feedback KM initiatives to Support. The issues with this approach are listed below:

- The KM needs for the Support business are different to those of the Submarines business [Appendix 5].

- Therefore the wrong tools may be implemented into Support due to a lack of understanding into KM requirements.
• The KM initiatives in Submarines may be ignored due to lack of involvement and ownership of these initiatives.

Statistics showing the use of the tools implemented by Submarines and their success can be viewed within Appendix 4. This option is viable but would not contribute to successful KM within Support. It would not direct the employees towards a united knowledge-sharing environment that would cater specifically for their KM needs.

4.2 Option 3 - Create a KM strategy for Support

4.3.1 The current £20,000 investment is projected to continue in 2005 but Support will need to decide what level of investment it wishes to commit to KM from 2006. This is suggested to be a full time engineer or alternatively another PhD student.

This is the most costly option but it will offer Support the greatest benefit in KM, as their KM needs have proven to be different to those of the Submarines business [Appendix 5].

4.3.2 After analysing the Support benchmarking results, the proposed long-term KM programme is suggested as:

• Create a KM strategy that is shared across the whole business showing Support’s commitment to KM.

• KM techniques such as Structured knowledge audits, Lessons learnt reviews and Peer assist can be applied to Process Excellence projects as they roll out to assist in process definition and re-engineering.

• Perform knowledge capturing exercises for knowledge at high risk of leaving the company.

• Embed KM principals in the RRDS to drive a clear link for line managers between the Business/department objectives and the training, development and skill/knowledge sharing needs of their teams. This can then be reinforced through the existing PDR/Development cell process. By doing this we should achieve benefits within existing budgets (no cost) and focus the training budget more effectively.

• Business areas scoring higher in the benchmarking need to share their KM practices and techniques with others.

• Implementing infrastructure/tools similar to those used within the Submarines and Aero businesses will support the need to ‘Document knowledge’.

• The use of KM tools needs to be imbedded into the processes.

4.3.3 The advantages of this method include:

• The avoidance of costly mistakes.

• Unnecessary training will be reduced, as the training needs will be more specific and catered to the departmental goals.

• Time saved as it is estimated the engineers spend 25% of their time searching for information [Appendix 6], if Support even saved half this amount per employee the productivity would increase significantly.

• It is anticipated that the benefits significantly outweigh the cost of the engineer.

4.3.4 Other issues KM would help R-R overcome are shown in Appendix 2 and examples of cost savings are shown in Appendix 4.
4. Recommendations

5.1 In order to continually improve on our knowledge base in Support a KM strategy must be put in place. It is the recommendation of this report that option 3 is further developed as a possible solution to make KM work in Naval Marine Support for the following reasons:

- It will provide a united way forward for all Support staff.
- The business aims/objectives can be supported with the aid of KM tools.
- Support can concentrate on the areas of knowledge that are at high risk.
- The risk of repeating work will be minimised if KM is centrally organised.
- Support will be in-tune with the development of KM within the business.
- KM may offer a financial saving as shown Appendix 4.

5.2 Steps Forward – No extra funding

- Documenting knowledge will be dealt with by initially creating folders in Outlook. The folder structure will have write access to only those in the department. Read access will be given to everyone in support and possible contents includes ‘Lessons Learnt, Hints and Tips etc’
- A knowledge management ‘Tool box’ will be created to hold KM tools that have been identified to be applicable to the Support business including Lessons learnt review, Peer assist (Appendix 7 is a list of the possible tools) etc. All managers will be made aware of the tools and their capabilities and a central person will be available to offer advice.

6. Appendix

6.1 Appendix 1

6.1.1 A benchmarking exercise carried out across Naval Marine awarded the following percentages for KM activities in Support:
- Establishing a knowledge sharing environment = 25%
- Understanding of knowledge needs and assets = 50%
- Sharing experiences between people = 33%
- Documenting knowledge = 31%

Support attained the second to lowest score from eight different business areas in Naval Marine. Unless Support start to undertake KM initiatives they will fall further behind the rest of Naval Marine.

6.2 Appendix 2

6.2.1 Knowledge is not currently accessible to decision makers as shown in a recent customer survey highlighting the inefficiency to respond to customer issues. Customer comments include ‘Slow to respond, respond late/fail to, need to take responsibility, unsatisfactory response’. [Forbes-Hunter 2004 Pg 5]. This issue could be reduced with the use of KM as KPMG highlighted a 71% better decision-making rate and a 72% improvement in customer focus with a KM programme in place.

6.3 Appendix 3

6.3.1 A Benchmarking exercise was conducted across Naval Marine. Support on 39 people. The 11 managers results are displayed below:

Knowledge Management Benchmark for Support

<table>
<thead>
<tr>
<th>Tool</th>
<th>Establish a Knowledge Sharing Environment</th>
<th>Understanding of Knowledge Needs and Assets</th>
<th>Sharing Experience Between People</th>
<th>Documenting Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Result</td>
<td>70%</td>
<td>80%</td>
<td>90%</td>
<td>100%</td>
</tr>
</tbody>
</table>

[Bar chart showing results for different benchmarks]
6.4 Appendix 4

6.4.1 The Submarines business has implemented eight KM projects, including Knowledge Capture, Communities and Practice and Internal Authorities. Examples of the benefits Communities of Practice have brought to R-R are:
- Helping to leverage a price reduction for the X-ray film contact (16% reduction on 2001 levels was forecasted)
- Savings in distribution time equals 50 postings per month, saving each manager an hour. Including Team leaders & secretaries the overall saving is £2,120.00 per month
- Manufacturing labs and materials communities have estimated savings of
  - Total savings per month - £5,257.60
  - Total savings per year - £63,091.20

6.5 Appendix 5

6.5.1 Support could structure its KM strategy to follow the work done by Submarines but it may not be successful as a small study conducted between two teams in Naval Marine showed that their tacit knowledge needs were very different. Support believed they used more tacit knowledge then the Safety area and due to this it is believed that a catered strategy for Support would be more appropriate and successful.

6.6 Appendix 6

6.6.1 KM can help overcome the following problems highlighted within RR:
- The amount of time being spent searching for information as presently 25% of engineers time.
- 50% of information exchanged takes place between individuals. To ensure this knowledge is not lost it needs to be supported by tools such as the Communities of Practice.
- As 25% of searches are unsuccessful employees have to reinvent the wheel, wasting resources (time/money) and creating a risk as decisions may be based on incomplete data.

6.7 Appendix 7

A list of possible KM tools to use in Support.

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<td>A facilitated network of people sharing knowledge and expertise across organisational and geographical boundaries</td>
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<td>Quick direct and effective communication tool</td>
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<tr>
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<td>Used to share knowledge and information throughout the company</td>
</tr>
</tbody>
</table>

7. References


Forbes-Hunter, Wendy, 2004 ‘Highlights of a customer survey’

APPENDIX 25

BUSINESS CASE QUESTIONNAIRE
1. Did you find the business case useful?  
   [ ] Yes  [ ] No  [ ] Maybe

2. Did you find the business case easy to follow?  
   [ ] Yes  [ ] No  [ ] Maybe

3. Would you use this business case template within your own organisation?  
   [ ] Yes  [ ] No  [ ] Maybe

4. If the business case format was presented to your decision maker/s, do you believe it would lead to a positive decision?  
   [ ] Yes  [ ] No  [ ] Maybe

5. Do you think anything is missing from the business case?  
   [ ] Yes, please detail below  [ ] No  [ ] Not Sure

Thank you, Hardev Ubhi
Knowledge Management within Support

1 Aim
The aim of the report is to highlight the requirements and options available to Support in Knowledge Management.

2 Background
In the 1990s' companies recognised the benefit of Knowledge Management (KM) and adopted different tools and techniques. RR Aerospace introduced KM with the development of a Capability Intranet in 1996 and has since led the way in KM with a successful ongoing programme. The first business area in Naval Marine to conduct KM was the Submarines business in 2003. MoD funding secured the program for KM, allowing a dedicated team to offer benefits to both Government and Industry.

3 Requirements

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1</td>
<td>Support to lead the effective use of KM.</td>
</tr>
<tr>
<td>2</td>
<td>To have an innovative knowledge sharing environment.</td>
</tr>
<tr>
<td>3</td>
<td>Utilise knowledge both within Support and in the rest of the business to assist better decision-making.</td>
</tr>
<tr>
<td>4</td>
<td>To give Support a competitive advantage.</td>
</tr>
<tr>
<td>5</td>
<td>As a key part of an efficient business and process excellence.</td>
</tr>
</tbody>
</table>

4 Issues

<p>| | |</p>
<table>
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<tr>
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<tbody>
<tr>
<td>1</td>
<td>Knowledge is often lost or difficult to locate when people leave the company [Appendix 1].</td>
</tr>
<tr>
<td>2</td>
<td>Duplication of effort is a result of knowledge not being captured and accessible to those who require it.</td>
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<tr>
<td>3</td>
<td>Reinventing the wheel occurs when knowledge is not shared efficiently.</td>
</tr>
<tr>
<td>4</td>
<td>Not learning from previous lessons is costly. As Support is a newly developing business, it cannot afford to make avoidable mistakes e.g. quality issues [Appendix 2].</td>
</tr>
<tr>
<td>5</td>
<td>A high number of supporting tools and trained staff are not being utilised to their full capacity.</td>
</tr>
<tr>
<td>6</td>
<td>Potential benefits of key projects are not realised across R-R.</td>
</tr>
<tr>
<td>7</td>
<td>The process of making new starters efficient is currently taking too long.</td>
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5 Options considered

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1</td>
<td>Do nothing and allow the business to continue in their current form, losing knowledge.</td>
</tr>
<tr>
<td>2</td>
<td>Allow different areas within Support to adopt their own KM tools and techniques.</td>
</tr>
<tr>
<td>3</td>
<td>Create a KM strategy incorporating all of Support.</td>
</tr>
</tbody>
</table>

5.1 Option 1 – Do Nothing
Support could stop its current investment into KM via a PhD student. This is the cheapest solution saving Support £20,000 per year. This option is not preferred for the following reasons:

- A Structured Knowledge Audit conducted on the different sectors within the Services business (November 2003) found that 10 key areas were at high risk of losing knowledge if it was not captured.
- A KM benchmarking exercise carried out across Naval Marine [Appendix 3] found that Support, had the second to lowest score. By doing nothing Support will continue to fall behind rest of Naval Marine.
- Support has an objective to ‘improve customer satisfaction’ (taken from the State of the nation presentation). This will not be achievable in Support’s current state as Appendix 4 shows the negative comments made by a number of customers. KM could help provide the decision-makers with the knowledge required to resolve customer queries effectively.
- A benchmarking study conducted across Support [Appendix 5] found that the weakest area of KM was ‘Documenting Knowledge’. The managers rated the efficiency of the teams to be between 5-12%. If knowledge is not being documented then issues such as reinventing the wheel, incomplete data equalling ineffective decisions and time being wasted searching for information become apparent.

5.2 Option 2 – Unstructured approach to KM in Support
Support could monitor the KM activities being conducted within the Submarines business and have updates briefed to its staff. This option would be slightly more expensive then doing nothing, as an employee would have to conduct the feedback. The issues with this approach are listed below:

- KM needs for the Support business are different to those of the Submarines business [Appendix 6].
- The wrong tools may be implemented into Support due to a lack of understanding into the employee’s knowledge needs.
• The KM initiatives from the Submarines business may be ignored by the Support business due to a lack of involvement and ownership.

The KM tools available across the business can be viewed within Appendix 7 and some cost savings can be seen within Appendix 8. This option is viable but would not equal successful KM within Support. It would not direct the employees towards a unified knowledge-sharing environment that would be catered specifically to their needs.

5.3 Option 3 - Create a KM strategy for Support

The current £20,000 investment is projected to continue in 2005 but Support needs to decide what level of investment it wishes to commit to KM from 2006. It is suggested that Support employ a fulltime engineer or alternatively another PhD student.

This is the most costly option offering Support the greatest benefit in KM. Supports KM needs have proven to be different to those of the Submarines business [Appendix 6]. After analysing the Support benchmarking results, the proposed long-term KM programme is suggested as:

• Create a KM strategy that is shared across the whole business showing Support's commitment to KM.
• KM techniques such as Structured knowledge audits, Lessons learnt reviews and Peer assist can be applied to Process Excellence projects as they roll out to assist in process definition and re-engineering.
• Perform knowledge capturing exercises for knowledge at high risk of leaving the company.
• Embed KM principals into the RRDS to drive a clear link for line managers between the Business/department objectives and the training, development and skill/knowledge sharing needs of their teams. This can then be enforced through the existing PDR/Development cell process. By doing this Support should achieve benefits within existing budgets (no cost) and focus the training budget more effectively.
• Business areas scoring higher in the benchmarking exercise need to share their KM practices and techniques with others.
• Implementing infrastructure/tools similar to those used within the Submarines and Aerospace businesses will support the need to 'Document knowledge'.
• The use of KM tools needs to be imbedded into the current processes.
• Encourage a knowledge-sharing environment when creating and using existing knowledge.

• Managers need to have a structured process that they can work to ensuring that all employees are made efficient at the earliest stage of recruitment/deployment.

The advantages of this method include:

• The avoidance of costly mistakes.
• Unnecessary training will be reduced, as the training needs will be specifically catered to the departmental goals.
• Efficient access to knowledge and information should reduce the current search time. This will equal a better service level to the customer and increase the level of contracts [Appendix 9].
• It is anticipated that the benefits significantly outweigh the cost of an engineer/student.

Other issues KM would help R-R overcome are shown in Appendix 9 and examples of cost savings are shown in Appendix 8.

6 Recommendations

In order to continually improve on our knowledge base in Support a KM strategy must be put in place. It is the recommendation of this report that option 3 is further developed as a possible solution to make KM work in Naval Support for the following reasons:

• It will provide a united way forward for all Support staff.
• The business aims/objectives can be supported with the aid of KM tools.
• Support can concentrate on the areas of knowledge that are at high risk.
• The risk of repeating work will be minimised if KM is centrally organised.
• Support will be in-tune with the development of KM within the business.
• KM may offer a financial saving [Appendix 8].
• The cost will be minimal as the tools and capabilities are all available corporately.
• The workforce will be more efficient

Steps Forward – No extra funding

• Documenting knowledge will be dealt with by initially creating folders in Outlook. The folder structure will have write access to only those in the
department. Read access will be given to everyone in support and possible contents includes 'Lessons Learnt, Hints and Tips etc'.

- A knowledge management 'Tool box' will be created to hold KM tools that have been identified to be applicable to the Support business including Lessons learnt review, Peer assist etc (Appendix 7 is a list of the possible tools). All managers will be made aware of the tools and their capabilities and a central person will be available to offer advice.

7. Appendix

Appendix 1

From the 1st January 2003 to 27th September 2005 it was recorded that 27 people left the Support business to either retire, work elsewhere or due to illness. Those who left the company took their knowledge and experience with them. There was no formal knowledge capture or a comprehensive handover period with a new person for that role.

Appendix 2

Analysis into quality failures found that the five most frequent were:
- Use of incorrect data
- Internal communication
- Inadequate checking
- Communication with customers
- R-R specifications.

These issues can all be overcome if the knowledge that is required is available and a knowledge sharing community was promoted.

Appendix 3

A benchmarking exercise carried out across Naval Marine awarded the following percentages for KM activities in Support:
- Establishing a knowledge sharing environment = 25%
- Understanding of knowledge needs and assets = 50%
- Sharing experiences between people = 33%
- Documenting knowledge = 31%

Support attained the second to lowest score from eight different business areas in Naval Marine. Unless Support start to undertake KM initiatives they will fall further behind the rest of Naval Marine.

Appendix 4

Knowledge is not currently accessible to decision makers as shown in a recent customer survey highlighting the inefficiency to respond to customer issues. Customer comments include 'Slow to respond, respond late/fail to, need to take responsibility, unsatisfactory response'. [Forbes-Hunter 2004 Pg 5]. This issue could be reduced with the use of KM as KPMG highlighted a 71% better decision-making rate and a 72% improvement in customer focus, with a KM programme in place.
Appendix 5

A Benchmarking exercise was conducted across Naval Marine Support on 39 people. The 11 managers results are displayed below:

![Knowledge Management Benchmark for Support](image)

You can see that the weakest area for knowledge management is documenting knowledge.

Appendix 6

Support could structure its KM strategy to follow the work done by Submarines but it may not be successful as a small study conducted between two teams in Naval Marine showed that their tacit knowledge needs were very different. Support believed they used more tacit knowledge then the Safety area and due to this it is believed that a catered strategy for Support would be more appropriate and successful.

Appendix 7

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Appendix 8

The Submarines business has implemented eight KM projects, including Knowledge Capture, Communities and Practice and Internal Authorities.

Examples of the benefits Communities of Practice have brought to R-R are:

- Helping to leverage a price reduction for the X-ray film contact (16% reduction on 2001 levels was forecasted)
APPENDIX 27

OPTIONS AVAILABLE TO THE SUPPORT BUSINESS DETAILED WITHIN THEIR KM STRATEGY
5. RECOMMENDATIONS

The Support business clearly needs KM to assist in growing and strengthening the current business. Therefore a proposed 10-step framework is presented below which should aid KM implementation. These steps are based on the lessons learned from the research and benchmarking described in the previous sections.

(It may be helpful, in the following 10 steps, to say on which bit of research each step is based - you have done this in some cases already)

1. Gain senior buy in and support
The importance of senior buy-in and support is paramount. As with any new project undertaken by an organisation, the push from the top shows both the importance of the project and the business commitment to its success.

2. Defining a KM strategy
The creation of a KM strategy has to be undertaken with the commitment to the strategy being agreed by all senior managers. The Aero business has devised a KM strategy that could be tailored to the Support business. The strategy will also have to be in line with the current objectives at both a business and organisational level.

The strategy should be concise and include the following:
- The KM vision
- Project stakeholders
- Resources available/required
- The detailed plan for implementing KM
- Documentation of the measurements techniques

3. Secure funding
KM, like any other project, needs funding to provide resource to support the project. People are required to manage the project and to act as KM representatives across the business. By having funding available to those who require it, the business commitment is shown and people will be more willing to participate if they have a contract number to book to.

4. Identify Knowledge Management Representatives
Each of the Support business areas needs to nominate a representative (Similar to the Business improvement and Documentum reps in Submarines) who will be the main contact point for KM issues and queries. Each individual needs to be a person who is enthusiastic, an excellent communicator and keen to improve the business. They will have to be well informed and support the KM strategy with a good understanding of the tools and techniques available. Regular meetings with teams within there area should be held to review if opportunities for capturing, reusing or disseminating knowledge have been utilised.

5. Establish knowledge needs
From the study carried out in the Support business it was shown that the TCP team rated tacit knowledge with slightly more importance. This is probably due to the business being fairly new and the culture having to adapt to a fast paced business. If the KM budget is restricted and will only allow for the implementation of a limited number of tools then the focus will have to be placed on KM tools that will aid the use of tacit knowledge.

6. Carry out benchmarking and establish a Balance Scorecard
Benchmarking gives a more detailed examination of the current state of KM within a selected area. The results give an insight into how the available KM tools are currently being used within the company. It is suggested that the Support business learns from the results of the benchmarking exercise by trying to aid the current level of tacit activity and by starting to document the knowledge that could be useful to others.

Many companies have used the Balance Scorecard approach for KM. Possible measurements could include; the number of times KM tools have been used, lessons that have been used, innovative approaches explored, etc.
7. Select the required tools
As all of the KM tools are available within the company, it is only the human resource cost that is required to support and guide the tools into use. It is therefore suggested that if the Support business has enough funding to support the manpower required, it should implement the tacit tools first, closely followed by the explicit tools, with the tools being implemented/promoted in order of usefulness:

1. Telephone conferencing
2. Lessons Learnt Reviews
3. Communities of Practice
4. People Pages
5. Peer assist
6. Story Telling
7. Capability Intranet
8. Company Intranet
9. Email
10. Lessons Learnt Logs
11. Hazard Identification Prompt Lists
12. Structured Knowledge Audits
13. TRIZ
14. Knowledge Acquisition Modelling Process
15. Benchmarking
16. Design Rational Editor (DRED)

Some of the tools, such as telephone conferencing, intranet and email would not need to be promoted as they are already well known throughout the company. However, it would be productive to remind people of the cost savings and advantages of using these tools across the business.

A proposed implementation technique is offered within section 3.6, based on lessons learnt from the Aerospace business and their implementation methods deployed. The key to any change within an organisation is to uphold high levels of communication with all those involved.

8. Build KM into the process
An example of how the Aerospace business has built KM into its processes is to use the Lessons Learnt tool where the lessons are reviewed and used to update the current processes so that the same mistakes are not made again. As the KM investment within the Support business is small it will have to select easy ways of building KM into the current processes. Three areas initially selected are:

- Entrance and exit processes
- PDR
- Processes excellence as an implementation route

The benchmarking highlighted areas that people found insufficient including the “Entrance and Exit processes” where people expressed their concern about joining a team and finding no official process to tell them the basics of how things are done. By working with HR the Support business could create a process that all managers and HR staff follow when they have a new starter. This should make the new starter more productive at an earlier stage (a request from the previous director of Support – Bill Simmons), gain their buy in for KM tools and techniques, and introduce them to a sharing culture.

The exit interviews are also very important as a considerable amount of knowledge can be lost when people leave the business and it is very important that this knowledge is retained. The Support business has highlighted people that are at risk of leaving the company in the near future so future planning needs to be in place for the use of a structure knowledge audit.

KM principals need to be embedded into the Rolls-Royce development system to drive a clear link for line managers between the business/department objectives and the training, development and skill/knowledge sharing needs of their teams. This can then be re-enforced through the existing PDR/Development cell process. By doing this, Support should achieve benefits within existing budgets (no cost) and focus the training budget more effectively.
Process Excellence has been rolled out across the whole business and KM techniques such as structured knowledge audits, lessons learnt reviews and peer assist can be applied to Process Excellence projects to assist in process definition and re-engineering.

9. Monitor and evaluate
The benchmarking technique is an excellent way to assess the progression of a KM project. As it has already been carried out within the Support business the base line has been set. It will only need to be done with a frequency of 1 or 2 yearly intervals to determine in which areas that techniques/tools have been successful.

Another method used by the Aerospace team is to analyse the use of each KM tool by counting the number of hits. The use of the tools and techniques within the business should be monitored and any benefits collated so that the KM investment can be justified.

10. Reduce the KM team
The main funding into KM can eventually be taken away with just enough money left to support the KM representatives that are working as champions across the different business areas. The employees should now be fully aware of KM and the tools and techniques available to them and any new tools should be filtered from the Marine business to the KM representatives. New starters will be informed about KM and the use of it within the business as part of their induction processes given to them by their manager. A high-level champion (director) will still be required within the business to continually highlight the importance of KM and to act as a point of contact for the Representatives.
APPENDIX 28

MARTIN GOWDRIDGE'S EMAIL
From: Gowridge, Martin W
Sent: 14 October 2005 08:57
To: Ubhi, Hardev K (NNPPI)
Subject: RE: unclassified

Hi Hardev,

Your presentation made more of an impression than you thought. It has prompted a detailed discussion on the way forward, which we haven't been able to achieve before. Duncan now sees that it is more than just Engineering, but it difficult to see who would be the Marine Executive Champion and who would be responsible for its development.

I'm keeping the subject as one of his priorities, but he has to get firm support from others in the Executive to make it work. As you are aware, it is one of those subjects that everyone accepts is essential, but nobody sees the need to do anything special to make it happen.

Don't despair, keep hacking away.

Regards

Martin

Martin Gowridge
Head of CCS Improvement - Marine

Cell Code: RAY-ECC
Internal: 57532 External: +44 (0)1332-637532 Mobile: +44 (07791) 923007 Fax: +44 (0)1332-7644 (Int 57644)
Email: martin.gowridge@rolls-royce.com
• Savings in distribution time equals 50 postings per month, saving each manager an hour. Including Team leaders & secretaries the overall saving is £2,120.00 per month
• Manufacturing labs and materials communities have estimated savings of
• Total savings per month - £5,257.60
  Total savings per year - £63,091.20

Appendix 9

KM can help overcome the following problems and this should lead to an increase in customer contracts:

• The amount of time being spent searching for information as presently 25% of engineers time.

• 50% of information exchanged takes place between individuals. To ensure this knowledge is not lost it needs to be supported by tools such as the Communities of Practice.

• As 25% of searches are unsuccessful employees have to reinvent the wheel, wasting resources (time/money) and creating a risk as decisions may be based on incomplete data.

8 References


KPMG, 1999 'Knowledge management research report 1999' KPMG Consulting.