UNIVERSITY OF STRATHCLYDE

DEPARTMENT OF DESIGN, MANUFACTURE AND
ENGINEERING MANAGEMENT

THE APPLICATION OF GROUPWARE IN THE MANUFACTURING INDUSTRY

SEAN KEMP

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ABSTRACT

Groupware was developed to address the limitations of existing Information Technologies in facilitating an increased level of collaboration in todays' customer focused industries. These systems are a hybrid between a database, to organise and store previously unstructured knowledge, and an e-mail system, to disseminate this knowledge across entire organisations.

Lotus Notes has become the recognised industry standard for a Groupware system, providing an application development platform on which can be built a company's knowledge infrastructure, and the research concentrates on this system.

Groupware systems are not designed to replace existing technologies, rather supplement them by capturing the information outwith the structure that they impose, and there are many applications where the implementation of a Lotus Notes application is not feasible. A review of the literature revealed that there is a limited amount of guidance on what constitutes a suitable candidate for implementation.

- From an analysis of the functionality of the system, the research develops a detailed reference model of the ideal Lotus Notes application, in order to provide a method of rapidly assessing the suitability of a potential application to the implementation of Groupware.

- Three case studies are presented, utilising the reference model to identify suitable candidates and following the implementation of these through to a point where the results can be assessed, providing a level of validation for the developed model.

- The case studies provide the opportunity to highlight methods of overcoming the potential barriers to success, revealed by an audit against the reference model. This experience is collected together as design guidelines, cross-referenced against the reference model.

The overall result being the production of a series of tools, and a methodology for their use, intended to facilitate the implementation of successful Groupware applications, maximising the benefit that an organisation can achieve from its investment in new technology.

DECLARATION OF AUTHOR'S RIGHTS

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CHAPTER 1

INTRODUCTION

1.0 INTRODUCTION

In order to maintain a competitive advantage in the marketplace, industry is having to shift its emphasis to concentrate more on the quality of service which it provides for its customers and re-engineer its processes to efficiently and effectively satisfy the customer's requirements. This involves the introduction of new products and designs, but an increasingly important factor is the speed and accuracy with which orders are fulfilled. To provide this improved level of service requires a comprehensive information strategy, making use of recent developments in systems and thereby ensuring that everyone is aware of the standards in performance which they are attempting to meet. Faced with the ever increasing demands for relevant, up-to-date information and virtually real-time information exchange, the traditional information system technologies are no longer adequate, but in recent years, developments in this area are addressing this vital issue.

1.1 Communications : Issues and Requirements

- Standard communication software limits the number of people involved in a project through its point-to-point messaging architecture. General messages become lost within the contents of a bulletin board.
- These communication systems concentrate on the transfer of information not the content, any organisation of the data must be performed by both parties outside of the system.
- Database Management Systems are limited in the amount of data sharing that can be accomplished, either through the way in which the data is presented (to suit one particular function) or in the complexity of dispersing the information throughout the organisation.
- The structure imposed on the data by the Database system limits the flexibility of the information that can be stored.

- A Hybrid system to meet the requirements of today's business processes needs to be able to store a varied selection of data in a structured manner which can be disseminated to as many members of an organisation as are required, as quickly as possible.

Existing electronic communication technology allows widely dispersed users to share information and knowledge and so reach decisions without the need for a physical meeting between the two parties. The information can be shared between several members, simply by addressing the messages to the appropriate people or by making it generally available to all on a bulletin board. However, these systems impose limitations on the level of information availability within the organisation as the communication is unidirectional, i.e. data is sent to a specified group of people, no-one can pull the data from the system, not even the intended recipients. This leads to the situation where work is performed on projects which has possibly been carried out before in another part of the organisation, but the use of this type of communication has meant that only those directly involved in the project are aware of the issues which arose from it, and only then if they have been specifically informed about it.

The communication system itself is concerned with the transfer of the information and is not interested in the data contained, therefore there is no structure to the data, other than that imposed by the personnel at either end of the communication link. The recipients of information must then read everything to extract the data relevant to their needs, and then reconfigure it before storing it in their own personal filing system. If this information is contained in bulletin boards for general release then their system is clogged with much unnecessary information resulting in wastage of valuable time.

The retention of knowledge and the increased availability of it, can be achieved by using a conventional database, storing the data in a structured format and allowing anyone with access to search for the information they want. The introduction of a large general database, containing the data generated by all the functions of a business can cause its own problems, due to diverse nature of the information itself, so much so that functions often develop their own databases which store information in the way that they want to see it. This obviously limits its availability, as even if others could access it, they may be unable to do anything with it because of the way in which it is presented. The performance of a centrally stored database would be affected by the number of people accessing it at any one time, and the rigidity of a database prevents two users accessing the same record simultaneously, which may actually slow down the process of gaining information.

The structured design of a database is used to ensure that records can be accessed and linked as smoothly as possible, unfortunately this often means that flexibility is sacrificed, and the information within each record must be stored in a rigidly defined way. Any information entered into the database must then be manually translated by those having editing rights, unnecessarily lengthening the storage process, and probably resulting in the abandonment or under-utilisation of the system.

In order to promote the level of information availability and communication necessary to achieve the desired level of performance, a system is needed which combines the best functions of the flexible but unstructured electronic mail type systems with the structure and formality of database systems. This type of integrated system would provide enough flexibility to allow everyone to place their data on the system, in whatever format they like, whilst storing it in a structured way, so that any user reading the information can find it, and any related information, very easily. The level of communication within this hybrid system must allow for the rapid and widespread dissemination of data, so that information is propagated throughout the organisation almost immediately. Although this type of system seems to be one of those 'theoretical ideals', an emerging class of software, called "GROUPWARE" is able to provide all these facilities and more.

1.2 Groupware and Multimedia : The Future

Essentially a Groupware system consists of three critical elements, these are :-

- The database which forms the nucleus of the system.
- The communications / messaging facility which provides the flexible free-format communications network between the users.
- The viewing / masking facility which allows each user to define data which is important to them consequently masking all other information which is considered to be irrelevant.

In database terms the function that distinguishes a Groupware system from conventional databases is that of replication. A copy of the entire database can be stored in several locations, on a server, and the users at each location can access their particular server, creating and editing documents as necessary. What replication does is, at regular intervals, reconcile all these unique databases into identical copies of each other, transferring all the files created or updated since the previous replication, from each separate database into every other copy. This feature means that geographically dispersed sites can be kept in synchronisation with each other, and the fact that each server is only accessed by local users means that the performance of the database will not be adversely affected even though every user is effectively accessing the same database.

The free format messaging facility, for all intents and purposes is similar to the electronic mail systems commonly used today, the key difference being that this messaging system is integrated within the Groupware system. This means that communications may take place through the electronic medium and the person, authorised to make changes to the relevant fields, is then required to review the information and make an amendment where necessary. Similarly, as soon as a certain entry in the database is changed, the interested parties are automatically informed of the change through the messaging facility, as soon as the document is saved, thus improving the efficiency and effectiveness of corporate communications.

The widespread sharing of information using bulletin boards, whilst a very attractive function, can lead to wasted time, searching for relevant information, and cause problems in maintaining the security of the data. Groupware systems can overcome this problem by giving the users access to information that directly affects them. This is achieved because Groupware systems store information as documents, using appropriate blank forms created by the application developer. Access to the information contained in these documents is obtained by opening them from a view. The views, which can be easily configured by the user, are typically used to display various documents in the format that the user wishes to see them. The documents to be included in a particular view can be specified so that unwanted data is not included, useful where many documents exist in one database as the view is recreated and indexed, each time that it is opened.

Because the views are comprised of data fields from the documents, one document can be used to store a lot of information which is then subdivided into meaningful portions for the view, so that users accessing the same document can gain information relevant to their needs. Furthermore to enhance the security of such systems, this masking feature can be extended into the document itself by separating the information into sections which can then be selectively made available based on who has accessed the document, and whether they are reading or editing.

The most versatile field type is a 'Rich text' field, which allows for the incorporation of many different data types into documents. Indeed, the blank form is simply a large rich text file, to which the necessary static text and fields are added. The fact that the form is a rich text field means that other objects can be embedded into it, to provide such facilities as the running of macros or the use of hypertext features, creating linkages between documents.

The versatility of the embedding and linking features within the system allows for the use of some of the more sophisticated multimedia technologies, allowing an almost limitless array of applications to be developed, containing conventional database information as well as audio and visual (still photos, video clips, drawings, sketches, etc.) information, within an integrated framework.

1.3 Formulation of the Research Hypotheses

The author's initial introduction to Groupware originated from experience gained whilst involved in the Teaching Company Scheme with J&B Scotland and the University of Strathclyde.

Having been presented with a defined business problem, the need to record Mandatory Labelling Requirements in a global system, the author was required to make a selection of the most appropriate solution.

A Groupware system, Lotus Notes, had been recently introduced into several divisions of the parent company Grand Metropolitan, and was just beginning to emerge as a potentially useful tool within the drinks division, International Distillers and Vintners.

Very little was known about this system, but further investigation revealed that it might be one of the best solutions available as it offered a simple means of making the information globally available through 'replication'. However, beyond that, the suitability of Groupware was not easily determined.

The investigation process did not reveal any clearly defined criteria for a suitable application for development in Lotus Notes. Many authors had presented a list of general rules that could be used to make a simple decision as to whether the system represented a potential solution or not, but the author found no reference to any means of quantifying the level of 'fit' that a specific application had to the system.

What the available literature did indicate was that there are no extremes in determining the suitability of Groupware as a solution, there was no one defined 'ideal'. With this being the case, the conclusion is that there will be methods which could be employed to address the likely problem areas in an application and thereby increase the chance of successful implementation, but with no means of assessing where these problem areas arise it is difficult to determine exactly what methods should be used or how they could be applied in a specific case.

The eventual decision to implement a Lotus Notes system in this case was based on the author's interpretation of the available literature into a basic set of criteria for a suitable application. At this point, no design work had yet been undertaken, and many mistakes were made in the initial stages of the project (Chapter 6), mainly due to the fact that the author was concentrating on the mechanics of design. Obviously with more design experience, many of these mistakes would not have been made, but they could also have been avoided to some extent had the author had a better appreciation of the areas of the application that would cause the most problems due to their slight deviation from the ideal Lotus Notes functionality, and how they could be addressed in the planning stages of the development.

1.4 The Research Hypotheses

Through attempting to determine Groupware suitability to a business problem and experiencing difficulty in the early stages of design it is thought that :

1. A Reference Model is required to determine the suitability of Groupware to address the needs of a defined business problem.
2. A set of Design Guidelines are required to assist developers of Groupware systems with the planning, design and implementation of a particular application.

Expanding on the ideas presented in the literature review at this stage it is thought that :

3. A generic Reference Model to determine the suitability of Groupware to address a business problem can be developed.
4. Generic Design Guidelines to assist in the planning, design and implementation of a Groupware system can be developed.

5. A methodology can be written for the application of any developed Reference Model and Design Guidelines to ensure accuracy and confidence in the results obtained.

1.5 Structure of the Report

Chapter 2 : Review of Research Methods

This chapter aims to develop a research plan, from existing management research methods, which will allow the proposed research hypotheses to be investigated with the appropriate rigour.

The chapter first looks at the existing research methods and then formulates some generic conclusions on the application of current thinking to individual projects, before relating these conclusions to the specific research area of the Development of Tools for use in Groupware Implementation and outlining a clear plan for the successful completion of the research.

The chapter concludes by specifying how the developed research plan addresses the issues of validating and supporting the research hypotheses.

Chapter 3 : Background : Evolution of Groupware

This chapter examines the rise of Groupware as an essential part of any company's systems philosophy, through the inadequacy of existing technology to fully integrate the various aspects of a business by retaining corporate knowledge with only a few select individuals. The text explains, by looking at the facilities of the leading Groupware development platform, Lotus Notes, how such a system can promote sharing and dissemination of this corporate knowledge to a much wider audience, integrating previously autonomous functions and ensuring that all employees are aware of the issues and barriers to achieving maximum productivity.

The chapter also warns of the potential pitfalls in the implementation of such a system, which mainly arise from the fact that Groupware attempts to change the way that groups interact, and states that more than any other system solution, Groupware must fit the existing practice and not attempt to dictate what that practice should be.

The chapter concludes by outlining the main aims of the research, which are to ensure that a Groupware solution is achieved as effectively as possible, and only where it will provide the desired level of improvement, and hence validate the research hypotheses.

Chapter 4 : Review of Lotus Notes Functionality and Application

In chapter 3, the author attempted to outline the evolutionary path of the emerging Groupware technologies, highlighting the basic functionality of the available systems and thereby trying to define the generic role which they are intended to perform in the workplace. This role being not to replace any of the existing software tools which have become commonplace, but to integrate them in a way which leverages improvements in group productivity rather than in individuals working in the partial isolation imposed by the PC environment.

No attempt was made at that point to try and prescribe the applications that should be transferred onto a Groupware platform, the reason being that the list of potential applications is almost limitless and will depend on an equally large number of dynamic factors specific to each individual company. Almost all of the literature relating to Lotus Notes contains some reference to the broad categories of applications which lend themselves to Groupware implementation, and contains a brief warning on those categories of applications which should be avoided.

Having examined the areas of a business to which Groupware applications are best suited, it is pertinent at this stage to investigate the validity of the conclusions drawn by looking at the implementation of Groupware in the 'real world'.

A report by the International Data Corporation [1994] looked at the implementation of Lotus Notes in more than 65 companies throughout the world, reporting primarily on the success of the applications in each case through financial return on investment. The findings of this report are summarised by the author, and related to the findings from the literature review, to give a broad indication of the 'ideal' Notes application.

The report only details the results of the financial analysis and does not look at the details that led to either success of failure in each case. To try and establish some criteria for success, four brief application studies are presented (Lloyd and Whitehead [1996]); looking at very different applications, which leads to a better understanding of the issues involved.

Chapter 5 : Reference Model : When to Implement Groupware

Chapter 4 concluded that the existing references for the ideal Notes application were not presented in sufficient detail to allow the developer to determine the feasibility of a potential application with anything but the most basic level of confidence.

One of the hypotheses presented in this research leads onto the statement that to allow for this more rigorous analysis, the developed reference model must contain a greater level of detail and be presented in such a way that a potential application can be audited against the model, thereby increasing the level of confidence in the results. If the analyst is presented with a graphical representation of their application which highlights the degree of fit with the tool they are intending to use, then a decision is more easily reached and more strongly supported.

The reference model will be developed by expanding on the ideas presented in chapter 4 and relating this discussion back to the functionality of the software outlined in chapter 3, maintaining the basic idea of trying to define quantifiable measures in each case to facilitate the auditing of an application against the model.

Chapters 6, 7 & 8 : Case Studies

The area of research presented in this thesis is a direct result of introducing three Groupware applications into one organisation using release 3 of Lotus Notes. The size and complexity of the organisation is such that the design issues involved in each case were very diverse, so allowing a better assessment of the validity of the reference model and for more generic design guidelines to be developed.

Chapter 9: Guidelines for the Design of Notes Applications

Designing a Notes application is very similar to designing any software application that supports a business process, providing that the development team can get their minds around the fundamental differences between Notes and other software tools. With this being the case there is very little difference in the techniques which should be used, and many notable authors have published prolific works dealing with a variety of structured techniques for systems design. By the same token, the actual mechanics of design, in terms of the fields, forms and views which make up a Notes database have been the subject of many books and developer guides. It is therefore redundant in this text to repeat any of this information.

Whilst involved in the design of the case study applications, issues arose within the design process which were noted as having an effect on the potential success or failure of the application. This chapter examines these issues in greater detail than many of the published works, maintaining a close relationship with the developed reference model from chapter 5. The hypothesis being that after the reference model has classified the application using the defined measures, a better understanding of the design issues which relate to the particular characteristics of the reference model will hopefully focus the developer on the correct path towards a suitable design.

Chapter 10 : Discussion : Review of Work Done

In this research, the author has attempted to develop a Reference Model for an ideal Groupware application and supplement this with Design Guidelines to ensure that the selected application has the best chance of producing the desired return.

In order to gain the maximum benefit from the use of the developed models and produce a level of confidence in the results obtained, this chapter first defines a methodology, taken from the case study experience, which should be used when assessing the suitability of a process to Groupware implementation via the Reference Model and Design Guidelines presented.

Groupware is a vast topic and the limited experience of one developer will never raise some of the more involved issues of implementation or design. However, by utilising a suitable research plan the author has identified many of the generic issues which need to be considered in every attempt to implement Groupware, and used these in the development of the Reference Model and Design Guidelines which should ensure that an application is both suited to Groupware and that the finalised design will provide the maximum benefit in the given situation.

CHAPTER 2

REVIEW OF RESEARCH METHODS

2.0 REVIEW OF RESEARCH METHODS

2.1 Introduction

This chapter aims to develop a research plan, from existing management research methods, which will allow the proposed research hypotheses to be investigated with the appropriate rigour.

The chapter first looks at the existing research methods and then formulates some generic conclusions on the application of current thinking to individual projects, before relating these conclusions to the specific research area of the Development of Tools for use in Groupware Implementation and outlining a clear plan for the successful completion of the research.

The chapter concludes by specifying how the developed research plan addresses the issues of validating and supporting the research hypotheses.

2.2 A Review of Management Research Methods

The role of management within any business is to make that business operate in a way which will generate the desired level of profitability for its shareholders. In order to do this the processes and systems which are employed need to be carefully considered, before and after they are implemented, to ensure that they provide a valuable contribution to the ultimate goal, in an efficient and acceptable manner. Hence the role of management research derives from this need of businesses, i.e. someone needs to take the time and effort to determine what is the best solution in any given situation, and having done that ensure that the processes used remain the best solution for the particular business in the long term.

Researchers into this field propose two different viewpoints from which the investigations can be carried out. The traditional method of carrying out research, reported by Gay and Diehl [1992], is to carry out 'Quantitative' analysis, gathering objective data from large samples to give the results rigour and generate generic conclusions, which are purportedly impossible with any other method. The alternative method, which has emerged from the studies into sociology and the like, takes a 'Qualitative' approach, Gummesson [1991], looking at a much smaller sample of data in a less statistically biased way to generate more practical and realistic results. Easterby-Smith et al. [1991] provide a discussion of both methods, looking at the pros and cons of each, and the applicability of either one to the variety of different research 'types' which they identify. It is this work which is considered and related to the specific area of this research, in order to develop a research plan which will hopefully yield rigorous and realistic conclusions.

2.2.1 Research Types

Three types of research are identified, although the first of these, 'Pure' research can be further split into three subsections. The main differences between each identified type is in the outcomes which are assumed to emerge, and this is summarised in table 2.1 below.

As well as presenting these basic research types, the literature also then goes on to say that the distinctions are never as clear as we would like them to be, and consequently do not always hold in practice. Indeed, in terms of the research presented here, the classification seems to be a clear indication of the 'Applied Research' type as the author is looking at the application of a new technology to solve an identified set of problems encountered in most businesses.

However, if the research is to prove useful and contribute something to the existing literature on the subject then it must also look at that new technology in terms of its applicability in different circumstances, solving a variety of problems and being accepted into a variety of different company cultures. Does this then suggest that it has some founding in the reflection aspect of 'Pure' research.

Also, the research is actually being carried out on the back of a project to change the way in which one particular business operates, meaning that it falls into the realm of 'Action' research, the results from this aspect being a partial indicator of the findings and the conclusions drawn from these.

Research Classification		Principle	Assumed Outcomes
Pure	*Discovery*	Revolutionise the thinking on the topic under research through the theoretical development of ideas from empirical research.	Totally new idea or explanation of existing ideas.
	Invention	Evolves from direct experience of inventor in the area of the research. Deals with a general problem.	New technique, method or idea to deal with a particular problem.
	Reflection	Existing theory, technique or group of ideas is re-examined in a different organisational or social context.	Revision or modification of a theory or development of ideas about cultural differences.
Applied		Evaluation of the process and results of particular courses of action, i.e. reorganisation of a department, introduction of new technology, etc.	Solution of a specific problem.
Action		Research should lead to change, and therefore that change should be incorporated into the research process.	Learn from the actual research process and most emphasis on determining 'What happens next'.

Table 2.1 Basic principles and assumed outcomes of the various types of research.

This inability to unequivocally define the type of research being performed does not affect the outcomes which will emerge, only the way in which they are related at the end of the research term, and it is the research method adopted which guides the findings in any one particular direction.

2.2.2 Two Approaches to Management Research

The two approaches to management research are seen by many experts in the field to be two diametrically opposite principles, however it is almost impossible for a researcher to limit their methods to those taken from only one of these schools of thought. In practice, even the most committed champion of one particular viewpoint will adopt a more practical approach and utilise methods from both sides in order to ensure that their findings are as realistic as possible.

Looking at the two approaches individually, the more traditional of the two is that of positivism, where the researchers deliberately isolate themselves from the subject which they are studying in order that they may be as objective as possible in their findings. The external 'world' which is thus created, is first split into its simplest elements before a fundamental law is applied to each one and tested using observable facts about that element. The resultant findings are then re-enforced by repeating the observation for a large sample of similar subjects, thus allowing for statistical validation of the reported data. The methods used in the collection and analysis of the data are often referred to as 'Quantitative' because, wherever possible, quantifiable measures are established. The conclusions arising from this type of research are thus non-specific to any one situation and, provided that the researcher has been thorough in obtaining the observed sample, are equally applicable in any situation of a similar nature.

If, on the other hand, a researcher was to subscribe to the phenomenological way of thinking then they would view the world, not from an external and objective viewpoint, but from the position that 'reality' is the result of social interaction between people and should therefore be viewed subjectively, taking into account the immediate factors affecting the given situation. Because the research needs to be subjective and consider 'the big picture', a new set of techniques are required, and these are given the name 'Qualitative' methods as they concentrate on what is meant by the results instead of the actual results themselves. Many of these techniques require the researcher to place themselves within the subject under study, and devote a lot of time an effort into the gathering and interpretation of information, therefore the use of large samples, which provide the positivist researcher with statistical validation of their findings, is not possible and the researcher must content themselves with the knowledge that they have acquired a greater knowledge into a specific situation and are probably better able to explain those spurious results that were obscured by the positivist researcher amid mounds of statistical data.

Obviously each standpoint has its benefits and limitations, which tend to be complimentary, and these are summarised in table 2.2 below.

Approach	Benefits	Limitations
Positivism	• Provided that quantifiable measures can be set up easily, a wide range of situations can be examined. • The gathering of objective data is fast and economical. • The use of statistics gives managers more confidence in making decisions based on the results	• The applicability of the results is hampered by the necessity to set up quantifiable measures in every situation. • Examining only the simplest elements of any situation leads to ignorance of 'the big picture'. • Very useful for testing theories, but not for generating them. • Concentrates on the 'here and now' and so future policy cannot really be determined based on these results alone.
Phenomenology	• The involvement of the researcher in a lengthy research project better illustrates how things change over time. • When viewed in the context of the 'larger whole', meanings are easier to see and understand. • Due to the long time spans involved, data is collected in a much more natural fashion, allowing theories to develop and take account of emerging issues and ideas.	• In order to reap the maximum benefit, the research must be carried out over a long period of time, with the necessary resources obviously reflecting this. • Analysis and interpretation is subjective in nature, i.e. relies on the perceptions of the researcher. • There are no easily identifiable milestones to the research, things just progress naturally, and so such projects often appear untidy and uncoordinated. • Less credibility is given to results that are perceived as being based on intuition.

Table 2.2 Benefits and limitations of the two approaches to management research.

The ideal research design will reap as many of the benefits from each of the approaches as possible, whilst obviously avoiding as many of the limitations. Adopting a purist attitude to either of the approaches is therefore unfeasible, and a hybrid approach must be derived to ensure that the subject area is studied in totality, with the conclusions being assigned as much validity as is possible

2.3 Potential Problems and Issues Involved in the Research

The aims of the research are to develop a general reference model which can be applied to potential applications to determine their suitability, and then to specify a set of design guidelines that will ensure suitable applications are rapidly developed and address all the necessary issues of the process involved. Adopting any one approach to defining these will not provide the necessary rigour in the results, as each one suffers from better addressing the needs of the other. The research design which is to be used must therefore take into account the following issues.

2.3.1 Sample Size

The enormous diversity of potential Groupware applications means that a suitable reference model, which can be applied in almost any given situation to assess the suitability of a suggested application, cannot be defined from a detailed study of only a small sample of applications from one organisation or even one sector of the manufacturing industry. Similarly, design guidelines, which look at overcoming the numerous pitfalls and blind alleys involved in the successful design of a Groupware application, can only be achieved by actually carrying out the design in a real situation, something which is completely impractical when the sample size is too large, as the time involved to complete the implementation of a Groupware application can often be lengthy.

2.3.2 Generalisability

The way in which a business operates is affected by many internal and external factors, the industry sector, the competition, the marketplace, the company culture, etc., which results in no two companies being identical in terms of the business processes which occur in the day-to-day running. For this reason, no set of design guidelines can fully encompass all the issues that may affect the successful implementation of a Groupware application, especially when it is derived from the detailed study of just one organisation.

2.3.3 The Hawthorne Effect

The Hawthorne effect recognises that any research which is carried out from within the area under study may in itself affect the results obtained, usually occurring where the questions asked by the researcher raise awareness of a particular problem to the extent that it is partially solved as a result. Any changes made by the researcher will then seem to be more effective than they actually are.

In this research, it is both the reference model and the design guidelines which may be susceptible to the Hawthorne effect as the introduction of any system will cause those involved to look more closely at what they do. Thereby raising the question, was the application really suitable for Groupware or are the users struggling to work with what they have been given in the absence of anything else.

2.3.4 Measurement of Success

As with many research topics, it is very difficult to assign numeric values to the success (or failure) of any conclusions that are derived, in this case the question is how can we say that the reference model has successfully eliminated unsuitable applications and that the design guidelines have promoted the best fit design for the application in every given situation. The answer has to be that we can't really do that, as the area of Groupware is so vast that there will always exist grey areas, where the suitability of application or design can be questioned.

2.4 The Adopted Research Method

The research presented in this thesis falls into the classification of 'Applied' research, introducing new technology to provide a solution to a specific problem. However, there are also aspects of 'Pure' and 'Action' research, examining the applicability of the new technology in a wide variety of business areas and through the applied research actually changing the way in which a process is performed, resulting in the author developing ideas of how future implementation of the technology would best be achieved in terms of application design.

As a result of this, the approach to the research combines both positivist and phenomenological thinking, conducting a wide but shallow review of Groupware functionality and application, and an in-depth study of a limited number of applications.

2.4.1 Positivist Approach : A Review of Groupware Functionality

The factors that affect the successful implementation of a Groupware solution are very difficult to define, a review of the evolution of Groupware as a genre and a more detailed investigation into the basic functionality of Lotus Notes will allow a certain amount of information to be derived in this area. Using this information to develop a broad set of criteria, objective 'measures' can be set up to assess the Groupware applications of a large sample of manufacturing companies. If the sample is large enough and diverse enough, with meaningful questions being asked, then the results should allow for the generation of a very robust reference model of what makes a successful application and what doesn't.

There are of course problems with this approach, as the success of an application is often subjective depending on who is asked and what other factors have affected the implementation of Groupware. Companies will also be very reluctant to detail their failures, modifying their response to make a bad application appear in a different light. Therefore, the results obtained from this review must be tempered against common theory on the subject of suitable applications, and against the authors own experience of implementing Groupware.

2.4.1.1 What is a Reference Model ?

The expected outcome of the positivist approach is the definition of a suitable model which can be used to assess the functions and properties of a particular process, to determine if that process could benefit from being implemented as a

Notes application. Within the research, this is defined as a "reference model" and it is pertinent at this stage to define exactly what is meant by this terminology.

Perhaps the simplest way to achieve this is by referring to the widely accepted models which are used by industry today. Perhaps the most well known of these is the "Model for quality assurance in design, development, production, installation and servicing" - ISO9000. Within the introduction to this standard are stated the main philosophies behind this reference model.

- The specified requirements are complementary (not alternative) to the technical (product) requirements.
- They specify what elements quality systems have to encompass, but do not enforce any uniformity.
- They are generic and independent of any specific industry or economic sector.
- The design and implementation will be influenced by the varying needs of an organisation.

In essence, this standard provides the basic skeleton of a quality system, which each individual company will then 'flesh out' to suit the peculiarities of their organisation.

This basic principle is continued in another industry recognised reference model. "The Oliver Wight ABCD Checklist for Operational Excellence", which defines a series of world-class benchmarks (the basic skeleton), against which a manufacturing company can assess its performance, with the ultimate goal being successful implementation of a Manufacturing Resource Planning system.

The reference model developed in this research should therefore follow the same principle, providing a theoretical ideal for the features that would lead to a successful Notes application being developed, with sufficient flexibility to allow the model to be used by any organisation.

2.4.2 Phenomenological Approach : Design of Case Study Applications

The developed reference model will initially be based on the findings of the review of Groupware functionality and as such represents a purely theoretical model. The model must be validated and developed further, including more information from real examples. To try and validate the model from the experience gained from only one application would be completely unrealistic, as the model is intended to be as generic as possible and no one Notes application will include all the aspects of the model . However, implementation of Groupware involves not only the specification of the code but the defining of the necessary procedures, testing of the pilot application and hand over with procedures for ongoing maintenance, and therefore it takes a long time to develop one application. For this reason, it is impractical to try and introduce a large number of applications to provide more general results and a more rigorous validation of the model.

A compromise number of applications for development must be reached, and here we can test (to a certain extent) the suitability of the reference model by assessing a number of suggested applications to determine which are suitable and potentially successful. In this selection stage, the potential problem of generalisability can be addressed by selecting applications which are as diverse as is possible within the same organisation. If the applications are selected with care, the range of functionality which is encountered during the case studies should provide the experience necessary to confirm or deny the applicability of the model in a more general sense.

2.5 Research Plan

A review of the evolutionary path of Groupware, will seek to demonstrate the validity of the research hypotheses by demonstrating how important such systems have become for modern businesses and how dedicated the major software houses such as Microsoft and Lotus are to promoting and developing these products.

The developed research plan then addresses each of the Hypotheses in turn.

1. A Reference Model is required to determine the suitability of Groupware to address the needs of a defined business problem.

    - Undertake a literature review of the current theories regarding the areas of application for Groupware, determining whether this gives a suitable Reference Model for the ideal Groupware application by comparing this with the reported performance of existing applications.

2. A set of Design Guidelines are required to assist developers of Groupware systems with the planning, design and implementation of a particular application.

    - Undertake a literature review of the methods used by Groupware systems to support business processes to which they are reportedly better suited, using a review of existing industry applications to determine where the current design methodology may be deficient.

3. A generic Reference Model to determine the suitability of Groupware to address a business problem can be developed.

    - Expand on the theories identified during the literature review to develop a more robust Reference Model, providing guidelines on the characteristics of a business process which affect the suitability for conversion into a Groupware application, and identifying those which are likely to promote greater benefit.

    - Utilise the developed Reference Model to identify three potential case study applications and develop a solution using Lotus Notes.

    - Assess the success of each case study application to review the validity of the developed Reference Model.

4. Generic Design Guidelines to assist in the planning, design and implementation of a Groupware system can be developed.

   - From the experience gained in the design of the three case study applications, develop generic Design Guidelines that can be applied in future developments to overcome the aspects of the application which do not fit neatly into the 'ideal' presented by the Reference Model.

   - The validity of the Design Guidelines is inherited from the fact that they are developed from the implementation of potentially successful applications. Further support for this hypothesis can be supplied by surveying the views of other developers regarding the Guidelines and the experience of the author in utilising them in any future development work.

5. A methodology can be written for the application of any developed Reference Model and Design Guidelines to ensure accuracy and confidence in the results obtained.

   - By combining the methodology inherent in the developed Reference Model and Design Guidelines with the experience of their application to the case study examples, define a sequence of steps to be followed to arrive at an appropriate and reproducable decision as to the potential for using Groupware in the situation under review.

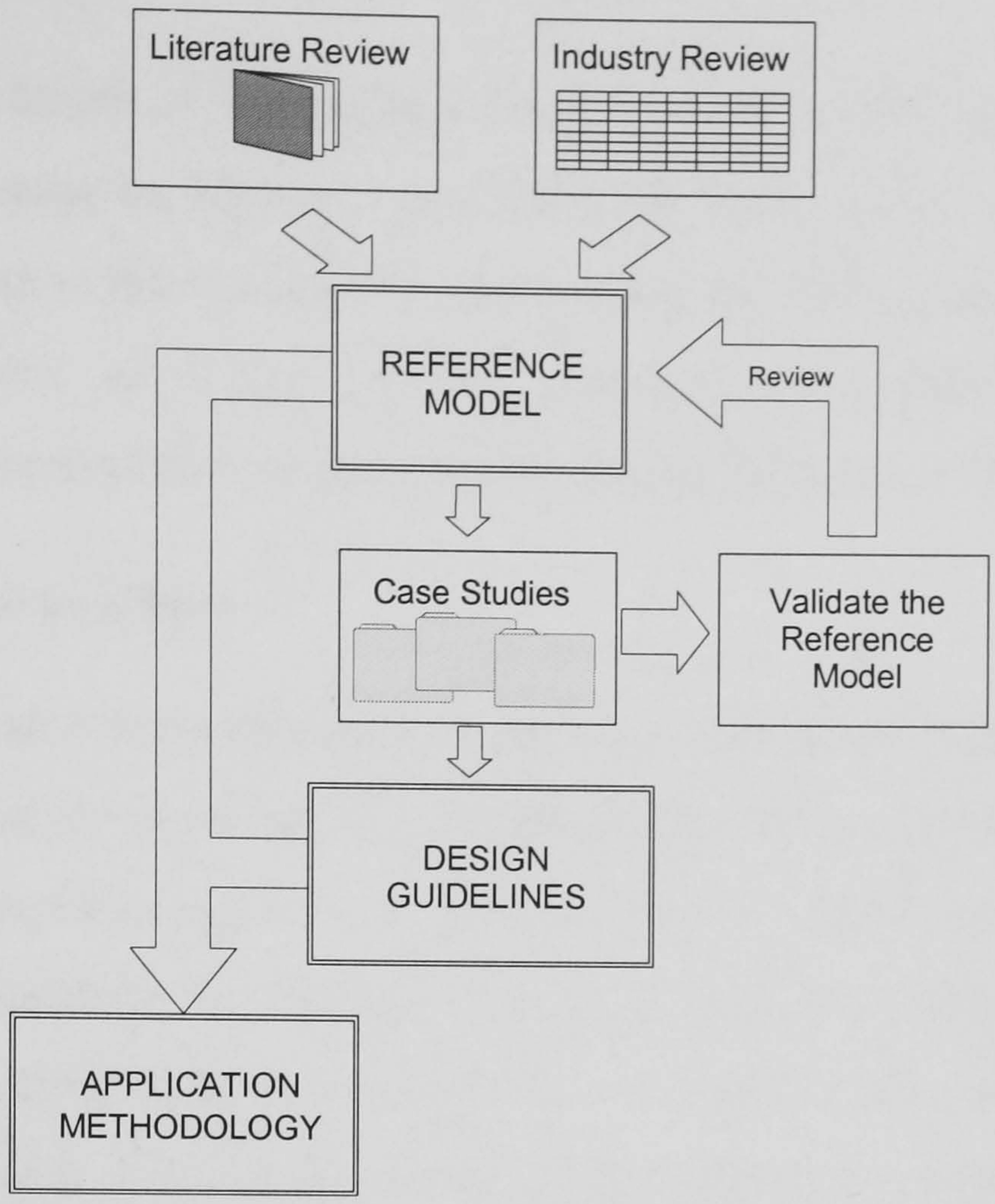


Figure 2.1 - Relationship of the various stages of the research plan.

2.6 Potential Problems Addressed

The research plan has been designed to achieve the desired results whilst at the same time removing, or limiting, the potential problem areas discussed above. The theories behind this can be tied to those problems.

2.6.1 Sample Size

The use of a large sample size in defining the reference model allows the model to be as general as possible, but it does introduce a lack of detail as the information does not go into detail as to "WHY" an application succeeded or failed. However, introducing this level of detail would lengthen the information gathering process and therefore reduce the feasible sample size. In this instance, the detail is substituted with the current theory on successful application development.

2.6.2 Generalisability

Due to the length of the design process for new applications the number of case studies must be kept to a maximum of three, which leads to a lack of generalisability in the conclusions drawn about the design process. By making the applications as diverse in their functions as possible, more generic conclusions are available as the design issues are different in each case.

2.6.3 The Hawthorne Effect

As the research deals directly with the implementation of new technology to solve an identified problem, it is impossible for that research not to have an effect on the business practices as a result. However, the question in this case is more concerned with the suitability of Groupware for a given application, as defined by comparison with the reference model, and so the assessment stage of the research plan looks at the possible alternatives to Groupware. As these alternatives are considered for the same applications, the Hawthorne effect is removed.

2.6.4 Measurement of Success

The case study applications have been identified as being potentially successful Groupware applications using the derived reference model and each successive design has used the experience gained from the others, experience which is included in the design guidelines. Therefore, if the success of the case study applications can be quantified, then the success of the developed theories can also be quantified to an extent, with the obvious limitation arising from the necessarily small sample size used.

2.7 Summary

Chapter 3 will outline the evolution of Groupware, leading to the assumption that when considering Groupware, as a classification of software, it is equally as relevant to simply consider Lotus Notes, as this has been acknowledged by most as the industry leader and the benchmark against which all others should be measured. Therefore, the research presented in this thesis will concentrate exclusively on Lotus Notes.

- Chapter 4 presents a review of some of the available literature on Lotus Notes, examining the types of application considered most suitable for implementation, and compares this to the reported results of organisations who have converted their existing processes into Notes applications.

- Chapter 5 takes the findings of the literature and industry review, and defines a reference model for selecting a business process which will provide the desired benefits if Notes was used as the system infrastructure.

- Chapters 6-8 present three case studies which were identified as potential candidates for Notes implementation by the author, using the developed reference model. An assessment is made of the probable outcome, based on the positioning of the application against the reference model, and following implementation the degree of success reported is used to validate the model as a suitable tool for the selection of a Notes application.

- Chapter 9 collects together all the issues with design encountered during the development of the case study applications, and cross-references these to the characteristics which affect success defined in the reference model. This provides a greater definition for the strategy to follow in Notes development to overcome some of the problems encountered where the process is not a perfect fit into the reference model.

- Chapter 10 summarises the research into a methodology to be employed when applying the defined models in any situation to ensure a level of confidence in the analysis of the results, before discussing the validity of the findings presented in the research.

CHAPTER 3

BACKGROUND : EVOLUTION OF GROUPWARE

3.0 BACKGROUND : EVOLUTION OF GROUPWARE

3.1 Introduction

This chapter examines the rise of Groupware as an essential part of any company's systems philosophy, through the inadequacy of existing technology to fully integrate the various aspects of a business by retaining corporate knowledge with only a few select individuals. The text explains, by looking at the facilities of the leading Groupware development platform, Lotus Notes, how such a system can promote sharing and dissemination of this corporate knowledge to a much wider audience, integrating previously autonomous functions and ensuring that all employees are aware of the issues and barriers to achieving maximum productivity.

The chapter also warns of the potential pitfalls in the implementation of such a system, which mainly arise from the fact that Groupware attempts to change the way that groups interact, and states that more than any other system solution, Groupware must fit the existing practice and not attempt to dictate what that practice should be.

The chapter concludes by outlining the main aims of the research, which are to ensure that a Groupware solution is achieved as effectively as possible, and only where it will provide the desired level of improvement, and hence validate the research hypotheses.

3.2 Changing Needs of Business Organisations

During the early part of this century, it was the manufacturing companies who dictated what the customer bought and the quote from Henry Ford, one of the pioneers of mass production, "You can have a car in any colour, as long as its black" reflects the state of business policy at the time. However if you were to buy a Ford car today, then the range of options which you, as the customer, could specify is enormous, even down to the colour that you want the car to be. What has changed, that now forces manufacturing companies to operate in this

"Customer-driven" style, and what effect has this had on the way in which businesses need to organise themselves?

Increasing competition from all over the world is often quoted as the main reason for this progression into a "The customer is always right" mentality, as the supplier who can get goods to the customer ahead of the competition and to specification is going to get the sale. Because the customer has increasingly been allowed to dictate the way in which businesses need to operate, then they are increasingly likely to change their needs from day to day, as they have become aware that someone will be able to supply exactly what they need in the struggle to increase sales and profits.

3.2.1 The Structure of the Organisation

The traditional organisational structure that operated in those early mass-production manufacturing companies stemmed from the family owned businesses of the industrial revolution, where all management decisions had to come from the top of the hierarchical tree. Organising the business in this way allows for a great deal of control to be exercised over the whole operation by the senior management, because if all the decisions have to be approved at 'board' level then they are always aware of the full implications of the decision. Each department head present at the meeting will also then have a picture of where the business is going and the whole thing is co-ordinated to produce the most efficient production system.

The desired level of efficiency is achieved by the department head within their own department by having the necessary expertise available to them to carry out the given task, but what if a problem arises that requires the assistance of another department. The hierarchical structure demands that the decision be made by the executives who need to get their facts from their subordinates, who in turn need information from their subordinates, and so on down the line until the person finding the problem eventually gets to tell someone what the problem is. This then needs to be routed to the appropriate executive who can provide an answer, then down through the levels of his department, before the holder of the necessary knowledge is found, and his expertise is routed back up the 'pyramid' and down to the person who needs it.

In practice the involvement of executives is not necessary, but the principle is the same as higher levels of management need to be involved in the decision making process and ensure the level of co-ordination and control that promotes efficiency in the organisation as a whole. All this routing of information up and down the management levels obviously lengthens the process of decision-making and the manufacturing company that still operates in this way in today's environment will not survive for very long, unless they have a monopoly on that market.

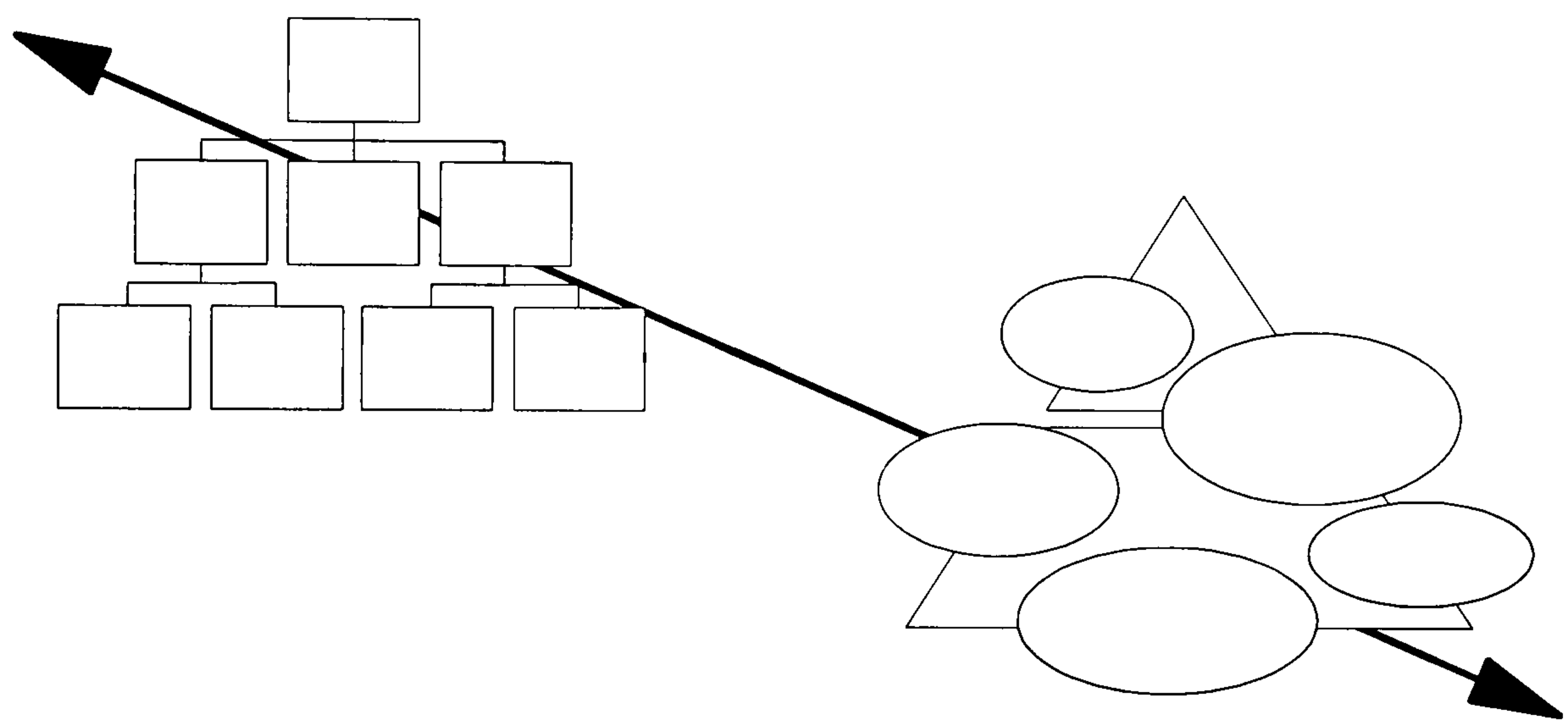


Figure 3.1 - The changing structure of today's organisations (Holtham 1992)

The company which has to provide a rapid response to market demands needs to flatten out the hierarchical structure and allow the experts to communicate directly without the need to route information through endless management levels. There has been much development in this area, with companies now realising that they can only achieve the necessary goals through the integration of the business as a whole, not simply within each department, maintaining the co-ordination and control of the hierarchical structure through a shared, and identifiable, vision whilst allowing greater collaboration across traditional departmental boundaries. Indeed, the fully integrated business encompasses not only its own personnel, but also its customers and suppliers, as they have realised that they do not hold the sum total of all knowledge on their area of business and require input from many sources in order to provide the best solution possible.

The integrated business can thus react to any given situation or market demand by creating an ad-hoc multidisciplinary team, which will have at its disposal the necessary expertise to solve any problems which arise, in the shortest time possible and in the most satisfactory manner.

Holtham [1992] summarises this by relating the two structures to what he calls the '5C's of information processing for group work', theorising how each is supported by the structure concerned.

	PRINCIPLE	HIERARCHY	INTEGRATED
CONNECTIVITY	Physical connection between group members and the data to be shared.	●	●●●
CONTROL	Assessing the performance of parts of the group functions and taking remedial action.	●●●	●
COLLABORATION	Working together of individuals within a group to achieve a joint goal.	●	●●●
CO-ORDINATION	Synchronisation of group activities (horizontal and vertical) to achieve objectives.	●●●	●
CHANGE	Business Process Re-engineering to facilitate the group function.	●●	●●●

Table 3.1 - The 5C's of information processing for group work.

The hierarchical structure represents one of stability and this is still relevant for some businesses and even some departments within organisations, where there remains a relatively stable environment or a need to retain specialist functions and expertise. The integrated structure allows for the flexibility to respond to market demands and therefore represents a 'change' environment, something which also has its drawbacks in maintaining a clear strategic vision and achieving the necessary level of accountability. What is needed by today's business is a system which will promote the weaker aspects of each type of structure, whilst maintaining the same level of performance in those which are already strong.

3.2.2 What is Needed ?

In order for the hierarchical structure to improve, the expertise that exists within a company, at whatever level, needs to be readily available to those who need it. Not only that, but anyone should be able to contribute to that expertise as and when they have reason to do so. Thorne [1994] quotes an example of an internationally recognised expert in a particular valve who took pride in his knowledge and was willing to share it and document that sharing for future reference. However in the traditional hierarchical structure there is no mechanism to effectively use that knowledge, the rate of dissemination and amount of knowledge available is limited. If a system existed which would allow this expert to continue logging his calls, whilst at the same time making these records available to the company as a whole, to retrieve from and possibly add to through discussion of a particular issue in the same log, then the expertise would rapidly become corporate rather than that of just one individual.

The responsive, integrated organisation has in its efforts to become as reactive and customer-centric as it can has possibly spread out too wide, with the introduction of modem links and the 'home office' based work force leading to a reduction in the achievable control which can be exercised over the business as a whole. If the salesmen and agents only communicate with the central core every so often, their information may well be out of synchronisation with the ever changing aims of the company on an increasingly regular basis. Again, systems seem to be the answer, if everyone within the company was aware of every issue affecting that company and could be assured that the information they had was current, then the control and co-ordination of activities is reintroduced into the organisation. IBM systems house, Triangle [Brenner:1995] illustrate this regaining of the control within a flatter management structure, with a client tracking system that gives not only the standard information of name and address, and what they have ordered, but also indicates the particular clients history, credit status, products bought and also products about which an enquiry has been made and so on. Each salesman out in the field has access to this system and can immediately decide whether to extend credit or whether to try and sell the client a new product.

In practice it is safe to say that no one structure is appropriate for a business to adopt, and they must organise themselves according to the needs of their particular industry. Holtham [1992] suggests that the most effective strategy would be to have a stable core to the business whilst allowing flexible arms to exist around it to deal with the ever-changing market environment. What is needed for this amalgam of organisation structures is some form of system which will achieve greater collaboration in the hierarchical core, whilst maintaining the necessary control over the activities of the flexible outer arms.

3.3 The Role of Information Technology

The integration of functions within a business to promote the desired fast-response organisation, has its fundamental principles in the use of the knowledge which represents the familiarity, awareness and understanding of the issues of the particular business, gained through past experience of running that business. Information is the physical representation of this knowledge, but very often the translation from the abstract to the physical is not performed and the knowledge forever resides within the mind of the expert.

The rapid development of Information Technology over the last 20 years has introduced the facility for the easy and effective storage of the knowledge which resides within a company. For instance, in a traditional manufacturing company, designing and building its own products, the expertise of the designer may be utilised in the production of CAD drawings of the particular product, this is then stored for all time so that similar jobs can be more quickly completed in the future, i.e. all the problems have been overcome beforehand. The knowledge inherent in the produced drawing is then passed on to the production department, who use their expertise in production technology to define the most efficient method of production, which again may be recorded electronically in a simple word processed procedure or in the other extreme of an Automated Manufacturing System, utilising the direct transfer of knowledge via technology to convert designs into products.

Therefore it could be said that Information Technology represents a significant advantage in the storage and interpretation of the resident expertise which guides and defines a businesses activities. Not only that, but with the introduction of multi-user environments, the technology provides the facility to allow the knowledge to flow as the essential business processes dictate, all within the confines of the electronic information network.

3.4 Deficiencies in Current Technology

In businesses that adopt the integrated approach to functions, the information which they hold becomes worthless if is not readily available where it is needed. The larger a company gets the more barriers there are to the required level of knowledge sharing and the less opportunity there is for full integration and realisation of potential. Therefore, as well as introducing information technology into a company to aid the retention of knowledge, businesses should look at the information strategy adopted to support the technology so that the necessary level of knowledge sharing is more readily achievable.

Traditional software tools which form the front-end of the information technology revolution have traditionally been concerned with individual aspects of a business and indeed could be said to promote and support the hierarchical, departmentalised organisation. Taking the earlier example, Computer-Aided Design packages are used to transfer and capture the knowledge of the design department in a traditional engineering drawing that is then stored electronically. This information cannot however be easily transferred to the computer systems of another department, such as purchasing, who require Bills-of-materials and specifications in order to supply production with the relevant raw materials and parts, using their acquired knowledge of suppliers and costing. The information would have to be physically taken from the drawing and re-entered into the purchasing system.

Even the non-specialised software tools, such as spreadsheets and word processors, do not adequately promote the level of interaction necessary within a business. Referred to as "personal productivity tools" by Jim Chapman of the Triangle group [Brenner:1995], they attempt to increase the productivity of one worker in isolation. The larger problem is how to get the work force working effectively together, so that every keystroke benefits the organisation.

Having said this, the increasing utilisation of multi-user environments has given rise to systems which allow a degree of data dissemination through an organisation, but again there are certain limitations to the degree of integration and group working that can be achieved by these systems.

The retention of knowledge and the increased availability of it , can be achieved by using a conventional database, but these are designed to manage structured, real-time information generated by the business operations and not the intrinsic knowledge which is needed in the processes themselves. A Corporate Strategy white paper [1994], published by the Lotus Development Corporation to support its 'Groupware' product, Lotus Notes, described database systems as "data-centric" and "transaction-oriented", in that they are concerned with only the current state of information which has been broken down into its simplest elements and organised in a way that will only support specific decisions. What the integrated business requires is another system, in conjunction with this "data-store", which will provide a means to analyse and interpret the changing nature of information over time and then convert that into the stored knowledge of the business as a whole, whilst still being able to relate it to specific individuals and activities.

In allowing for the dissemination of information throughout a company, databases actually limit their scope of application and suitability to the needs of the integrated business. Because they reflect the real-time nature of data produced on a daily basis, any distributed system is required to be a single system, so that changes are reflected throughout. Disconnected, occasional users are then almost excluded from having access to the system, a factor which is of particular importance when looking at companies with international sales, i.e. a salesman in the field can only have access the figures as of the last time he obtained them from the central system.

Existing electronic communication technology allows widely dispersed users to share their information and knowledge and so reach decisions without the need for a physical meeting between the two parties, so seemingly addressing the problems that databases present to a company. Virtually any form of information can be shared between any number of people, simply by using e-mail or bulletin boards for wider broadcast.

However, these 'mailing' systems are designed for the efficient transmission of electronic data and nothing more, they are not capable of tracking that information beyond the receipt of an addressed message, nor can they capture the transferred information in any structured way other than that imposed by the recipients upon receiving it, a large task in itself if the information is extracted from a bulletin board. Traditional electronic mailing systems are also concerned with the transfer of information between interested parties, often a one-to-one, or one-to-many, transaction. Where work performed on projects is manipulated via electronic mail, only those directly involved in the particular project are aware of the issues which arise, and future similar projects do not benefit from previous experience, unless the same people are involved. Therefore, electronic mail provides a very good system for directly transferring knowledge for short term use, but not for sharing it on a wider scale and over a longer time-span.

The ideal communication system would still allow for the transfer of any type of information, but would allow controlled many-to-many discussion messages to be sent back and forth, whilst providing tools to "transform this unstructured text into databases without the usual constraints of field and record length" [Schlack:1991].

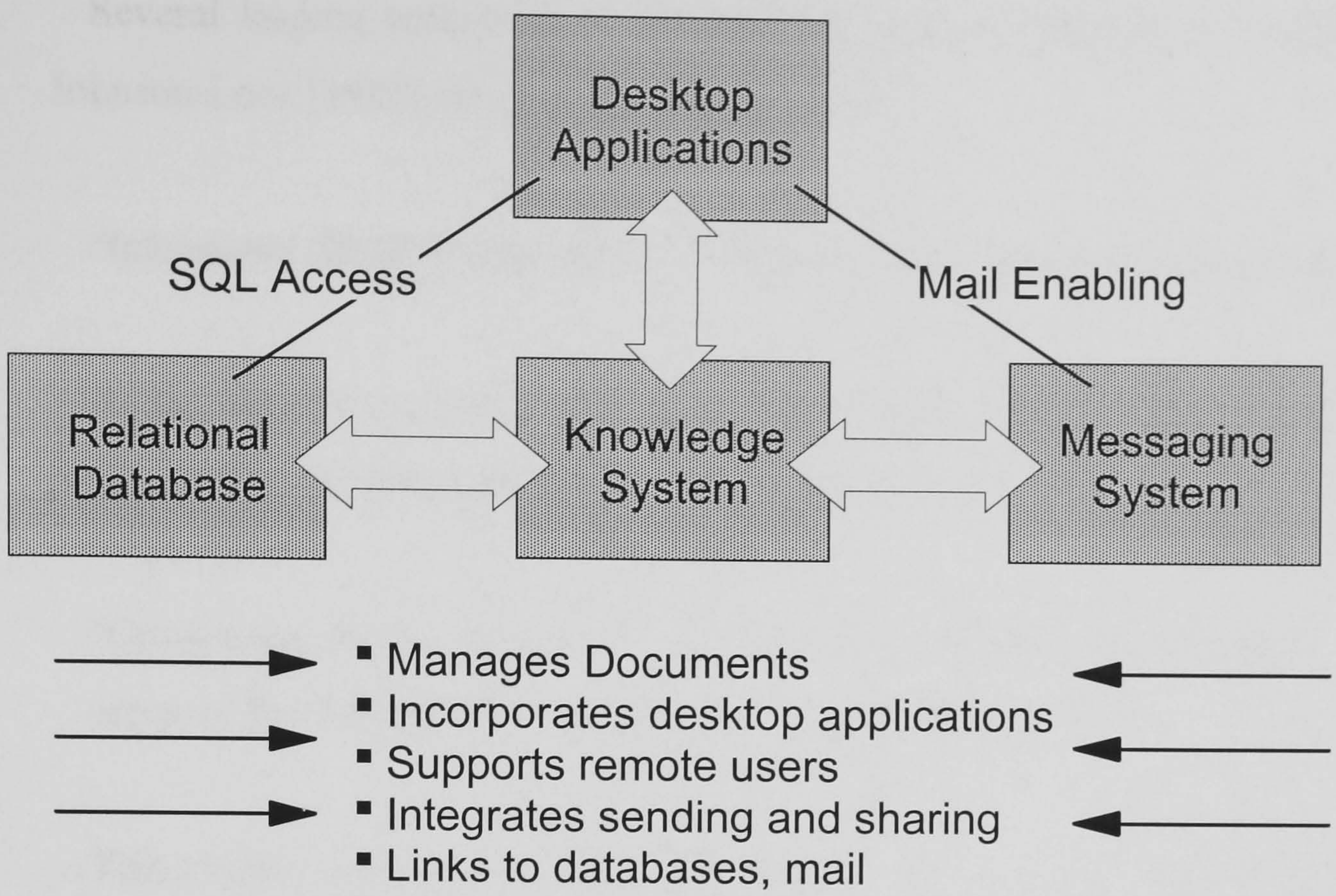


Figure 3.2 - The knowledge system should integrate existing systems not replace them (Lotus 1994)

3.5 Groupware Systems

In the above text we have outlined the deficiencies inherent in the conventional software tools for the recording and sharing of information, concluding in each case that what is needed is a system that is more like the other. In other words, a database that is more like electronic mail, and electronic mail that is more like a database. In an early review of Lotus Notes, the leading product in the newly emerged Groupware category, Bond [1990] described it as "part E-mail system, part conferencing system, part database manager and part network connection. When all its parts are combined, it (Notes) forms an interesting distributed-database network". This does not provide a definition of Groupware, but it does give an indication of the facilities which a Groupware system could provide if introduced in the right circumstances.

Several leading authors have attempted to give a definition to Groupware, Johnson-Lenz [1982] summed up Groupware as -

"Intentional GROUP processes plus the softWARE needed to support them"

As the industry realised the potential market and started releasing Groupware products, Dyson [1990] developed a slightly different definition -

"Groupware, in the broadest terms, describes software, systems and services that help groups of workers to do their jobs better."

This slightly broader definition indicates the problems of trying to tie down Groupware to one specific area of application, seemingly wherever a group of people interact there is a possibility to introduce Groupware to improve the way the process is carried out. This is not strictly true, as there will always be better systems to deal with the more process-oriented interactions which exist in a manufacturing environment, but communication-oriented procedures are the ideal areas for the implementation of Groupware. An example given by Thorne [1994] illustrates the way in which the customer service department of a PC manufacturer could immediately tell him the status of his order, without the need to contact anyone else in the company, and despite the fact that he did not know the specific order number and could only give his own name as reference. This was possible because the manufacturer had implemented a Groupware system, that all areas of the business contributed to regarding every order.

This level of integration within an organisation can only be achieved if the Groupware system is capable of operating in two ways, regulating work content and controlling workflow [Dyson:1990]. The ideal Groupware system will regulate the work content of the information which is going back and forward, so that each user is presented with only that information which they need and in the format that they need it. A Groupware system also recognises that users will require the integration of data from many sources into one meaningful document, providing interfaces to the commonly used "personal productivity tools" as necessary. In a workflow application, the data contained in each document is of little meaning to the system, what is important is the relative position of each document within the defined chain of recipients, the status of each document and a map of the future path once the status changes. Groupware systems recognise that there are different users, sources, views and routes for the data they contain.

The potential for Groupware applications can only really be investigated by looking at the capabilities of one system, and in the case of Groupware the leader in the field and recognised industry standard is Lotus Notes. In an article by Smith [1996] in the Lotus SmartNotes magazine, reference was made to announcements by Lotus which indicated that Notes had over 4.5 million seats deployed in over 7,000 companies, with the realistic growth potential to exceed 20 million users in the next few years. Therefore for the purposes of the remaining discussion, the features and functionality of Lotus Notes will be used to represent the generic Groupware system.

3.6 Lotus Notes : Fulfilling the Role of Groupware

When explaining the functions of which Lotus Notes is capable, it is very difficult to place them in a logical order which is relevant to every potential application and user group, however one thing that should be stressed at the outset is that Notes is not a ready-made system that can be loaded onto a PC and used immediately. Rather it is simply an application development platform [Rayl:1994] that can be used as the starting point for building a set of Groupware applications (true Groupware will never consist of just one application). Prince [1995] describes the secret of Notes as being "the fact that it is not any one thing but a set of building bricks, that when stacked and cemented the right way, can make an impressive and comfortable home - be it a mansion or a cottage".

Lotus initially released Notes in December 1989, and the features which it included at this time, although being greatly enhanced by the rapid progress made in computing technology, have not changed a great deal to the present day. Notes still includes the same fundamental functionality.

- Information is stored in a database.
- Data synchronisation between dispersed groups is achieved through replication.
- e-mail plays a major part is the way the data is utilised.
- Applications can be quickly developed using a simple set of tools.

3.6.1 The Notes Database

At the heart of Lotus Notes is a database containing a collection of related documents, stored in a single file and organised and maintained through the use of forms, fields, sections, views and documents. Every Notes application will contain at least one database, but many will contain several linked together. The Application Developers Reference [Lotus:1993] quotes the example of a Status Reporting application having one database where users post weekly status reports, whilst a Purchasing application may have several databases, dealing with products information, requisitions, purchase orders and inventory tracking.

3.6.1.1 The Structure of the Database

In a conventional database a **document** would be called a record, the different terminology is used with Notes as a document can contain almost anything from user entered data, to calculated formulas, to objects from other software tools. This flexibility in the contents of a document leads to the unstructured nature of the database, but a certain standardisation is incorporated through the use of a **form**, a blank layout of each type of document in the database, which determines the positions, reference names and formats of the document contents. The information to be specified in any particular form is defined by creating a **field** at the design stage. Notes fields are not constrained to a certain length as with a conventional database, and they can be of several different types depending on the information they are to contain and the function of each field. For instance structure can be imposed in a simple discussion database by including a topic field specified as a Keyword type, allowing the user only certain choices when entering the topic of the document. By far the most powerful field type is the rich text field which can contain virtually any type of information. The contents of a database are referenced in a tabular summary of the documents, called a **view**, and these views can select all or only a proportion of the documents, and categorise and sort these documents using any of the fields they contain. Private views allow users to impose their own organisation to the documents, to avoid the need to have one view for every possible sort order and selection.

3.6.1.1.1 Flexibility in the Format of Data

Notes provides some very powerful tools to overcome the differences in the software used by individuals within an organisation, with the ability to either copy part or the entire file into Notes through the operating systems clipboard, translate the entire file contents into a Notes document or view or attach a file to a document so that it does not become part of the Notes document but utilises the replication for dissemination purposes. Each method of utilising external files is relevant to certain situations, for instance attachments are of most use when the recipient wishes to use the source application to view the contents and not a Notes document, importing is used where the file is available but not the source application, and so on.

Whatever the software that is used to generate the information, Notes should in theory be able to provide at least one method of handling and sharing that data throughout the Notes community.

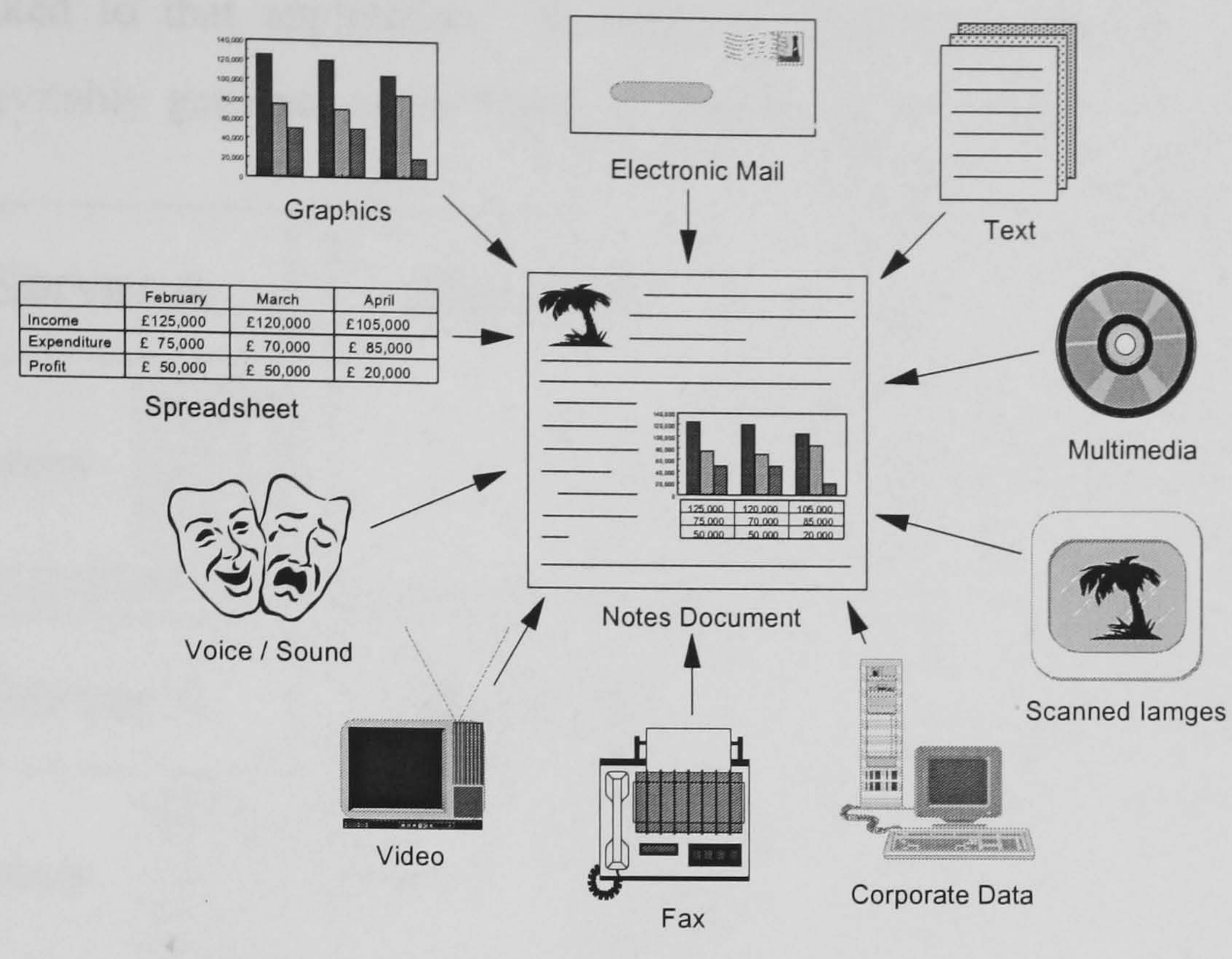


Figure 3.3 - Range of file formats which can be incorporated into just one Notes document.

3.6.2 Database Replication

One of the requirements of a Groupware system listed in section 3.5 was the need for a database that acts more like electronic mail, and Notes achieves this, to a certain extent, through a system called replication. Each Notes application is located on a dedicated Notes server, and replicas of that application are made on other servers within the same organisation. Each replica is open to a specified group of users who, in their day to day operations contribute to and change the contents of the Notes database on their server, therefore over time each replica becomes unique to its particular server.

The replication process then brings all these unique copies back into synchronisation by copying all the new and updated documents from each replica to all those replicas which do not contain them. Records are not locked in Notes when they are open, and so it is possible for more than one person to change the same document simultaneously, with the added facility of replication the same document can be amended by any number of users at different sites, with the full knowledge that in time all those changes will be seen by everyone linked to that application. In order to avoid the conflicts which this will inevitably generate when Notes is used to its full extent, a complete revision history is maintained which is used to determine the most recently changed copy of the document and designate all the other copies as responses to it.

The replication process can be set at a variety of intervals related to the time-dependency of the information, an exclusionary factor in the applicability of Notes to process-focused real time operations. Another drawback was found during the implementation of one of the case study applications, in that if the replication fails on one of its scheduled attempts it will not try again until the next scheduled replication.

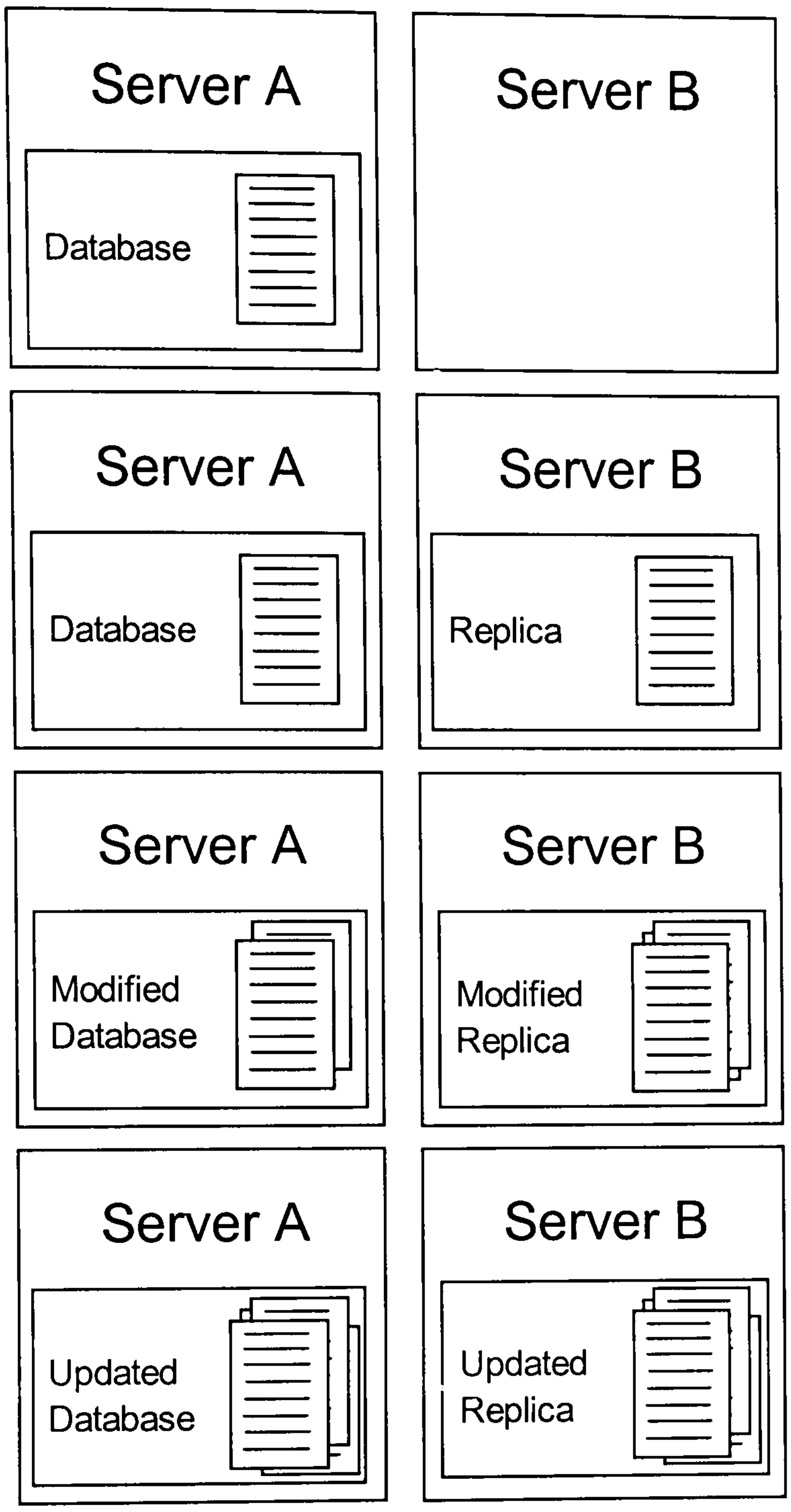


Figure 3.4 - The process of database replication

Therefore the replication interval should almost be set at half of the actual desired length, to ensure that even if it fails the information is still passed along in time for it to perform its function.

3.6.2.1 Remote Access

Bond [1990] states that Lotus Notes is for large businesses and indeed the replication facility does seem to best satisfy the needs of a large multi-site organisation, but when you consider that the replication can occur over a modem link, then the size of the organisation needed to reap maximum benefit from Notes reduces considerably, with the largest benefit being for the roving salesman who needs up-to-date information off site. In a case study relating to a firm of printers, salesmen quoted up to 2 hours per day going to and from the office to log their last call and prepare for the next one. If a salesman, anywhere in the world could log into the Notes server back at base and replicate the latest information from and to the central copy then his power out in the field is increased tenfold.

Another justification for the introduction of Notes into a smaller business is in the ability to integrate not only their own internal departments but also the external suppliers and customers, sharing the information that they need in the processing of orders from raw material in to goods out. The truly integrated and collaborative organisation would be able to determine the status of their orders with a particular supplier without ever having to contact them directly, and the eventual customers would also be able to assess their order within the core organisation, and so on through the chain to the consumer. Through the security of Notes, those who need to know can find out for themselves and those who don't need to know aren't even aware that its available. Obviously this level of collaboration is an ideal which is probably almost impossible to achieve in practice, but the possibility exists with Groupware systems and is just waiting for the right environment in which to emerge as the only way to work.

3.6.3 Integrated E-mail

From section 3.6.2 it can be concluded that although replication is a very powerful feature of Notes, it does not fully replace the current e-mail systems in use, as it is neither real-time nor specific to a group of addressees. The specification of addressees goes against the Groupware principle to a certain extent, and represented one of the drawbacks of electronic mail in fully integrating a business, however there will always be instances when this is a necessary option and there will always be instances when real-time transfer of information is required. Rather than use two systems in tandem with each other to support both methods of communication, Notes integrates a mailing system which can be accessed through its own interface and can automatically link the mail message to a specific Notes document.

For example, a company may wish to store its quality manual in a Notes application with the benefit that one copy is held and anyone in the company can make suggestions for change through the system. When a new revision is finalised it may be desirable to immediately inform all the holders of that procedure of the change. The integrated mail facility within Notes allows the revised document to be automatically mailed upon saving (no interaction from the controller of the document is required) to all the listed recipients of that particular procedure with a message relating to the content and a link to the document within Notes. Upon receiving the message all that needs to be done to view the procedure for the first time is activate the link into the Notes database. i.e. the mail message is simply a notification that the Notes database has changed and can be deleted once used.

A problem which might occur is in the running of two mailing systems, one that is used by those having access to Notes and one to support those who don't. In the company which has fully embraced Notes, e.g. Triangle [Brenner:1995], this would never be a problem, but it is unlikely in most companies that everyone will have, or indeed need, access to Notes. Therefore Notes also supports the use of other e-mail systems so that Notes does not represent another mail system but links into the existing one.

3.6.4 Rapid Application Development

The simple way in which a Notes database is constructed means that an entire application can be built in a significantly shorter time than would be possible using a more traditional, more powerful database development tool. Rayl [1995] quotes an example of a bug-tracking system created using a PowerBuilder/Microsoft SQL Server solution, which took three developers nine months to complete. The developed system also had some problems in the distribution of the data to remote sites, remote dial-up access from those in the field and in the use of the system by MacIntosh developers. Using a similar specification and Lotus Notes, Rayl developed an application in less than a month, which although lacking some of the robustness of the PowerBuilder system, was immediately a multi-platform, distributed database that allowed for remote access.

Obviously the development of a Notes database has its problems as with any system, Udell [1993] in a review of release 3.0 of the software commented on the necessity for better up-front syntax-checking of the formulas that control workflow within an application. The current method of building and checking formulas requires the drill-down through a series of dialogue boxes to get to the place where the code is specified, before retreating out through the same path to check the change that has been made. During the development of the applications detailed in the case study, many more glitches in the development architecture were found, at the time these seemed like enormous gaps in the system. However, with a little creative thinking the problem could be overcome using a different method or using an external software application that could be linked into the Notes application in one of the ways mentioned above.

Since its introduction in 1989, the Notes industry has grown considerably and, as with all software tools that show the potential to become so important, many independent software houses have developed ready-made Notes applications and add-on tools that make the process of designing and implementing an application specific to your needs so much faster. Such add-ons are the subject of many reviews and articles [Lindsey:1991, Mendler:1994, Essen:1995], but one that sticks out as that which apparently displays the full potential of Notes is a product called Business-in-a-box [SmartNotes:1996]. It is comprised of 18 separate database applications, integrated and mail-enabled in such a way as to allow all functions to communicate, co-ordinate and collaborate under the control of business owners and managers.

3.7 Developments in Lotus Notes

Figure 3.5 gives a summary of the developments and enhancements which have occurred within the Lotus Notes product, from the initial release to its present state as release 4.6 of "Lotus Notes with Domino Server".

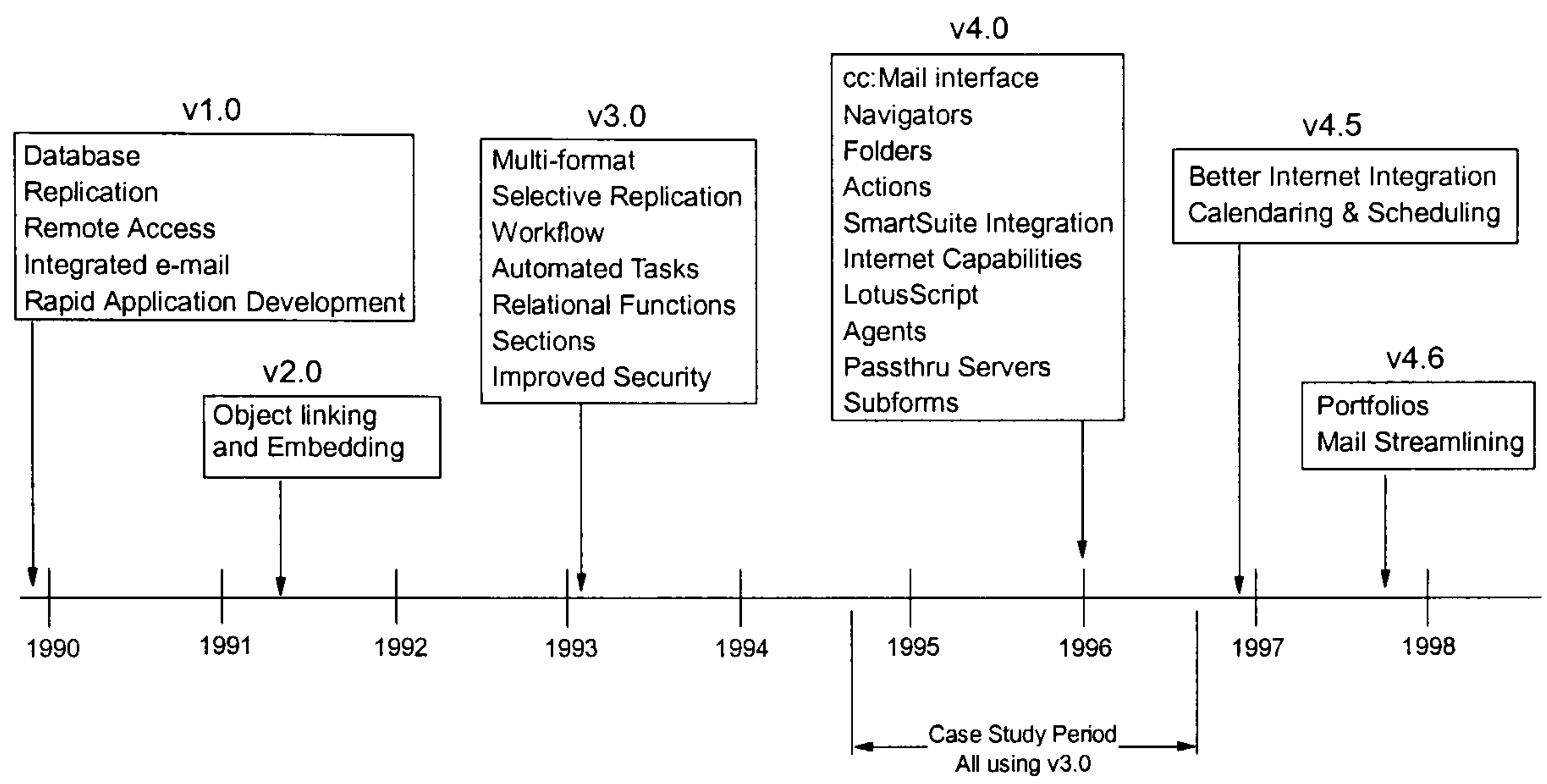


Figure 3.5 - The Lotus Notes Product Life Cycle

3.7.1 Object Linking and Embedding (OLE)

With release 2 of the software a greater degree of flexibility was added by not only allowing static information from other sources to be included in the contents of a Notes document, but also allowing files to be dynamically embedded into a document.

This allows the originator of the embedded object to work in the external software to update the details contained within it, in the knowledge that any user viewing that file from within the Notes database will always be looking at the latest version, without the originator having to do any editing within Notes.

For example a project team may be using a software application such as Microsoft Project to control and display progress in a Gantt chart format. The project leader could embed the Gantt chart within the Notes document for access by interested parties and then do all his reorganising and progress reporting within the external software, knowing that anyone looking at the Gantt chart in Notes will be looking at the correct status of the project.

3.7.2 Multi-format Support

One of the biggest barriers to the sharing of information throughout the whole a department is in the different hardware and software platforms that are used by individuals to best perform their functional tasks. For instance, designers have long realised that an Apple MacIntosh is superior to a PC as the design tools available are much better. If all these are to be integrated by just one Groupware system then it must be able to communicate and share information from the majority of platforms used by industry today.

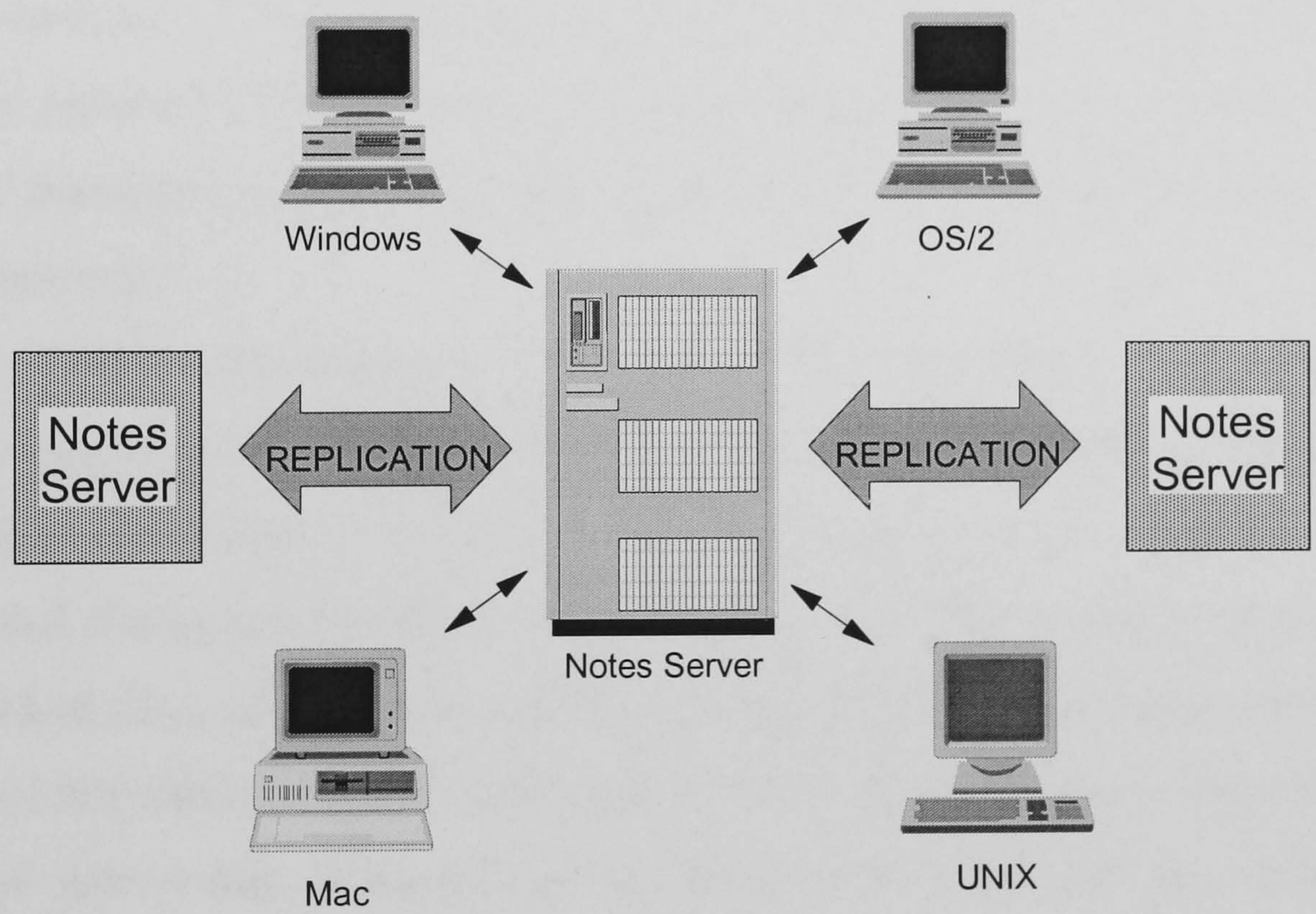


Figure 3.6 - Multi-format support from one Notes server

Notes supports the use of four different platforms, Windows, OS/2, Unix and MacIntosh and is quoted as having a "reliable sameness" [Udell:1993] across all these platforms, in other words the Notes interface is virtually identical on whatever system it appears. The benefits to this are considerable, training media can relate to the application in general and not to a specific hardware platform, the developers can utilise the most appropriate and powerful tools for the development of the application and be virtually assured that the application will look the same on every desktop that it appears, regardless of the hardware that sits there. This is not strictly true, as the experience of the author using just PC's is that when a lot of formatting is used in the design of a form (tab spaces and the like), then the use of a different sized screen or the use of imperial settings instead of metric within the windows environment can result in that formatting being lost. The fundamental information which the form contains remains the same, but it is so much more difficult to read for those affected.

3.7.3 Selective Replication

One of the features of Lotus Notes which made it attractive to potential users and contributed to it gaining such a strong foothold in the Groupware market was the replication feature, the ability to synchronise dispersed databases as an almost automatic process with the only cost involved being the price of a telephone call.

The power of this feature is fully realised when the organisation concerned operates an external sales force, as they can maintain the database and be kept up-to-date whilst still on the road. However, the nature of the database may mean that it contains thousands of documents, containing a significant number of attached files, all of which contribute to the physical size of the database in terms of megabytes. As well as presenting the problem of storage space for the external sales person, if the data is very dynamic in nature then the replication time needed will also be considerable.

In release 3 of the software, Lotus addressed this problem by allowing the user to specify a subset of the documents they were interested in and then selectively replicating these and not the entire contents of the database. For instance if the sales person is to visit only one particular area then they are only really interested in documents concerning this area. By using selective replication that is all they need take with them and subsequently replicate.

This feature also makes the integration of customers and suppliers easier to manage and police, as by only replicating the documents that affect a particular partner to the external Notes server, the partner is denied from ever knowing the existence of the other documents which the database may contain.

3.7.4 Workflow Applications

Up until release 3 of Lotus Notes, the applications which were developed in Notes were primarily concerned with the storage and dissemination of large amounts of unstructured data, with direct communication of that data being instigated by the users through the integrated e-mail features.

With the introduction of workflow features the system now had the ability to communicate data between individuals as a result of certain prerequisite actions being completed, and Notes attained a much greater level of functionality. A simple example of this would in an approval cycle (section 3.5) for employee travel. The document could be composed by the employee wishing to travel, filling in basic details of where, when and why. On saving these details the document could be automatically routed to his immediate supervisor to approve the travel, then onto a designated travel co-ordinator to arrange flights, hotels, costs and so on, going for financial approval and then arriving back at the traveller giving them all the details of their travel.

This is only a simple example and the possible uses for work-flow features are virtually infinite, one company has developed and successfully marketed an application to control the entire document approval process for ISO9000 procedures (International Data Corporation - Triangle [1994]), using the basic workflow features that Lotus incorporated into release 3 of Notes and enhanced with later releases.

3.7.5 Automated Tasks

With the introduction of workflow (section 3.7.4) came the possible requirement to process large amounts of data to determine if a specified criteria had been met. The easiest example being that of expiry date, i.e. has the date specified in a document been reached, if not then do nothing but if so then perform a certain action to resolve the situation which arises.

For an operator to perform this manually would be unfeasible, especially in large databases, and in release 3 macros were introduced which could be initiated as a timed background processes to keep a check on such criteria affected documents and initiate the actions necessary as a result of that check.

With the integration with the Internet which occurred in release 4 (section 3.7.9), these macros (now called Agents) provide another important function as the system can be arranged to automatically search specified Internet sites and download information which may be crucial to business, all ready for the user to view when he logs on in the morning.

3.7.6 Basic Relational Capabilities

Lotus Notes isn't a true relational database (Londergan and Freeland [1996]). Information in one Notes database can be accessed from another database, but the relationship is strictly one way. In a traditional relational database, the information could be edited in either database and cause all records containing that information to be updated.

With release 3 of Notes, a degree of relational capability was introduced. The information contained in a Notes document is displayed in a view in what is essentially tabular format, and Lotus introduced two functions which could be used to obtain values from these tables and put them into other documents. As the view is a display of the contents of the documents within a database, if the contents change, then the view changes and the values obtained by the new relational functions are different and reflect the current state of information. However, they cannot work automatically in the background, unless a routine is performed at set intervals to force this (section 3.7.5), and so do not provide true relational facilities.

The two functions are @DbColumn, which returns the entire contents of a specified column within the view, and @DbLookup, which returns the contents of a specified column which relate to a given key value. Although they do not give true relational capabilities, they do provide a very powerful tool within applications, and the author has used them many times to achieve a requested level of automation and consistency.

3.7.7 Sections

Despite the best intentions of the designer it may be impossible to reduce the amount of information which is stored in any particular form, and so the user is forced to scroll through the whole document to find a relevant piece of information.

In release 3, this issue was resolved by having the ability to include Sections within a document which contained subsets of the information and could be collapsed to a one line summary at the control of the user. The reader of a long document would then only be initially presented with a list of sections, which they could expand at will to find the information they wanted.

In this release, the sections were access controlled so that only specified users could edit the contents of a particular section, especially useful in workflow applications. However, in later releases, sections could also be used to simply break up the document, having no restrictions to who views or edits the information they contain.

3.7.8 Changing the User Interface

Release 4 saw a major change in the user interface. Prior to this, on opening a database the user was presented with a view, either the default view or the last one they had opened in the application, giving a simple list of the documents contained within the database, or defined subset of these. The user changed the view being used by selecting from a defined list in the pull down menu at the top of the screen.

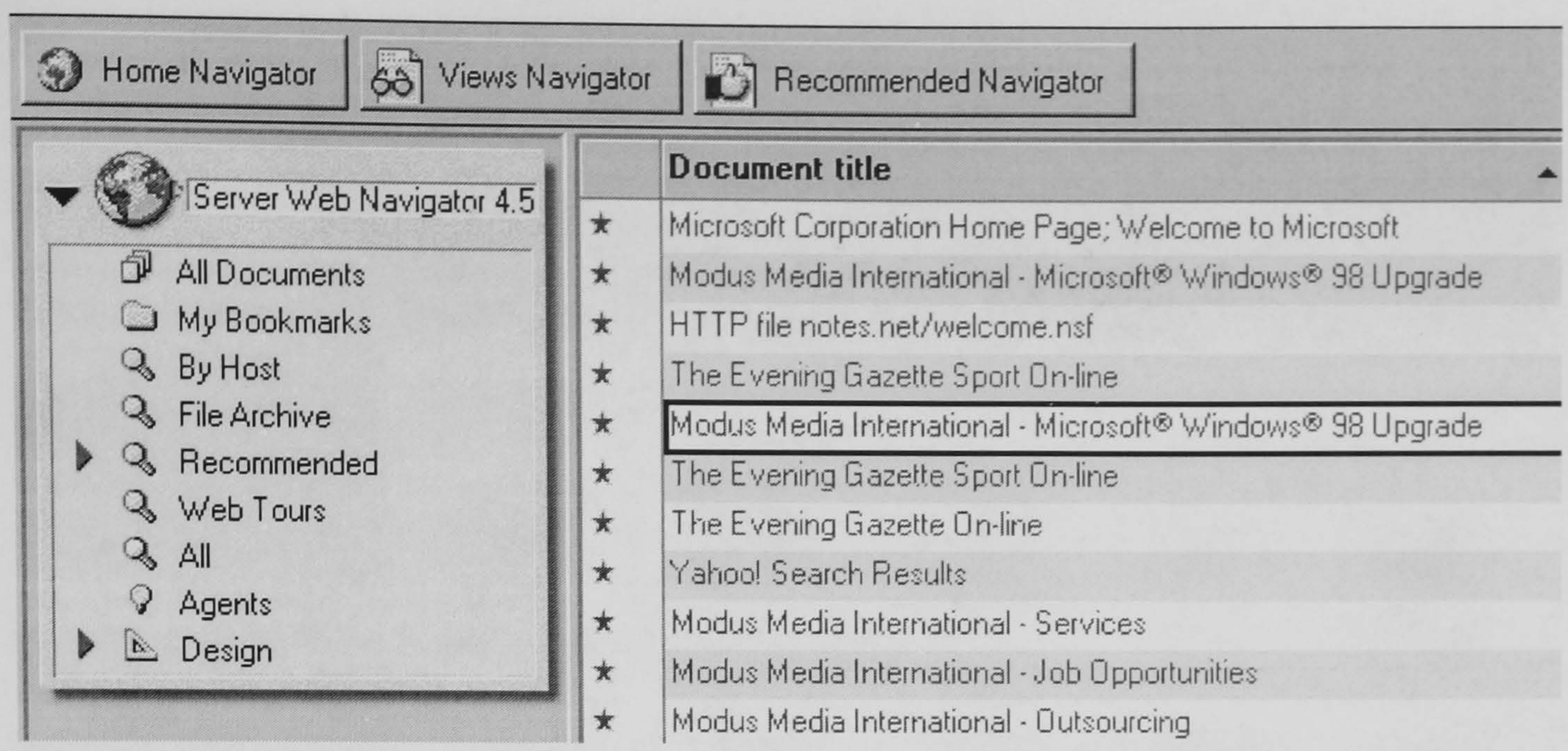


Figure 3.7 - "cc:mail" interface used for Notes from release 4 onwards.

Release 4 changed this by presenting the user with an interface more akin to another Lotus product, cc:Mail, where the available views are listed down the left hand side of the screen, and the relevant view then being presented on the right hand side. The example given in figure 3.7, shows the standard layout for the views contained in the Internet database, but this can be further enhanced by replacing the simple list of views with a more graphical navigator, where Hotspots within the graphic change the view display on the right hand side of the screen. Figure 3.8 shows two such navigators, one giving an introduction to the database (the whole screen is a navigator and the user has no view of the documents contained), and the other giving the Navigator representation of the view in figure 3.7.

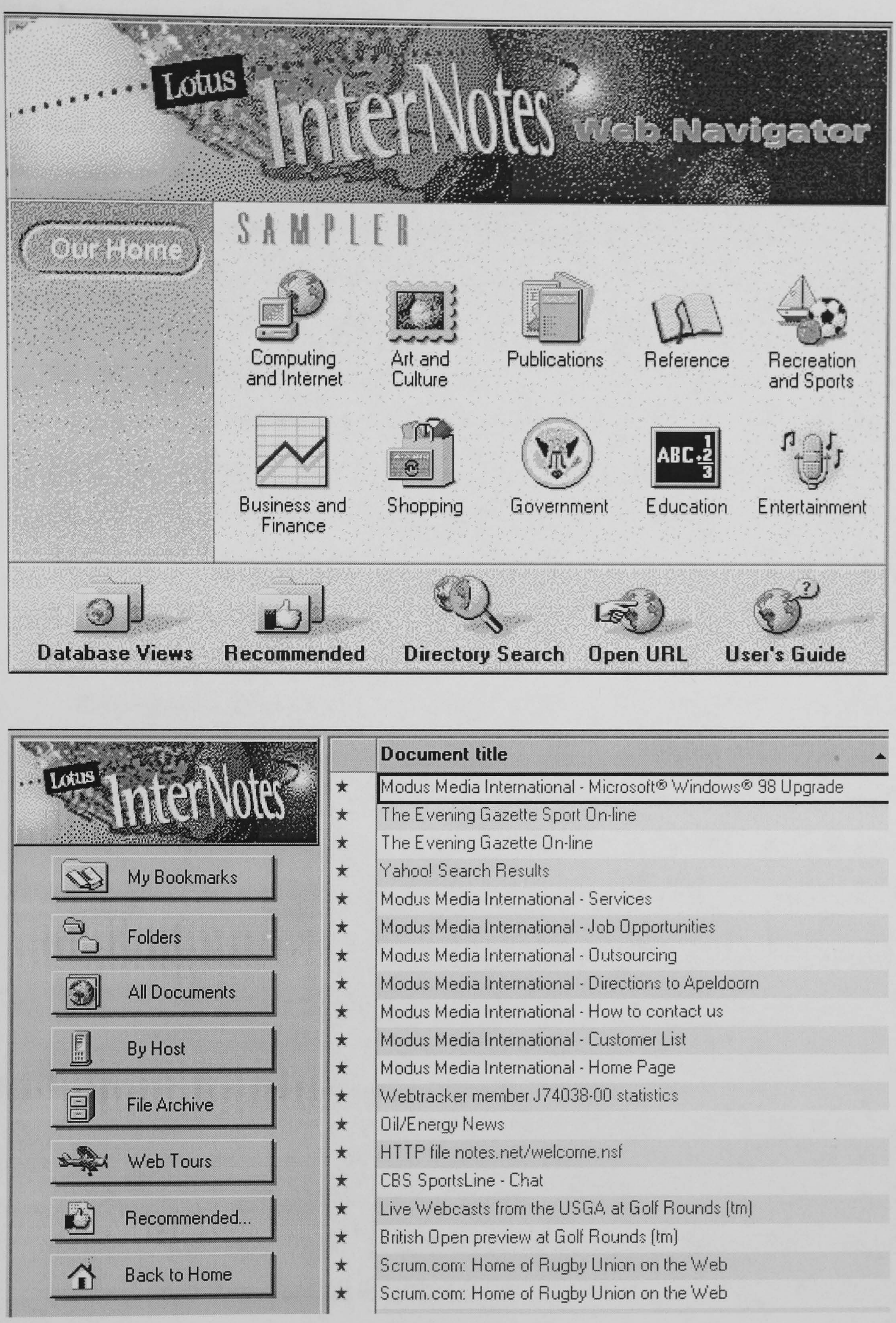


Figure 3.8 - Graphical navigators improve the presentation and use of Notes databases.

3.7.9 Integration with the Internet

No-one can deny the impact that the Internet has had and will have on the way business is conducted. This technology was first integrated into Notes in release 4, where users were given access to a central database used for browsing. Everyone used the same database and everyone could see all the cached pages that others had downloaded, with the view being that useful information didn't have to be found by many different people, once found on the Internet it was available to all.

However, the browser left a lot to be desired and release 4.5 saw a departure from this system to one where each user had their own personal Internet database which utilised either Microsoft Internet Explorer or Netscape Navigator for the browsing facility. The sharing of information was maintained to a degree by allowing pages to be easily mailed to other Notes users as soon as they were downloaded.

This release also saw the incorporation of the Domino Server which was basically the Notes server with extra functionality geared towards the Internet. Companies could now host their own sites on the Notes server, utilising all the security features of Notes. Where companies wanted to extend their organisation to include customers and suppliers, these business partners no longer needed to have Notes installed, they only needed to have access to the Internet and they could access the contents of a Notes database.

3.7.10 Calendaring and Scheduling

Whatever systems are put in place to allow for the greater sharing of information among a group of people, there will always be a need for those people to physically meet. If this is such a fundamental principle of group working, then it should also be a function of any Groupware system to not only allow this but to facilitate and organise it.

With release 4.5, Notes incorporated a calendaring and scheduling system where each user has a personal calendar as part of their mail database in which they keep track of their appointments (much as Lotus Organiser and other similar products did). But because each user's mail database is stored on the server, Notes can look into each of these and determine a free time schedule for each user on request, allowing for appointments to be scheduled (and rescheduled) electronically with a higher degree of attendance success being the likely outcome.

This free time analysis is not limited to people and each organisation has the capability within Notes to set up meeting rooms and resources which also have a calendar, so that meetings are set up without the chairperson having to check diaries of attendees and rooms manually.

3.7.11 Future Developments

Release 5 of Lotus Notes is due in the second quarter of 1999 and Lotus are planning to simultaneously stop any future development of alternatives, such as cc:Mail, with the intention that all users of these systems migrate to using Notes. For this reason most of the development has gone into making this an attractive prospect, developing the migration tools that will hopefully mean less user retraining for those deciding to stay with Lotus.

The other major development in this release are what are to be termed Knowledge Management systems [Information Week 1998], for instance K-Tools provide a series of systems to better leverage the knowledge that exists in the Notes environment, allowing users to search across multiple Notes databases and the Internet to find the information they require or hold whiteboard and chat sessions across the Notes system giving more synchronous collaboration than is currently possible. K-Apps are basic applications such as LearningSpace (distance learning) and ExpertNetWork (visual maps of user networks), and K-Services are consultancy offerings that aim to ease the development and deployment of these new solutions.

The biggest drawback of Notes is its current inability to provide real-time transfer of information between dispersed sites. With the introduction of these K-Tools it seems as though Lotus are trying to address this issue, and this will undoubtedly contribute to the continued growth and expansion of Notes as the leading Groupware product.

3.8 Lotus Notes Competitors

At this point it is pertinent to look at the major competitors in the Groupware market, for although the research is primarily dealing with Lotus, products from Microsoft, Novell and many others are beginning to make inroads, and this will obviously have an impact on the validity of the research findings.

Table 3.2 summarises the findings of study of the leading Groupware products carried out by Creative Networks Inc [1998].

	Lotus Notes 4.5	Microsoft Exchange 5.0	Novell Groupwise 5.1
Design Goal	Collaboration and document management with multiple “hard-coded” views of documents.	Communications infrastructure with heavy emphasis on e-mail.	Integrated infocomm architecture. Complete collaboration suite.
	Rich customised application development and process automation.		
Primary Value	Enterprise document sharing. Collaboration for horizontal applications such as field service and loan processing.	Ease of use. Integrated with desktop environment. Easy to administer.	Ease of use. Full functionality. Unique application mix. Directory architecture. Infrastructure integration.
Cost Advantage	Sharing of heterogeneous documents. Advanced replication.	Simplified management. Desktop application integration.	Application mix. Usability. Integration with NDS, Netware.
Architecture	Database. Cross platform.	Messaging. NT platform.	Hybrid infocomm. Netware-centric. Cross platform.

Table 3.2 - CNI report on the three main Groupware systems.

3.8.1 Microsoft Exchange

Exchange was originally released in February of 1995 as part of the Microsoft backoffice which fitted into the Windows NT server product, and has quickly risen in popularity as an enterprise messaging system, allowing users to utilise their own e-mail account from any suitable workstation in the organisation.

As a messaging system, the functionality of Exchange far exceeds that of Notes, but the main reason being that this is all that it does. It does not have the same functionality and scalability of Notes and any development which is needed in Exchange requires external processing in Visual Basic first of all.

To enhance the Groupware aspect of Exchange, Microsoft Outlook although being a completely separate stand-alone product, can be used in conjunction to provide the organisational capabilities (Group calendaring and scheduling) whilst utilising Exchange to provide the connection between users.

Exchange requires Windows NT as the operating platform, which may not be a disadvantage to many companies in the near future, unless the security issues which seem to be affecting this product become of major concern. Indeed the fact that it uses NT may in itself contribute to it's success in the Groupware market share, as the product will be given away as part of Windows NT5.

3.8.2 Novell Groupwise

Novell released the early versions of Groupwise as long ago as 1988, before Notes itself was released, however it only seems to be in the last few years that it has made any impact on the Groupware market.

For any company looking for a cheap, "out-of-the-box" Groupware product, allowing them to share their information quickly and easily between sites, then Groupwise presents probably the best alternative. Saatchi & Saatchi, the advertising company, have recently made the decision to implement Groupwise, primarily due to its low cost per seat (Network News [1998]).

However, for those users looking to do more with their Groupware product, Groupwise doesn't offer much in the way of a development environment and is very difficult to customise.

3.8.3 Focus of the Research

Although there are many competitors to Lotus Notes, the more successful of them do not offer the same level of functionality, although not necessarily in the same areas, i.e. Microsoft Exchange falls behind Notes in a different way than does Novell's Groupwise. Effectively Notes is the generic model of a Groupware system, of which all the others have taken sections and enhanced to provide their own solution. Therefore, the conclusions which will be drawn in this research apply to a generic model of a Groupware system, represented by Lotus Notes, and should be applicable in any instance, albeit to differing degrees.

3.9 The Perfect Solution ?

Lotus Notes seems to provide the answers to many of the problems involved in fully integrating a company and ensuring that the integration is as successful and comprehensive as possible. However, as with many systems, Notes is only a tool with which this can be accomplished and if the tool is not utilised to the best of its capability then any applications will be doomed to failure. Groupware also has many potential hazards outside of the development environment as it is a concept which is attempting to change the way in which groups of workers interact in a business environment, no longer will an individuals power come from the knowledge that he holds, as that knowledge is available to all, no longer can departments operate in isolation from all else, looking out for themselves, they must lay their work open to all for scrutiny and criticism. Grudin [1988] outlined the major external factors to the successful implementation of Groupware, even before Notes was developed and these have been echoed in later articles [Udell:1993, Thorne:1994, Brenner:1995, Prince:1995] at a time when Notes has become widely accepted by many large and small organisations. Once again it must be stressed that Notes is a tool, there is nothing that the Lotus developers can do to combat these constraints to a successful Groupware implementation.

Many of the external barriers to successful implementation reside in the users themselves, they do not want to share their information as they appear to lose a certain amount of their worth to the company, the new system requires more work of them and yet they do not receive a direct benefit from its use, or they often tailor their responses to group situations based on intuition and understanding of social issues (something that the computer cannot do unless explicitly told). There is no easy way around these problems and the designer of the application must be aware of them, and try and overcome them through user involvement and intuition before any design work is actually carried out.

But the designer can be as much at fault in promoting an unsuccessful application as can inadequately prepared users of the system. Many systems people who will become Notes experts will be systems analysts and developers who have a firm grounding in the principles involved in traditional database applications, what seems to be the problem with Groupware is that it is not a traditional database by any means, and it may actually be dangerous to apply the principles which have been built up by the designer over their previous years as a developer.

On a Notes developers course which the author attended, the tutor started off by asking who had developed database applications before using Access, Paradox and the like. There were a few of the class who raised their hands, to which the tutor replied, "Right, forget everything that you know about these systems".

It is also impossible for one designer to fully appreciate all the dynamics that will affect the user group for which he is building an application. It is the experience of the author that a prototype application works fine when testing it out, creating and manipulating documents in isolation and on one workstation. Problems immediately start occurring when the pilot application is launched to the user group as they all try and do things with the system that were not anticipated, and designed out, at the outset.

Prince [1995] in an article discussing Notes implementation stated that "If installed well, Notes can transform the way a company does business - neatly complementing, or even driving, the modern, flattened and open management style and dramatically improving that company's efficiency. But if installed poorly, the management process itself can become so costly and disruptive that the benefits are outweighed". He then went on to say that the implementation should adopt a "structured evolutionary approach, rather than a revolutionary one". More than any other systems solution, Groupware must fit the way that the organisation operates so that the take up of applications is easily achieved and rapidly results in the enormous benefits which are possible. It is almost impossible to change the operation of a business by introducing Groupware, but in saying that the full Groupware solution should comprise the initial streamlining of the processes, with a system like Notes then providing the software support for the revised working practices. Brenner [1995] sums this up by saying "If you want to reap the benefits of Notes that you've been promised, the first thing you need to do is put your own house in order."

3.10 Research Issues

In the field of Groupware, Lotus Notes has emerged as the clear forerunner, with over 4.5 million seats installed in a seven year period since its introduction in 1989, and a projected base of over 20 million seats within the next few years [Smith 1996]. Evaluating the major competitors to Notes, all other systems appear to have taken Notes as the generic blueprint of a successful Groupware solution and used selected functionality of this blueprint to define their own system. With this in mind the following text deals exclusively with Lotus Notes, and all the conclusions drawn are in reality only relevant to this software, although where other systems share similar functionality the conclusions are theoretically equally valid.

In this chapter the author has sought to reinforce the hypotheses presented in section 1.4, by demonstrating both the importance of Groupware and the necessity to have useful tools which will enable to greatest level of benefit to be realised from a flexible system which is open to virtually any interpretation that the user can imagine, viable or not.

- The main advantage of Lotus Notes over its competitors is the ease with which new applications can be developed. For this reason Notes comes as a blank sheet with virtually no guidance given on what route any development should take.

- A successful Groupware solution must be more than one or two standard applications, it must evolve into a set of useful applications which suit the individualities of the particular organisation.

- The biggest barrier to success is the people involved, if a new system requires twice the effort for half the productive output then not only will the application fail but the future of the entire Groupware system will be questionable.

- Early success can lead to different problems where users quickly see every business process as benefiting from the development of a Groupware application, leaving the development team with an overload on their available resources.

All of these points could be addressed if the developer were given a set of criteria (Reference Model) against which each potential application could be measured for suitability, and some direction (Design Guidelines) on how to begin the development. The limited resources of the development team could be focused on the areas that were likely to yield the greatest benefit with the least amount of pain, and the applications could be planned in such a way as to best accommodate the requirements of everyone involved.

CHAPTER 4

REVIEW OF LOTUS NOTES FUNCTIONALITY AND APPLICATION

4.0 REVIEW OF LOTUS NOTES FUNCTIONALITY AND APPLICATION

4.1 Introduction

In chapter 3, the author attempted to outline the evolutionary path of the emerging Groupware technologies, highlighting the basic functionality of the available systems and thereby trying to define the generic role which they are intended to perform in the workplace. This role being not to replace any of the existing software tools which have become commonplace, but to integrate them in a way which leverages improvements in group productivity rather than in individuals working in the partial isolation imposed by the PC environment.

No attempt was made at that point to try and prescribe the applications that should be transferred onto a Groupware platform, the reason being that the list of potential applications is almost limitless and will depend on an equally large number of dynamic factors specific to each individual company. Almost all of the literature relating to Lotus Notes contains some reference to the broad categories of applications which lend themselves to Groupware implementation, and contains a brief warning on those categories of applications which should be avoided.

Having examined the areas of a business to which Groupware applications are best suited, it is pertinent at this stage to investigate the validity of the conclusions drawn by looking at the implementation of Groupware in the 'real world'.

A report by the International Data Corporation [1994] looked at the implementation of Lotus Notes in more than 65 companies throughout the world, reporting primarily on the success of the applications in each case through financial return on investment. The findings of this report are summarised by the author, and related to the findings from the literature review, to give a broad indication of the 'ideal' Notes application.

The report only details the results of the financial analysis and does not look at the factors that led to either success of failure in each case. To try and establish some criteria for success, four brief application studies are presented

(Lloyd and Whitehead [1996]); looking at very different applications, which leads to a better understanding of the issues involved.

4.2 The Nature of Business Processes

With so much power and versatility at the hands of the Notes developer, it would seem that it could be used to support every activity within an organisation, with immediate and significant benefits readily available once users are given the application to use. However, the author has already stated that Notes is neither a relational database nor a transaction-based system, and consequently there are many activities that are unsuitable for Notes implementation.

The Lotus Notes Technical Overview [1994], makes the point that as a general rule, Notes should be used to support business processes, and the other office software tools available should be left to accommodate the requirements of the operational activities which occur within a business. This text also presents the fundamental differences between these processes, which are summarised in table 4.1.

This provides a very broad definition of what should and what shouldn't be considered as a potential Notes application, but it obviously leaves the question very open within each of these categories. This vague definition is probably the most appropriate situation, as it then leaves the users scope to develop applications which suit their particular processes, without the guiding hand of "Thou shalt not develop....". However many authors detail applications and processes that may be more suited to Notes development than others, and this represents a helpful guide, especially if it is the first Notes application within a company and the 'Champion' is looking for a "quick-win" development which will encourage the future widespread use and development of the Notes system as a whole.

	Features
Business Processes	Define and Co-ordinate the activity of people working collaboratively to perform a business process.
	Extended organisation, including customers and suppliers.
	Need to share, track and route many types of information.
	Focus on maintaining the integrity of the work process.
	Managing the information needed to support the business function.
Operational Activities	Capture and Analyse business transactions. e.g. Movement of stock items.
	Part of the 'back-office' operations.
	Maintaining integrity of data relationships. e.g. Order processing allocates stock.
	Focus on data.
	Consistent real-time transaction state. e.g. stock situation at any one point in time.

Table 4.1 - The characteristics of processes within industry

4.3 Typical Applications

Section 4.2 looked very briefly at the functionality required for business processes. Having identified the aspects of Notes which provide the greatest potential for the construction of a successful and powerful application, it is necessary to more closely define the types of business processes which utilise these facilities. Many authors of documentation related to Notes agree that there are five broad processes which are best suited to Notes, and these are discussed below.

Types of Business Process best suited to Lotus Notes	**Example of Notes Application**
Discussion	Brainstorming Feedback or Opinion Customer Support
Reference	Policies and Procedures Market Research Software Code Library
Broadcast	Industry Current Events Meeting Agendas / Minutes Newsletters
Tracking	Sales Account Histories Project Status Reports Employee Tracking Product Forecasts Service Tracking
Workflow	Conference Room Schedule Purchase Approval Travel Authorisation

Table 4.2 - Five main types of business application supported by Notes

4.3.1 Discussion Applications

The discussion applications represent the least complex of the classes of Notes applications, as they are only a short step up from the standard e-mail systems. Where they benefit over e-mail systems, is in the ability to allow true group communication without the need for the same message to be sent to all members of the defined group (limiting the access of potentially interested parties) and in the semi-structured storage of the discussion contents to allow everyone to pick up the thread of any topic simply by following the structured trail of the discussion documents within the database.

4.3.2 Reference Applications

With the introduction of formal systems to control quality, health and safety and personnel records, the number of reference manuals which exist in companies has rapidly increased. All of these have to be controlled to ensure that all the documents contained within are of the latest revision, and that replaced documents are destroyed by the manual holders. This is difficult enough in single site organisations, but where the same manual applies within a multi-site organisation or even in a large site, occupying a large surface area and many buildings, the problems of document control are increased tenfold.

By loading these manuals into a Notes database, the problems are eased considerably and holders only need to be given access to the relevant documents within the database. There is only one copy of the manual (replicas at other sites are controlled by the master copy) and so revision control of documents is no longer an issue.

Reference applications are by no means limited to the above examples, any item of information which potentially needs to be read by a large number of people within the organisation, could form the basis of a reference application.

4.3.3 Broadcast Applications

Such applications are very similar to reference applications, but where the latter provides a latent reference library of information which is only accessed as and when a user needs to find something out, broadcast applications actively transfer the information to all interested parties. The need for this electronic broadcast of the information is a result of the time-critical nature of the information, with a typical example being the dissemination of news articles throughout the business.

4.3.4 Tracking Applications

Within any company there will be numerous files holding a collection of information relating to customers, the orders they have placed, the contact address, any sales calls made, etc., thus providing a complete history of all the dealings the company has had with its customers. The basic format of these historical records will be duplicated throughout all aspects of the business, in purchasing, in personnel and so on. The histories will be continually updated as the daily business of the company continues, and many users will contribute items of information to the complete record.

This is the ideal application for Lotus Notes, bringing together information in a variety of formats, from a variety of users, whilst organising the details in a way which will suit the individual needs of anyone accessing the data. Virtually any system which builds up a history of transactions over time can be transferred into a Notes application.

4.3.5 Workflow Applications

The tracking application is simply a data dump where information from a variety of sources can be stored. The only action that is performed on documents within the system is to organise them into an output format which will allow meaningful reports to be generated. Where further processing is required on the contents of a document, typically an approval of the information, then the application falls into the realm of a workflow application.

This is the most complex of the types of applications suitable for Notes, both in terms of operation and design, as it involves the transferral of the entire business process into the system, including the automatic transfer of the information to those performing the next step in the process and any subsequent routing or storage of the documents within the system.

4.3.6 Usage and Benefits

A study published in 1995 by the Lotus Notes user group (Europe) summarised the current implementation of these types of Notes application and also asked each user to express their feelings as to which type of application represented the most benefit to the organisation. The results are summarised in tables 4.3 and 4.4 below.

Type of Application	Percentage of the 120 surveyed Companies using this type of application
Tracking	80%
Discussion	70%
Reference	70%
Workflow	30% to 40%
Broadcast	30% to 40%
Newsfeeds	30% to 40%

Table 4.3 - Application usage in 120 members of Lotus Notes User Group [1995]

Type of Application	Percentage of Users Expressing Benefit from type of application
Tracking	54%
Reference	39%
Discussion	38%
Workflow	27%

Table 4.4 - Most beneficial types of application : opinion of 120 members of Lotus Notes User Group

4.3.7 Alternatives to using Lotus Notes

The author has attempted to bring together the thoughts and feelings of Notes 'experts', to develop a model of the applications which are most suited to Notes implementation, and provide a justification of that implementation. However, it should be considered that Notes is not the only solution and there are many software tools and packages available that would allow a different, but probably just as adequate, solution to be derived. The following section expresses a very limited view of how the more traditional office products could fulfil the same role as Notes in any of the application types discussed above.

This is only a very limited view of the alternatives available, but it does serve to highlight the fact that the simple reference model presented above does not have sufficient detail to be an absolute definition of the ideal Notes application.

4.3.7.1 Reference Application

A reference application, in its simplest form, makes documents available to a wide audience whilst retaining control of the contents of the documents for the originator of the document. A PC/LAN file server is intended to store the collective files of all users within a company, directories can be created to organise those files in a way which makes it obvious where to look for the required information and security can be imposed to prevent unauthorised access or editing of the documents.

What Notes adds to the basic functionality is the ability to organise the information to suit the user, irrespective of any structure imposed by the creator of the documents concerned, the ability to identify the files by a meaningful label which is visible at all times, not just the eight character file names imposed by DOS, and the ability to allow display and access to files without the need for the user to have the relevant application package loaded onto their machine.

4.3.7.2 Discussion and Broadcast Applications

Electronic mail is the recognised standard for the transfer of information around a network, discussions occurring everyday as messages pass back and forth between users connected to the mail system, and general information being broadcast to a wider audience using bulletin boards.

Discussion via e-mail restricts access to the information to the direct recipients and anyone to whom the information is subsequently forwarded, a situation (as already discussed) which does not allow for the full exploration of issues surrounding the topic concerned. By using Notes, anyone with the appropriate level of access to the relevant databases are able to view the information, and also give their opinion.

E-mail is very versatile in the different file types which can be attached to messages and sent around the network, but there are disadvantages in this. All the recipients of the information receive a copy of the file, which has the potential to lead to everyone talking about different versions of the document, and in order to access the file the user needs to have the relevant application, or a conversion package, on their own PC. With Notes, the document exists once and is not physically transferred to the recipients of the message, it is the access rights to that document which they are given, therefore everyone on the system is always assured of accessing the correct revision of the document in question (with the obvious limitation imposed by replication frequency). As discussed in the reference application section (4.3.7.1), the Notes user does not require the specific package to view the contents of an attached file, and Notes acts as the conversion interface.

Bulletin boards on electronic mail packages give a forum for the widespread dissemination of information throughout the company, they can be set up to categorise the information in a relevant manner and the user is not required to read every message, they can simply pull the bits that they need. However, the categorisation is the same for every user of the system, and a meaningful placement of a particular message relies on the common understanding of terms within the entire organisation. The identification of the messages and the subsequent retrieval of the most relevant ones by the reader relies on the subject field of the message expressing as much information as possible without becoming confusingly lengthy.

Using Notes as a bulletin board theoretically allows each individual to organise the documents in a way which is meaningful to them, pulling out the contents of fields within a document to categorise information relating to their needs. By being able to pull out information from within the document, the same document may be identified in two completely different ways by two users. The inclusion of doclinks into documents makes the retrieval of information even easier with the user being led through related documents, instead of being required to search through a whole host of unsorted 'junk mail' to find relevant additional messages.

4.3.7.3 Tracking Applications

The information that is stored relating to a business process is traditionally held within a conventional database, allowing for very powerful retrieval routines to be used to produce reports and access the information within the database. However, these databases tend to impose a rigid format on the information which is contained, this facilitates the structured organisation of the data but it severely limits the information which can be stored, to that defined in the design of the database.

Consider a sales visit tracking application, the rigid structure of the traditional database does not easily allow for the salesman to record his impressions or feelings on the meeting and he must therefore hold a vast store of customer specific knowledge within his head. This is the basis on which relationships are built with the customers, but what happens when the salesman leaves the company, a entirely new relationship must be established. By being able to record 'trivial' details in a database, the relationship can be maintained at a certain level indefinitely, and it is through Notes virtually unlimited field lengths that this can be recorded in an organised manner. The stored data must be organised if it is to be useable at a later date.

4.4 Positioning the Application

Having identified the potential areas for the application of Notes, many companies will still be faced with several questions, the main consideration being the size of the application and the resultant number of people that will need to be involved in the process. Very often, the wrong positioning of an application can be the deciding factor in the success or failure of an application, or in the extreme case, in the success or failure of the entire Notes system.

A technical paper compiled by IDC [1994], examining the financial impact of Lotus Notes identified three levels of implementation possible for the system, each bringing its own benefits and hazards.

4.4.1 Discrete Applications

Discrete applications are those that affect only one process and a specific group of users. By limiting the scope of the initial implementation, it is easier to control the changeover process and assess the results which are obtained. Another reason for introducing Notes on a discrete level is that the manager in charge may not have the authority to alter the workings of other departments which are affected by extending the scope of the Notes system. The overall advantages of employing Notes in a discrete environment are :

- Costs and benefits are under the control of the originating business function.
- Current levels of IS resources are usually sufficient to provide support.
- The technology infrastructure can be upgraded incrementally.
- Training, support and maintenance requirements are manageable.
- The Notes experience can be studied and leveraged across other areas of the corporation.
- Return on Investment calculations are less complex and easier to explain.

4.4.2 Enterprise-wide Applications

Enterprise-wide implementation provides Notes to all employees within the organisation to create what is increasingly being termed the Intranet. Dumping Notes on the desk of every employee will not automatically create a synchronisation of the group effort of the company, but it does maximise the potential productivity of the entire organisation. Applications which could fall into this category are Mail databases, Corporate newsletters, Expenses forms and so on. The benefits from introducing such wide reaching, and subsequently less controllable applications can be summarised as :

- The establishment of a corporate memory.
- Ability to bring to bear the entire problem-solving resources of the corporation on a single problem.
- Provides a single standard for electronic communication throughout the entire organisation.
- Requires a corporate-wide commitment to be made in the form of upgrading the technology infrastructure and providing basic services such as training and support.
- Provides a new electronic culture which makes it easier for new employees to gain a sense of belonging.

4.4.3 Redefining the Enterprise

Redefining the enterprise introduces the concept of Notes as a form of Electronic Data Interchange (commonplace in today's banking industry), but for business information not accounting details. This level of implementation involves extending the boundaries of the organisation to encompass both the suppliers and customers of the business, providing the potential for true 'Groupware' applications (Most business processes involve some communication with people outside of the organisation).

- Communication overhead is sufficiently reduced between the companies so that both entities benefit from the more timely resolution of issues.
- Overhead associated with the tracking function is reduced.

- Business cycles are compressed due to more effective decision making, based on a more timely view of the same data at the participating companies.
- New areas of business opportunity are opened up.
- Increases mutual dependency and the convenience factor of doing business.

It is unlikely that a company implementing Notes for the first time will try for anything other than a discrete application, but that is not to say that this is impossible. Indeed many of the standard applications available are aimed at an enterprise wide solution, the electronic mail facility and the Internet connectivity tools.

Very often developers will be faced with applications that soon outgrow the realms of the discrete application, and yet do not quite attain the dimensions of the truly enterprise wide system, and it is clear that there are no hard and fast rules associated with the positioning of the application, it is merely one of many considerations in the assessment of the suitability of an application for Notes development.

4.5 Financial Impact of Lotus Notes on Business

Table 4.5, summarising the findings of the IDC report [1994], uses the classifications developed in this chapter to analyse the most successful types of process which have been converted to Lotus Notes. The conclusion as to the positioning of applications was drawn from this report and so this classification is easy to include into the summary, whereas the type of application is derived from a brief description and so may be slightly inaccurate, especially as most large applications are often a mix of various types, with Groupware there is no black and white definition.

		Type of Application						
		Disc.	Ref.	Broad cast	Tracking	Work flow		
Computer	Discrete		125%		194%	178%	166%	**205%**
	Enterprise-wide	338%		189%			264%	
	Redefining							
Construction	Discrete							**101%**
	Enterprise-wide							
	Redefining				101%		101%	
Finance	Discrete			16%	49%		33%	**39%**
	Enterprise-wide	52%	40%				46%	
	Redefining							
Government	Discrete							**85%**
	Enterprise-wide	124%			45%		85%	
	Redefining							
Healthcare	Discrete					300%	300%	**319%**
	Enterprise-wide							
	Redefining		337%				337%	
Insurance	Discrete		95%		108%		102%	**75%**
	Enterprise-wide	46%					46%	
	Redefining				49%		49%	
Manufacturing	Discrete	39%			210%	45%	98%	**83%**
	Enterprise-wide	46%			75%		61%	
	Redefining							
Non-profit	Discrete							**142%**
	Enterprise-wide							
	Redefining					142%	142%	
Process	Discrete							**79%**
	Enterprise-wide	20%	138%				79%	
	Redefining							
Publishing	Discrete							**466%**
	Enterprise-wide				730%		730%	
	Redefining				202%		202%	
Services	Discrete		108%		499%		304%	**287%**
	Enterprise-wide	196%		57%			126%	
	Redefining				578%		578%	
Telecom	Discrete		50%		97%		74%	**74%**
	Enterprise-wide							
	Redefining							
Transportation	Discrete			378%			378%	**378%**
	Enterprise-wide							
	Redefining							
Utility	Discrete			158%	320%		239%	**239%**
	Enterprise-wide							
	Redefining							
Discrete		39%	95%	184%	211%	174%	**Source : IDC**	
Enterprise-Wide		117%	89%	123%	283%		**Sample : 48**	
Redefining			337%		232%	142%		
		108%	**128%**	**160%**	**233%**	**166%**		

Table 4.5 - Findings of the IDC report : Financial Impact of Lotus Notes on Business [1994]
(Percentage values indicate Return On Investment achieved)

The analysis would appear to indicate that a Tracking application will produce the best Return on Investment, and the greatest advantage could be gained by introducing this on an enterprise-wide basis. Obviously, this statement is not entirely accurate, an enterprise-wide tracking application produced one of the lowest ROI's in the study when implemented in a Government institution. An equally inaccurate statement could be that Discussion applications should be avoided, particularly where they only affect a discrete section of the business, but some of the discussion applications investigated produced ROI's in excess of 120%, with the largest being 338% in one computer firm.

The reason for the failure of discussion applications in a discrete implementation could be in the fact that limiting the discussion group to a small number of people, effectively cuts off many potentially useful contributions from the discussion, a greater ROI would probably have resulted from a wider implementation. But without knowing the details of the applications concerned then this is pure conjecture, so many of the factors affecting a Notes application are not concerned with the code which is used or the functions which are included, but are more concerned with the way in which the group involved will accept the 'intrusion' of the new technology, and the way in which the application is implemented.

Looking at the types of industry involved in the study, the applications which were introduced into Computer companies seemed to consistently produce ROI's in excess of 100%, irrespective of the type of application or the positioning of it. One possible explanation is that employees of a computer firm are more willing to accept technology than others, and because of the relative immaturity of the industry, are more able to adapt to the concepts of closer collaboration than the old established industries such as the finance houses.

Again, these conclusions are pure conjecture, but the underlying theme in the development and implementation of Notes seems to be the involvement and acceptance of the users at an early stage, with the best applications being developed, not by third party 'code-cutters' , but by the employees of the business, the people who have the greatest knowledge of the process involved. Therefore in order to leverage the most benefit out of Groupware, a company's first task should probably be to train every employee in the development of Notes applications.

4.6 Transforming Organisations through Groupware

Lloyd and Whitehead [1996] have collected together more than 50 surveys on the industrial application of Lotus Notes, looking in more detail at some Notes implementations in a variety of industries, and a selection of these are presented here to try and illustrate the external factors which influence the success of a Groupware application. Table 4.6 gives a summary of the four applications presented and relates this to the text in sections 4.3 and 4.4.

	Type of application	Positioning	Success
GM Europe	Tracking Discussion	Enterprise-wide	Good
Intel Corp. (UK) Ltd	Discussion Reference	Enterprise-wide	Good
Cleer University	Tracking Reference Discussion	Discrete	Average
Ambouw BV	Reference Tracking	Enterprise-wide	Poor

Table 4.6 - Summary of presented application studies.

4.6.1 Application 1 : GM Europe

4.6.1.1 Background

In 1989, GM Europe (GME), the maker of Opel, Vauxhall and Bedford vehicles, found its spending on desktop computing was increasing dramatically. Senior managers did not feel that the return on investment justified this, and therefore asked EDS to undertake a study of GME's office automation environment. (EDS is an independent subsidiary of General Motors that specialises in computer consulting and systems integration.)

4.6.1.2 Reason For Implementation

The fact that GME was spending increasing amounts of money on desktop computing without comparable returns on investment let to an investigation by EDS. Out of this investigation came a prioritised list of remedial activities and projects. Number one on almost everybody's list was the ability to share data with colleagues in the same, similar or linked departments and especially the ability to do this as quickly as possible. This necessity led to a complete change from character-based computers, running MS-DOS, to a mouse-driven graphical user interface. Most desktop machines were Intel-based personal computers, so Microsoft Windows became the standard user interface.

Another outcome was the formation of an office automation (OA) board, representing GM and EDS office systems managers across Europe. The primary task of this was to monitor markets trends and make strategic decisions on the evolution of desktop tools.

4.6.1.3 Problem to Overcome

The OA board had already looked into information sharing within the company via e-mail. It was simply not sufficient to handle all the information, GM and EDS already had a combination of e-mail systems available, mainly host based and they were not helping users the way the OA board had envisaged.

As employees began to see the benefits of the Groupware systems being involved, they began to demand that it be installed in their offices too. The problem here was that in many instances there simply wasn't the infrastructure (Windows, servers, etc.) in place to support the program. The Groupware had become a victim of its own, almost overnight, success and EDS combated this by setting up a rigid implementation plan.

4.6.1.4 Success of the Groupware Application

For the most part, the major return that GME has seen has been qualitative, not quantitative.

- Groupware has increased the speed with which information could be shared.
- The improvements in quality of information have led to increases in the overall quality of service.
- Users' greater understanding of their own position within the company has increased their personal satisfaction.
- The previous point gives rise to improvements in the quality of users' work and, with it, GME's product.

Some of the decisions taken by EDS when they were brought in turned out to be critical for the later success of Groupware in GME :

- EDS introduced it as a solution to a problem, not because it was a nice tool. This largely eliminated the need to convince staff of it's worth.
- Senior managers made and endorsed the decision to introduce Groupware, ensured funds were available and gave a clear message to employees at all levels that they were committed to the system.

- A central team steered and co-ordinated the implementation after the initial pilot stage, ensuring a standardisation of approach, training, help desk availability and similar aspects.

The pilot system was put to use in GME's headquarters, in Zurich. It served 200 users, all of whom were GME top executives. These first users had access to some 'killer apps', applications that would be immediately useful. One of these was a restaurant menu and it was used to introduce the executives to Groupware. Once there, these executives could then search a range of other databases and so their introduction to Groupware was an easy, comfortable one.

4.6.2 Application 2 : Intel Corporation (UK) Ltd

4.6.2.1 Background

In 1993, microprocessor manufacturer Intel reported net revenues of $5.8 billion, had 26,000 employees worldwide and was one of the world's fastest growing companies. As part of its efforts to retain competitive advantage, the company introduced an efficiency improvement program in its sales and marketing operations. One aim of the programme, called 'Intelligence', was to reduce the existing proliferation of approaches to information technology used within the company.

Dene Isherwood, European Programme Manager at Intel at the time explains the problem:- "Intel is proud of the proportion of income it pumps back into the company, particularly in research and development and capital spending. This has been particularly true in our factories and our engineering offices. Yet we have made little use of personal computers in the business. Those employees who had them found it hard to share information because their colleagues were often using different applications software".

4.6.2.2 Reason For Implementation

Intel operates in a business environment where its operations are global and where customer service is a key issue. "We needed to get rid of the 'I'll get back to you' response to customers", says Mr. Isherwood. "In 1993, Intel decided to become a 'just in time' business, through the use of computer-supported collaboration". The overriding purpose of the efficiency improvement campaign, 'Intelligence', was to make it possible to share information around the organisation. The company saw certain issues as being fundamental to the successful implementation of a collaborative working strategy.

- The system had to cater for mobile workers, both those travelling with laptop or notebook computers and those who worked at home using desktop computers.

- The system had to be available to everyone who wanted to be part of it. Mr. Isherwood felt that such a system could only be useful if 100% of a group that needed it had access to it.

4.6.2.3 Problem to Overcome

Automatically scheduled replication of the databases across the world is carried out every two hours, using Intel's local and wide area networks. Information inputted in the European headquarters in Munich takes just six hours to filter around Europe and eight hours to reach the US and Japanese offices. Laptop and notebook computer users maintain replicated databases on their computers and initiate the replication program themselves. This proved to be a problem; "We needed to persuade these users to do updates regularly", says Dene Isherwood. "It's like brushing your teeth- do it once in the morning and once at night. If you leave it much longer the information to be transferred builds up rapidly". The processing power of the computers used in the system had to be sufficiently fast (and expensive) to take advantage of new developments, such as sending video clips over networks. They would also have to provide the sort of response times that people had become used to with their personal and home computers.

4.6.2.4 Success of the Groupware Application

According to Mr. Isherwood the successful take up of Groupware can be attributed to a number of reasons :

- Senior business managers drove the implementation top-down, rather than from an information systems department.
- The programme met with the warmest welcome in groups where people were not only enthusiastic about the new technology, but also had a genuine business need for it.
- The company provided thorough and appropriate training in the use of computer technology. This ensured staff understood their working environment and could maximise their value from it.

Discussion databases, which allow a wide participation in discussions on projects, proved to be particularly successful. The Northern Europe management team, for example, can work closely together through Groupware, despite being based in different countries. "These databases are successful", says Mr. Isherwood, "wherever there is a business need for cross-company discussion".

Dene Isherwood points out that the value of Groupware as a reference library is also often overlooked. In Intel, users can access technical information, and also product updates, customer information and competitive information. The diverse and often confidential information available within these databases calls for extensive use of the Groupware package's security features. Two years later, by which time Intel's revenues had reached $11.5 billion, you could look back and call Intel's programme a success.

4.6.3 Application 3 : Cleer University (pseudonym)

4.6.3.1 Background

Cleer University (CU) is a pseudonym for an institute of higher education in the Netherlands. It provides distance education which enables students to study when and where they prefer, at a pace they can choose themselves. One of the headquarters departments is the Pedagogical Technology Unit (PTU). This is a research and development department, whose primary task is to find solutions for teaching problems that Cleer University staff may encounter. The PTU designs and develops new course modules, develops modules for tests and examinations, and tests information technology infrastructures suitable to CU's educational purposes.

At the time of this case study there were 50 members of staff in the unit. Some of them spent most of their working time outside the office. There was a small management team, comprising a chairman with an executive committee and a secretariat. The rest of the staff were organised into project teams.

4.6.3.2 Reason For Implementation

In 1992, the PTU management team expressed the wish to gain insight into how information planning and management could serve the PTU and improve departmental communications. For this reason a pilot Groupware project was suggested, with the following aims :

- To find out whether the LAN could help in the supply of information.
- Does the proposed set of Groupware applications improve communications and information supply?
- Is Groupware suitable for enabling improved departmental communication?
- What obstacles and enablers would be encountered in the process of trying to improve departmental communication and information supply.

The applications the pilot would be used for would be to improve the 'tracking' aspects of the PTU (who did what, when, how and why?) and to allow people greater access to reports and various projects, etc.

4.6.3.3 Problem to Overcome

The Groupware program was given to 22 people, about half of the department. They came from four project teams, as well as the secretariat and the management team. Eighteen of them worked in the PTU office, two worked from another office and two worked from home. A larger group was not possible because the license for the Groupware did not permit this. Mr. Scone, a systems analyst charged with running the pilot, felt that this smaller number of users would decrease the value of the system.

Those who were using the pilot system were finding that they had to do work twice, once for their colleagues with the Groupware and then once again for those without. As the project continued, many people went back to their old, preferred ways of working, demonstrating that the users were satisfied with the system they had already in operation, the change to Groupware was not necessary in their minds.

4.6.3.4 Success of the Groupware Project

When the project is taken and considered just as a pilot exercise, it can be seen it was a success due to the important lessons that were learned, such as its improvement of information supply but not on communication. The Groupware applications supported information that was not important to users so these applications tended to be hardly ever used and they fell by the wayside. It was also the case that there was no responsibility on anyone to enter any new information into the system so hardly any new information appeared and this sped the demise of the reference applications.

It is still important to remember that the Pedagogical Technology Unit's project was primarily intended to be a learning experience. In light of this, the project was a success; a large number of important lessons were learned.

4.6.4 Application 4 : Ambouw BV

4.6.4.1 Background

Ambouw BV is a wholesaler of locks and hinges in the Netherlands. They buy their products from various manufacturers and sell them to retailers, who in turn sell them to their customers. Each customers' building that needs to be secured is treated as a separate project. The company employs 27 people, including the general manager, and is divided into the following departments:

Administration and Accounting
Computing Services
Secretariat
Public Relations and Marketing
Documentation
Purchasing
Sales
Sales Office
Key Workshop
Warehouse

These departments all report directly to the general manager. All employees work in one building. Everyone uses the same means for communication-meetings, telephone, paper memos and internal mail.

Everyone in the sales, marketing, purchasing and documentation departments, as well as the secretariat and the general manager are involved in customer projects. An important activity in these projects is the tracking of business contacts. With a frequency varying from occasionally to daily, everyone in this group of people needs to know what activities have been undertaken for which business contact. These departments together constitute the project work group and carry out a number of tasks such as gaining new customer projects (sales and marketing), buying products at the lowest possible price (purchasing), maintaining product brochures (documentation), handling correspondence and so on.

4.6.4.2 Reason For Implementation

The general manager of Ambouw BV set up a project which he started with the computer manager, Mr. Sweden. This project had four objectives:

1. Information concerning business contacts needed to be collected and stored in an efficient manner: This would be achieved by introducing one central system for sharing commonly needed information.
2. Improving co-operation between people from different departments.
3. Providing better support of daily operations.
4. Providing a software bridge for transferring information to and from the existing Ingres database.

4.6.4.3 Problem to Overcome.

The following bottlenecks existed in the business processes of the project work group before the Groupware project was initiated :

- Tracking business contacts:
  - required data about contacts was hard to retrieve from the existing paper files.
  - not all the data that was needed was in the files.
  - some data was stored in multiple locations, causing inconsistencies.
  - there was little insight into the composition of the collection of business contacts (manufacturers, retailers and customers).
- Managing documentation:
  - there was no clear record of what brochures had been sent to which customer.

- finding the right documentation took a lot of time.
- brochure stocks were uncontrolled.

- Putting forward proposals:
  - no overview existed of what proposals had been forwarded to which contract.
  - no procedures or rules were used for the follow-up on proposals made.
  - searching product/price combinations was a time-consuming activity.
  - proposals were not uniform in appearance or layout, neither was there any support for creating a proposal layout.
  - the routine of retrieving customer data and rewriting this data onto the proposal document was a tedious chore.

A further problem arose because, prior to the start of the Groupware project, only about half of Ambouw BV's employees had worked with computers, none had ever worked with graphical user interfaces on personal computers before.

4.6.4.4 Success of the Groupware Project

The bottlenecks that existed before the introduction of the Groupware project have not been removed, except for the bottlenecks in managing brochure stocks. From this point of view, the project was unsuccessful. Mr. Sweden felt that the following factors played their part in the generally disappointing results :

- The departure of the head of sales office who had been 'pro Groupware'.
- The hybrid composition of the pilot group, a mixture of staff from different departments, appeared to create two different ways of working among people in the same department. This eventually led to a decreased use of the Groupware.

- Technical problems encountered while trying to build a software bridge to the existing Ingres database during the design stage caused a certain amount of distrust in Groupware, which led to decreased use.

The cause of the poor results lies in the analysis phase of the project. Mr. Sweden had analysed what information about business contacts was lacking, but he never investigated how that information could be produced without causing additional work. It would also have been of help had the data been arranged by project rather than by contact. The artificial composition of the pilot group split natural work groups in two and this obstructed the adoption of new work methods, because the old methods had to remain in effect for the sake of nonusers.

4.7 Coleman's Criteria for Success

In section 4.3.7, the point was made that a simple list of the general types of application to which Notes was suited, did not represent a robust reference model which could be used as a guideline for the ideal system, mainly because of the obvious lack of detail that existed. Even when this basic model was expanded by incorporating ideas on the 'position' of the application, it still did not contain sufficient detail to fulfil this role.

This is highlighted in the results gained from the application studies, even where similar types of application where introduced at the same level within an organisation, the level of success achieved in each case varied considerably. Therefore there are obviously many factors which influence the success or failure of a Notes application, Coleman [1995] attempted to summarise these as a list of 20 criteria for the success of a Groupware application. This is presented in Table 4.7.

These criteria reiterate the statements made in section 3.9 that the biggest single obstacle to the success of a Notes application is the people who will have to use it. However, it is interesting to note that a fair percentage of the points raised in table 4.7 relate to the need to select the correct project to ensure that "any win is a big win", hinting that by doing so many of the criteria related more to personnel issues are satisfied with less effort.

1	Find a Groupware champion - the higher up the hierarchy, the better. By getting top management involved, they will see the benefits and give a lot more support.
2	Groupware changes the corporate culture - plan for it.
3	Pick a pilot project rather than trying to roll Groupware out to the whole organisation.
4	Pick a project with boundaries and a group that is supportive of both technology and innovation.
5	Pick a project with both visibility and financial impact if possible.
6	Realise that training, maintenance and support will be the majority of the cost, rather than the initial cost of the software alone.
7	Measure productivity factors before and after the project has started. This is a good way to cost justify Groupware.
8	Pick Groupware based on a specific business problem that needs to be solved and has not been solved successfully using traditional methods. Do not try to pick the Groupware and then try to find a problem to fit it.
9	Make sure that there is adequate planning, support, training and maintenance for the project.
10	No single Groupware project can do it all. Do not expect it to do so.
11	Don't expect software vendors to offer all the services needed for Groupware. May need to use internal people or consultants to ensure the project's success.
12	Groupware is not a quick fix. As part of a re-engineering effort, it may take two or four years to see the results.
13	Listen to people involved in the pilot project. They are the experts on what needs to be done and can often suggest ways to better the process.
14	Don't be afraid to make changes. A pilot project is an experiment. Learn as it goes on.
15	Make sure the software selected fits with existing systems. Try to offset the LAN investment by connecting to the mainframe or similar systems.
16	People cannot be changed overnight - be prepared for resistance.
17	People take time to change. Organisations can take even longer.
18	It takes courage to change a corporate culture. Applaud those who are willing to change.
19	Be careful about what is automated. There is no point in automating a very inefficient process as there will be no big productivity wins in it.
20	Groupware can be very political - make sure the win is a big win.

Table 4.7 - Coleman's 20 rules for Groupware success

4.8 Conclusion

The review of the available literature discussed in chapters 3 and 4 serves to validate the two initial research hypotheses presented in section 1.4.

1. *A Reference Model is required to determine the suitability of Groupware to address the needs of a defined business problem.*

The available literature states that Groupware should be used to support business processes and leave the operational activities to the software better suited to that function, the relational databases and so on. However this cannot be used as a reference model, in the context specified in chapter 2, as there are many business processes which will not be suited to Groupware.

But this basic premise does represent the main principle that a model should follow. Many authors have taken this to the next level and presented a list of five business process categories that are those best suited to the implementation of Notes.

- Discussion
- Reference
- Broadcast
- Tracking
- Workflow

However, subsequent examination of some of these application types in the 'real-world' reveals that it is not a simple case of selecting systems which fit into one or more of these groups and expecting the implementation of Notes to succeed. There are undoubtedly other factors which affect the success or failure of the applications, factors which could potentially be overcome by utilising a more detailed and rigorous selection process for the application to be developed.

From the results of the literature review a number of observations can be made regarding these other factors affecting the implementation of Groupware.

- A higher ROI was experienced where the users were more aware of new technology and the industry was relatively immature, they were more willing to accept the changes (and the nature of those changes) that adoption of Groupware systems require.

- The greatest benefit occurred where the users themselves designed and built the application, probably through a better understanding of the process leading to a more suitable solution, and the fact that the users had a higher level of ownership of the system.

- The success of a Groupware system as a whole is strongly related to the projects which are selected.

2. *A set of Design Guidelines are required to assist developers of Groupware systems with the planning, design and implementation of a particular application.*

Analysis of the application studies presented in section 4.6 indicates that the main reason for the poor performance of a system is the failure to plan the project with sufficient detail, leading to a lack of appreciation of the issues involved with this relatively new software tool. With more guidance on how to maximise the benefit of the application through identifying the possible problem areas at an early stage, and more information on how to overcome these problems, the applications presented may have reported a greater level of success.

3. *A generic Reference Model to determine the suitability of Groupware to address a business problem can be developed.*

What the discussion presented in this chapter gives is a starting point for the development of the reference model, for although it is by no means the full story, it does hold true for all potential applications and provides the fundamental premise on which the model should be based, any further points arising in chapter 5 being refinements to these principles. This leads to a basic specification of the required Reference Model.

- Develop a model of the 'ideal' Groupware application which could be used to indicate the suitability of a particular business process to implementation via Groupware.

- Define the model in such a way as to allow applications to be quickly and easily classified against the characteristics of a process which affect its suitability to Groupware, and provide a rapid identification of the level of fit to the defined ideal.

- Validate the developed model by identifying three suitable business processes and following the implementation of those applications to a point where the level of success can be determined in each case.

4. *Generic Design Guidelines to assist in the planning, design and implementation of a Groupware system can be developed.*

This specification also includes provision to develop some generic Design Guidelines.

- Utilise the design experience gained during the implementation of the case studies to determine basic Design Guidelines which could be used to overcome some of the aspects of a process which do not fit the concept of the 'ideal' application.

5. *A methodology can be written for the application of any developed Reference Model and Design Guidelines to ensure accuracy and confidence in the results obtained.*

As with any set of tools, the results obtained from their use will only be meaningful if the tools are used correctly to get to that point. The development and validation of the Reference Model and Design Guidelines provides the basics of a methodology which will ensure they are used correctly, by deriving the necessary sequential steps from the application of the two models in the case studies presented.

A review of the numerous Structured Systems Design Techniques and Business Process Mapping Tools (Yourdon et al. 1989) was performed as part of the research, but it is felt that the main objectives of the research do not require the incorporation of this information. With reference to a typical software design project (figure 4.1), the reference model represents the feasibility study for a suggested application, which used in conjunction with the design guidelines, used for planning the design stage, serves to highlight the areas where the Software Design Techniques should be employed to increase the chance of success of the application.

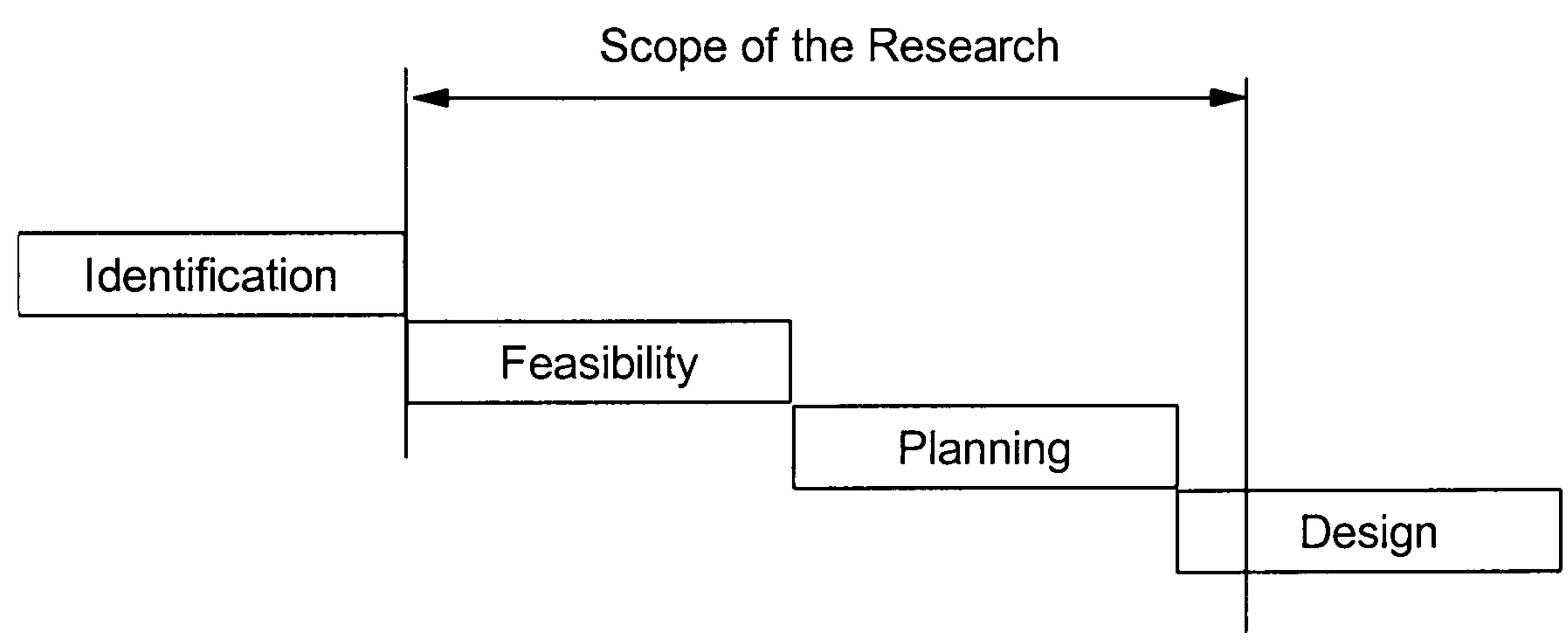


Figure 4.1 - Scope of research in relation to typical Systems Design project plan

CHAPTER 5

REFERENCE MODEL : WHEN TO IMPLEMENT GROUPWARE

5.0 REFERENCE MODEL : WHEN TO IMPLEMENT GROUPWARE

5.1 Introduction

Chapter 4 concluded that the existing references for the ideal Notes application were not presented in sufficient detail to allow the developer to determine the feasibility of a potential application with anything but the most basic level of confidence.

One of the hypotheses presented in this research leads onto the statement that to allow for this more rigorous analysis, the developed reference model must contain a greater level of detail and be presented in such a way that a potential application can be audited against the model, thereby increasing the level of confidence in the results. If the analyst is presented with a graphical representation of their application which highlights the degree of fit with the tool they are intending to use, then a decision is more easily reached and more strongly supported.

The reference model will be developed by expanding on the ideas presented in chapter 4 and relating this discussion back to the functionality of the software outlined in chapter 3, maintaining the basic idea of trying to define quantifiable measures in each case to facilitate the auditing of an application against the model.

5.2 Business Process vs. Operational Activity

The author has already stated that it is very difficult to arrive at a clear definition for Groupware and therefore equally difficult to state exactly what it should be used for. With a word processing package it is very easy, the system is intended to make the production and publication of written documents easier and quicker, a spreadsheet is mainly used for the processing of large amounts of numerical calculations as would be encountered in the accounting profession and so on. With Groupware there is no such definition, it is intended to be used to facilitate groups of people working together, the range of applications which this could encompass is virtually infinite.

One idea that has been put forward in section 4.2, is that it is much easier to define what Groupware shouldn't be used for as the necessary level of flexibility of the system has resulted in certain features not being supported. These features are mainly connected to operational activities and are :

- Capture and analysis of business transactions
- Maintaining the integrity of data relationships
- Providing a consistent real-time transaction state

5.2.1 Business Transactions

In most applications there will always be a certain degree of change in the information as the business process occurs, only in a few situations will the information remain the same once it has been created. For instance in a discussion application, once the main argument has been put forward then it will not change only be added to as others contribute to the discussion.

This represents one end of the spectrum where the information remains static, at the other end the information is always changing. If you walk into one of the popular catalogue shops just before Christmas then many operators will be accessing and updating stock records as shoppers select and purchase items from the catalogue. Groupware cannot support this level of transaction for a variety of reasons.

The main reason being that to allow for the level of collaboration and sharing of information that is necessary to facilitate the group processes that the system is intended for, documents which are opened by one user can also be opened by everyone else simultaneously as the record is not locked at any point. Not only does this apply to opening and reading the document, but to editing it as well. Theoretically, many users can edit the same document at the same time, although this can cause save conflicts to occur. Applying this to the example given above, one operator could call up the record of a particular catalogue item and determine that there are a certain number of items available in stock. They can then reduce the stock by the amount ordered and move on. However, if another operator called up the same record whilst the first transaction was still in progress then the stock figure would be in error. If they both edited the amounts and saved the document then a conflict would occur, stock records would quickly become meaningless and control of stock would be lost completely.

These two extremes in the rate of change of information can be represented as two ends of a scale, as shown in figure 5.1.

Figure 5.1 - Rate of Change of information

The scale could obviously be enhanced by including graduations between these two extremes, starting somewhere around 'Once every second' at the left hand end of the scale and moving all the way through to 'Once a year' at the right hand end. Where the actual intervals start doesn't really matter, the author only used the above examples as information changes in intervals less than a second for an operator controlled system would be virtually impossible therefore once a second is constant change, and information changing once a year represents a very static environment.

The rate of change of the information represents one of the characteristics of an application, and in order to allow for this to be audited against the reference model, values should be included on the scale developed in figure 5.1. As the scale is intended to represent a time dependant characteristic, it is very easy to assign graduations by using the standard time intervals.

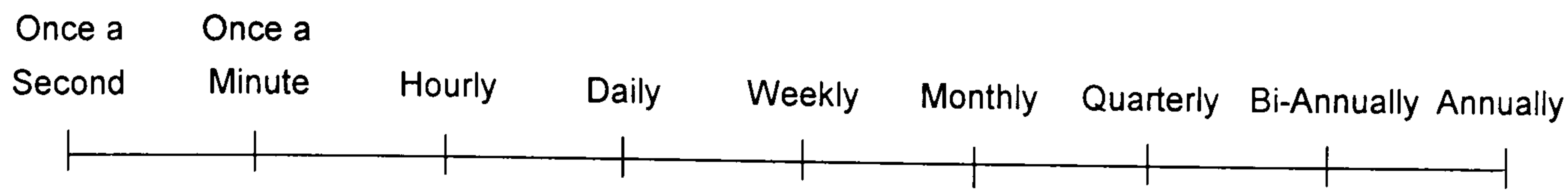


Figure 5.2 - Defined Scale for Rate of Change

The important concept is how the application being audited can be represented on the scale and more importantly where the break point is between a feasible application and an unfeasible one.

Any application will have a core of important information that is required to be correct at any time at which it is accessed by a user of the system, and it is therefore the rate of change of this information which will be analysed using the reference model. There can be no absolutes, even this core information will contain variations in the rate at which it changes, but it should be possible to make an intelligent assumption as to how the application can be classified onto the scale in figure 5.2.

The theoretical break point which represents a feasible/unfeasible split for the application is very difficult to define. As one could expect, there is actually no one point on the scale, rather the entire middle section of the scale is a grey area that the break could occur anywhere within. If the application is being used by only one person at a time, theoretically not the situation that will happen in the real-world with a Groupware application, then the information could change as often as is made possible by the speed of the hardware and software being used (Notes tends to be slower at opening and closing records especially where sophisticated formulas are used to control the display of information to individual users - i.e. this processing is performed each time the document is opened) without causing the data to become corrupted. As the number of users increases then the rate of change becomes more of a factor in the applicability to Notes, but again this is not an absolute, if the information can handle a certain amount of corruption or the actual readers of the information need updated information less frequently than the information changes then a higher rate of change could be acceptable.

The author will attempt to clarify some of these points in the later discussion, but what can be stated at this point is that an application which falls to the left hand end of the scale presented in figure 5.2 is less suited to the implementation of Notes than is one which falls at the right hand end. To allow for a more useable reference model to be built, this basic premise will be used to develop the other characteristic measures of an application.

5.2.2 Data Relationships

The example given in table 4.1 to illustrate this feature of operational activities was that of order processing. To take this one stage further, systems which deal with the processing of Manufacturing Resource Planning (MRPII) calculations need to relate many records together, looking at the sales orders on the system to determine demand, the stock records to obtain current availability, works orders and purchase orders to add to this future supply of the stock items and then bill of material records to determine what additional materials and processes are needed to make up the shortages in the stock item. This processing goes down through the levels of the bill of material, performing the same calculations at each level. This is accomplished by relating all the relevant records within the system to each other in some way, usually by using the stock item number as a key.

The relationships which exist in such systems are both numerous and multi-directional, in the respect that not only are works orders linked to sales orders because they are making the relevant stock item, but in a contract environment, they are raised to fulfil the requirements of a specific sales order, irrespective of the stock items involved.

The relationships which can be defined in Notes are restricted to a one-off unidirectional, hierarchical structure. A document can be created as a response to another and inherit specified values from that 'parent' document at the time of creation. Theoretically that is as far as the relationship can go, if the details of the parent change the response document is unaltered. Again this can be represented as two extremes of the relationship characteristic, as in figure 5.3.

Figure 5.3 - Information Relationships

It is much more difficult to define a suitable scale which could be used to allow for an application to be classified on the above scale, where the rate of change of information relates to intervals of time and is fairly easy to determine for the application under scrutiny, the relationships which occur in a process are not always as obvious.

Within the defined Notes framework, a simple two-way relationship would occur where the parent document in the hierarchical chain contains a summary of some item of information from the responses to it. The next level of relationship will exist where documents at the same level of the hierarchical structure need to be related, going on to the situation where different levels in the structure are sharing information to the point where information needs to be shared between documents in separate databases. The distinction between these classifications is represented in figure 5.4.

Figure 5.4 shows each subsequent relationship as a development of the previous one, however this may not be the case. Although the primary unidirectional relationship will always exist, whether information is inherited by the response document or not, the other levels can be a mix of any of the types specified, e.g. only a one way relationship between main documents in different databases may exist, sharing basic information to prevent duplication of effort at creation stage. Therefore it is very difficult to define a scale for the measure defined in figure 5.3, the basic structure of Notes databases would seem to preclude any but a unidirectional relationship, meaning that any application which does not fall at the extreme right of the scale cannot be developed in Notes.

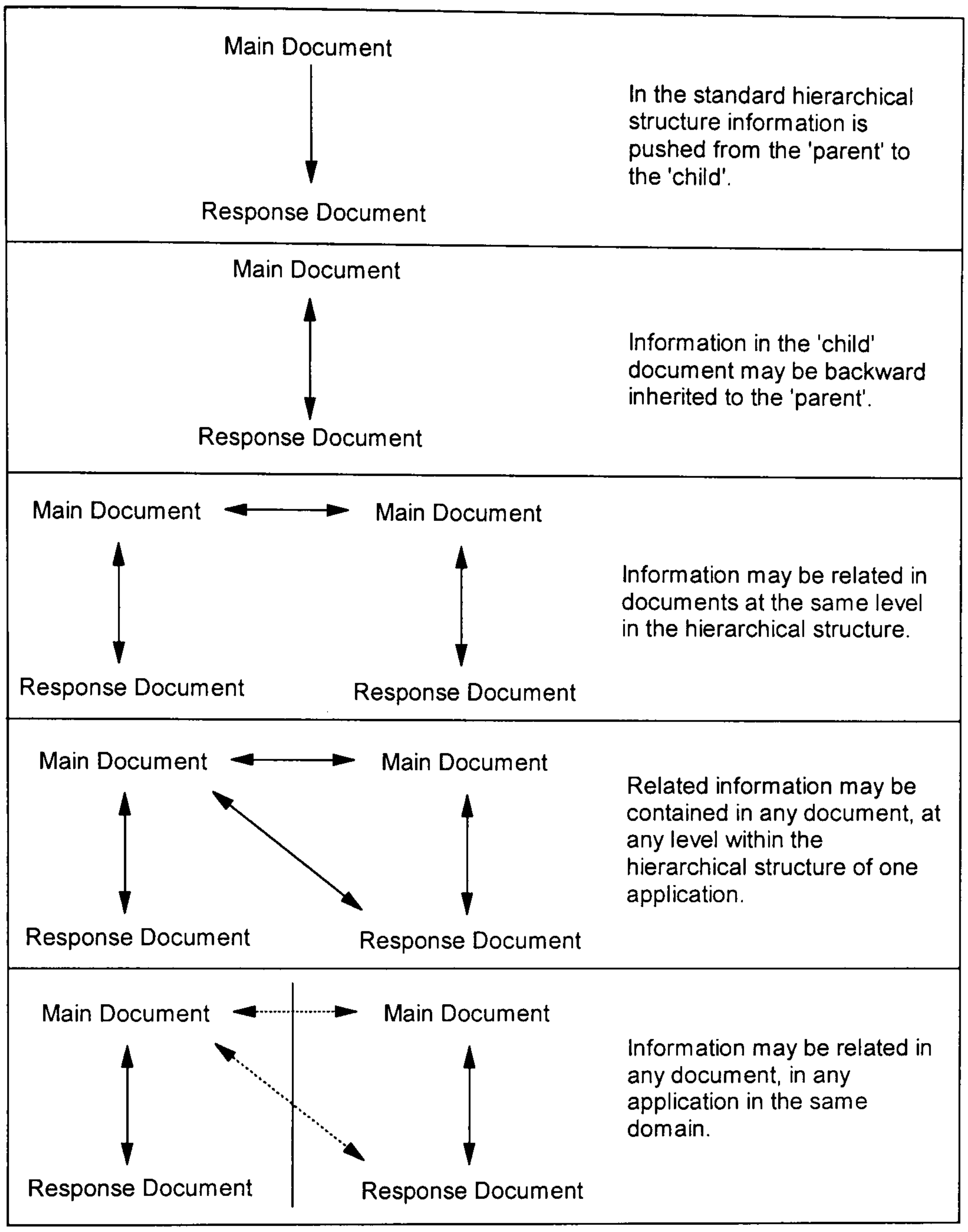


Figure 5.4 - Basic relationships possible within hierarchical structure of Notes databases

However, this would be very limiting and Notes does include some relational functionality to overcome the obstacles presented by the need to synchronise information in more than one record. This feature has to be designed into the application as routines which execute either at the command of the user or at predetermined intervals, and the more relationships that need to be established, the more complicated the design becomes, the more routines have to be run to keep information accurate and so the more likely the information is to become corrupt over time unless the designer has a full grasp of all the intricacies of the relationships involved.

Applications with some relationships that do not fit the ideal pattern for Notes should not therefore be discounted, there are tools available within the software to overcome the problems, but again the specific point at which this characteristic becomes too much for a Notes application to handle is not easily defined. For instance in a contact management application, the details of a large customer will be entered as a main document in the database and all the individual contacts within that particular organisation will be stored as responses to it. To facilitate a single point of reference for address and telephone numbers, these details will be inherited into the contact documents from the parent organisation document, a one-off unidirectional hierarchical relationship. But what if in the future the organisation changes its address or other similar detail, that change must be transferred into all the contact documents which exist below the main organisation detail. The frequency with which an organisation will change its address or telephone details is probably very small, and so the relational tools available to synchronise the contacts with the parent organisation could easily overcome this relationship problem.

The analysis of this characteristic in terms of the reference model is virtually twofold, firstly the number of different relationships which exist between the different forms (the basic templates for the records) within a database, and secondly the rate of change of the information which is related across these different forms.

The number of relationships that exist will affect the number of routines which have to be designed and run and the rate of change of the related information will affect the interval between subsequent runs of the defined routines. The acceptable level of processing which needs to occur within the application to keep all the information relationships intact and prevent the data from becoming corrupt, will define the break point to be used in the model, but it is more likely to be closer to the right hand end of the scale, as with many relationships and frequent changes the hardware on which the application resides or the users themselves will be forever activating the necessary routines and all the benefits of using Notes will be lost.

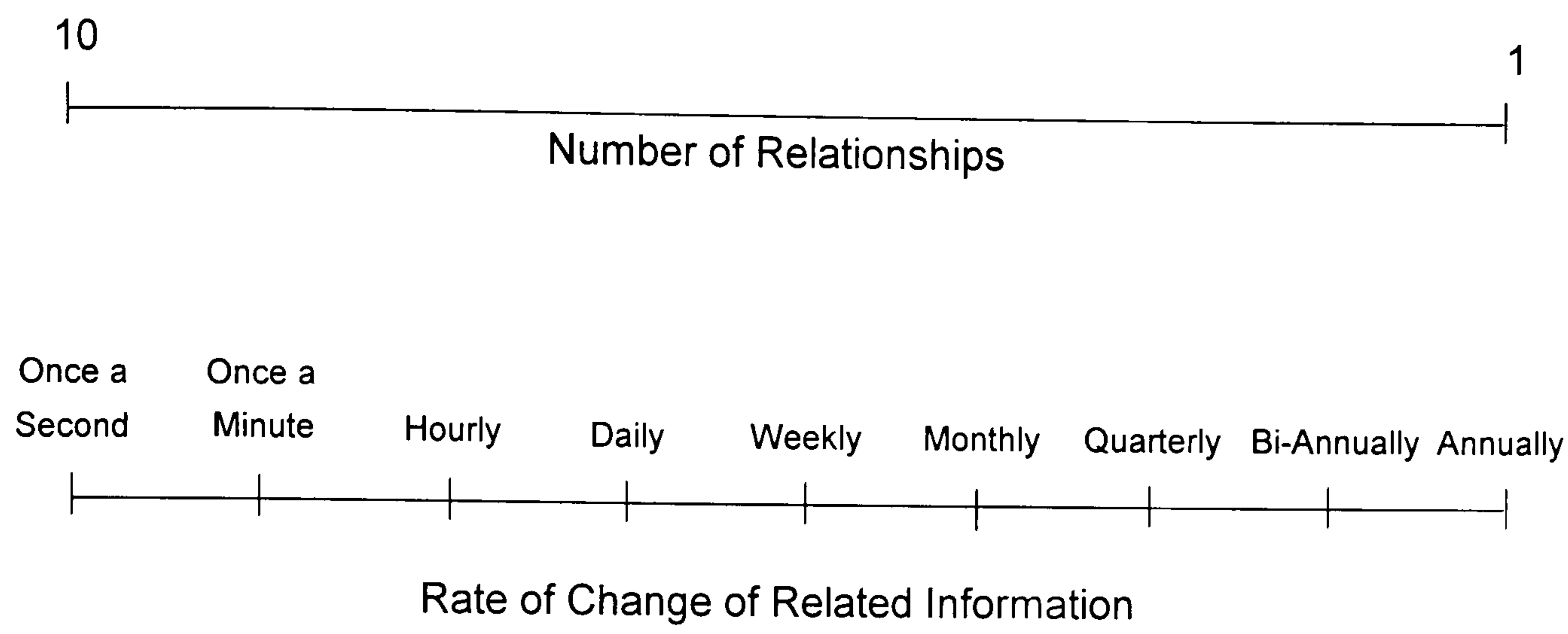


Figure 5.5 - Defined Scales for Information Relationships

In figure 5.5 the author has defined the extreme left hand end of the scale with a value of 10, implying that if there are 10 separate data relationships within an application then it is unsuitable for Notes development. This represents an arbitrary value, arrived at through an analysis of existing applications (Maclean et al. [1996]) which tried to simulate the functionality of relational databases.

One notable example was a system which attempted to reproduce, in a limited way, the functionality of an MRP system. The basic system required the control of contracts for the supply of finished goods, which involved the calling off of differing amounts of these items at various times throughout the life of the contract. These individual call-off documents were required to be recorded in the top level contract document as a rolling schedule by month and as a total quantity for the contract. Due to the nature of the business, material was often returned from a contract and this had to be related to both the original call-off and the contract, to keep a concise record of all transactions. The raw material to produce these items was always ordered to fulfil the requirements of the contract and the developed system contained functionality to allow this to be recorded and allocated against each contract. All of these transactions were finally required to be collated into a rolling material schedule to indicate where shortages were likely to occur.

The resultant number of different relationships which were required in the system to meet the requirements of the users was only around 7 or 8, but the data very quickly became corrupted because the relationships could not be kept synchronised in an efficient manner. The system was later scaled down, with some of the functionality being removed thereby reducing the number of relationships, and yet problems were still encountered in trying to keep the related data synchronised.

Further experience of systems development may well reveal that the defined scale could be altered, allowing more or less relationships to represent an unsuitable system, but the scale defined in figure 5.5 is considered to provide a good indication of the level of suitability of a process at this time. The extreme left hand end of the scale does not represent the maximum number of relationships that could occur in any system, rather an indication as to the point where Notes becomes an unsuitable solution.

The bottom scale of figure 5.5 acts as a control for the break point of the top scale, as the more frequently that the related information needs to be re-synchronised (the closer the analysis falls to the left hand end of the scale) the less relationships the system will comfortably handle. This theory of controlling factors can also be seen in the remaining development.

5.2.3 Real-time Transaction Status

The views within a Notes database can be a simple dump of all the documents within the database, sorted only by the date of creation, or they can be virtually unlimited in complexity, sorting documents on several columns, displaying information in columns that is the outcome of a complex formula, and limiting the information contained in the view through a detailed selection formula.

Each time a record is added to the database, and the views that contain that document are opened, the view must first be refreshed, at which point all the formulae are evaluated and all the sort criteria are reused to display the necessary information in the desired format. Because Notes provides client-server applications, these refreshing processes occur on the Notes server itself and not on the user's desktop. If there are many users on the system simultaneously, the time taken to rebuild the view will be lengthened considerably.

Where the information contained in an application is fairly static, the slow rebuild time of the views is not really an issue, although users may get a little frustrated at the time the system takes, the performance of the business process will not be affected. However, where information is needed quickly and is in a constant state of flux, the effects of rebuilding views will have a strong influence on the performance of the developed system.

Figure 5.6 - Response time required

The acceptable response time of an application will depend on the process involved. For instance a telephone help desk would require a fast response time so that customers are not kept waiting while the system rebuilds the information for the operator. Such a system will involve large amounts of data, but if there are only a few different views of this data then a Notes system would probably give an acceptable level of performance as it is only required to rebuild one of only a limited number of views when information changes. In this case the rate of change of core information should also be considered as a deciding factor in this issue, as the positioning of the application on figure 5.2 moves closer to the left hand end of the scale then the break point of acceptable response time moves further to the right. As the number of views that are used regularly increases then the response time will reduce, limiting the applicability of Notes to the situation, and again moving the break point towards the right hand side of the scale.

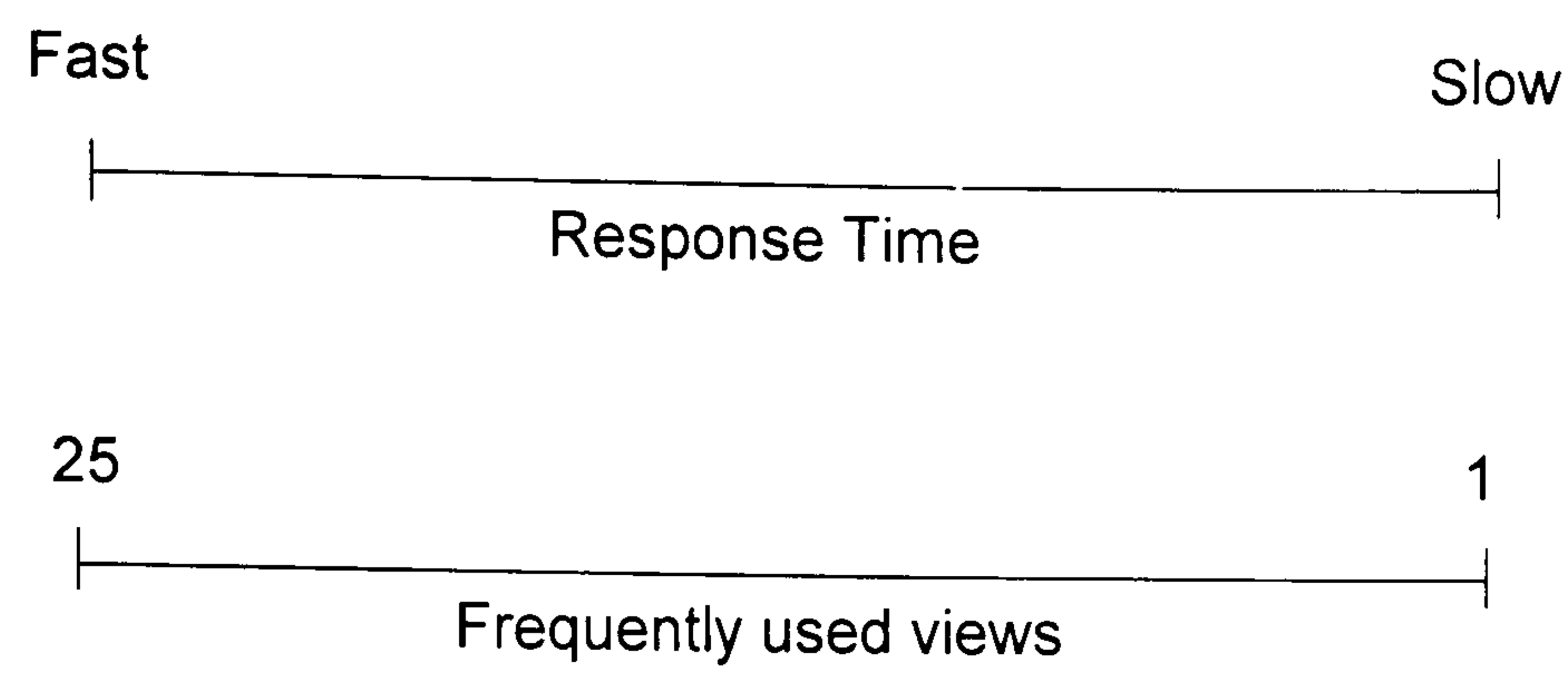


Figure 5.7 - Defined Scales for Response Time

The author has been involved with an application to control the Quality and Health & Safety documentation for an organisation which contains 42 different views of the various types of document contained within the database. Placing this on the defined scale in figure 5.7 would indicate that it is unsuitable for Notes implementation and yet it is probably the particular organisations most successful application. The reason for this is that although the QA Manager uses all the views contained within the application, he is not required to access them all on a regular basis, at most there are probably 5 views that are accessed regularly, all related to the control and tracking of outstanding items, such as document approvals, audits and outstanding incidents. If it were the case that all were used on a regular basis then the response time allowed by the system would be less acceptable, but it is still quicker than accessing the paper based records previously used for the same purpose. Therefore the defined scale should allow for a meaningful analysis of the application with regard to this characteristic.

The controlling factor for acceptable response times of the number of frequently accessed views of information relies on those views existing as standard options within the system. If there are to be many different ways to look at the information contained within the database but these cannot be defined at the design stage, then a further consideration is presented with regard to the access to the real-time transaction state of information.

The views which are used in Notes are very versatile in the information that they can contain, and the way in which that information can be represented. Virtually any field which is contained within a document can be displayed as a column in a view (Rich Text field contents being the exception), information can be categorised to group similar documents together, a response hierarchy can be displayed so that all responses to a main document are also grouped together, and a variety of formatting and colour options can be used to help the user find the information they are looking for, the most powerful of which being the identification of those documents which have not yet been read by the user.

The exact contents of a view, in terms of the documents that are accessible through it, are controlled via selection formulae, and each view can only have one selection formula. If a particular user wants to view only a selection of the documents then they must either

- go to the selection they require using the hot keys as the quickest way to find information, however if they want to isolate information within a sub-category, then this option is not available
- use the full text search index to try and isolate only those documents that they require, this requires a certain amount of programming knowledge and users may often get frustrated that the searches performed do not find the required documents without constant reiteration of the search criteria
- modify the design of the database, which requires designer access to change the view for everyone or design knowledge of how to create a private view based on the existing view format.

Therefore, without creating a lot of views of the same information to suit every query that users of the particular application might have, any system that will require a rapid response from "Show me the documents related to ..." queries outwith the scope of the included views is probably not ideally suited to development using Notes.

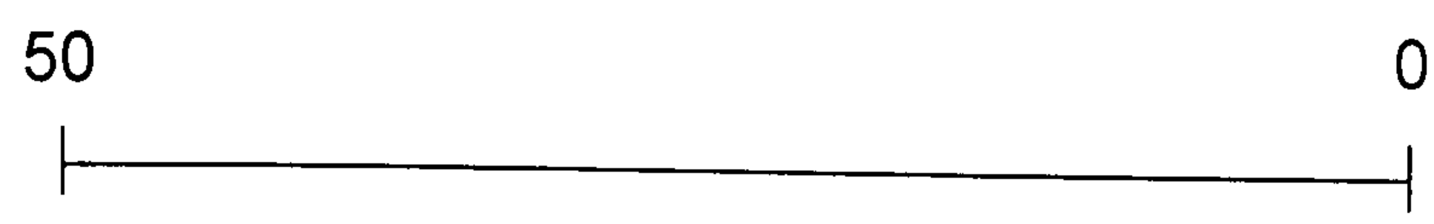


Figure 5.8 - Number of Ad Hoc Queries on the Information

Although related to the response time of the system, the more ad hoc queries required the slower the system will perform, this characteristic could stand alone as one of the controlling factors, the break point being determined by a combination of the design of the system (views could possibly be arranged to make the selection of a subset of information easier), the amount of information (a full text index obviously requires more processing power the larger the database becomes) and the user skill level (they could develop their own personal views of the information whenever necessary).

A requirement for a high number of ad hoc queries highlights the fact that the initial specification of the structure of the information may be insufficient to meet the requirements of the process, hence pointing the developer to an area where a greater degree of planning and design effort will be required. However, if an application will require a lot of design effort to accomplish a relatively simple task then it may be that another system would be better suited to providing a solution.

The values quoted on the scale in figure 5.8 are again taken from an investigation into existing applications, if the number of queries is less than around 15 then either the performance is not affected to a significant extent or the design effort required to better facilitate this requirement is negligible when viewed against the whole project. As this number increases both performance and design effort begin to become more significant and therefore affect the suitability of the application.

5.2.4 Corruption Sensitivity

All of the points discussed in the development of the reference model have in common the fact that they could result in a corruption of the data used within the application. If the information is frequently changed by many different people then it is likely to become corrupt over a short space of time, if many data relationships exist outside of the standard one way hierarchical structure then the designer is facing an uphill struggle to prevent the data becoming corrupt when the related data changes, and if access to the information is time-critical then the lengthy rebuilding of views, defined or not, could lead to wrong assumptions being made by the reader.

Therefore another controlling factor can be defined which should be used in conjunction with all the measures developed so far, that of corruption sensitivity.

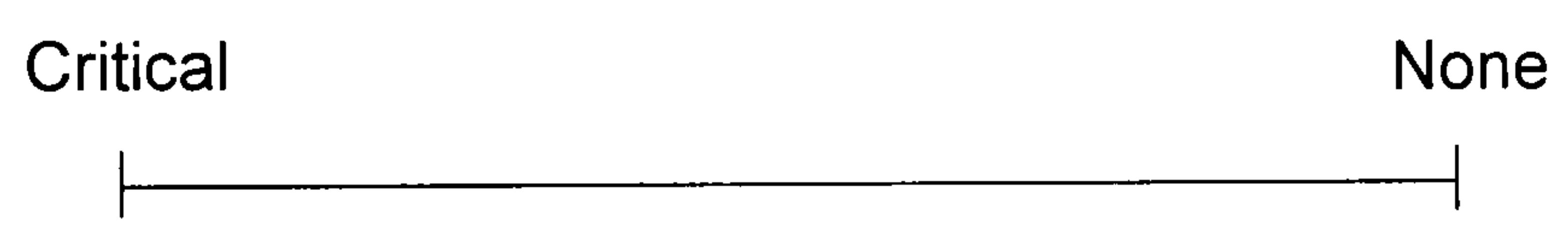


Figure 5.9 - Corruption Sensitivity

This represents the biggest single factor affecting the break point as to what is a suitable Notes application and what isn't, the closer to the left of the scale that the analysis places the application being audited, the further to the right are pushed the feasibility break points on the scales defined so far. However, it is very difficult to determine the corruption sensitivity of the information, many people will feel that data should not be allowed to become corrupted at all. The argument presented here is that all data has the potential to become corrupt at some point, but most multi-user systems are designed to prevent that as much as possible. With the flexibility inherent in Notes this is much harder to achieve, but by linking this factor to the others above a measure can be determined as to how long the system has to address the corruption before it becomes a significant failing in the system.

5.3 Notes Functionality

So far the discussion has looked at those aspects of an application which will have adverse effects on the feasibility of using Notes to transfer the process into electronic format, but there are also aspects of an application which the inherent functionality of Notes will better suit. As stated in chapter 3, the Groupware paradigm evolved through a deficiency in the current technology to address certain issues.

5.3.1 Structure of the Information

A document within Notes can contain as much or as little structured information as is necessary to fulfil the requirements of the business process. All the fields could be of a defined type and length, and require one of a range of values to be entered or no fields could be defined, allowing the user to enter anything at all into the document, including files created using different applications. For instance a discussion application may have one field which is used to categorise the document into a certain topic category, and then allow the user to enter any detail that they want. More traditional database applications are not as flexible in the format of information that they can handle, and may therefore be unfeasible for certain applications.

To express this in the same terms as the previously defined controls for the reference model would therefore be inaccurate, there are still two extremes to the characteristic being discussed, but the use of Notes is not excluded from either end of the scale, rather the further to the right that the potential application is positioned in figure 5.10, the more benefit that will be gained from using Notes and the less likely it is that another application will be able to provide the necessary functionality to cope with the level of unstructured information to be recorded.

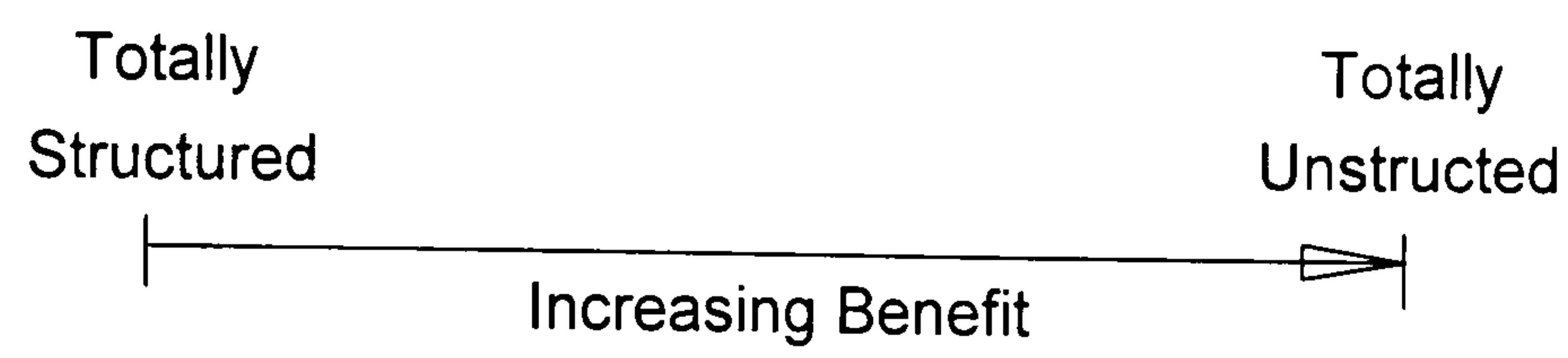


Figure 5.10 - Structure of the Information

As well as providing an indication of the benefits that will be gained from using Notes for the application, this measure also has an effect on the controls developed in section 5.2. For instance, the more structured the data that will reside in the application, presumably the more sensitive it will be to corruption, therefore moving the feasibility break point towards the right hand end of the scale.

5.3.2 Replication

The main advantage that Notes has over other systems is the replication facility, the ability to synchronise widely dispersed copies of a database as a background operation. Taking this in the context of increasing benefits, any application which shares the information between multiple copies of the database residing on different servers becomes almost exclusively suited to Notes.

This is not limited to multiple sites of the same organisation, nor to simple server-to-server replication. If the organisation wants to share its information with customers or suppliers than Notes provides a very useful tool to do that, all the external body needs is a replica copy of the database. The actual replication can occur over a dedicated telephone line or over an existing Internet connection, requiring little in the way of extra cost to either party. The replication facility also allows remote users to access the latest information whilst out of the office, information not limited to simple e-mail as may be the case with other systems, but any database can be transferred wholly or in part onto a remote users machine using a simple modem connection.

However, if the scale developed to incorporate this feature into the reference model were a simple representation of the number of locations that need to share the information, then any assumptions made could be slightly in error. If the application involves two locations that are server based and likely to be accessed by more than one person at that location then the benefits of using Notes are greater than if the two locations are one server copy and one remote user. Therefore, having defined a scale to include this in the reference model (figure 5.11), the analyst should mark three points on the scale, one for the number of servers, one for the number of remote users and one for the number of external organisations (where applicable).

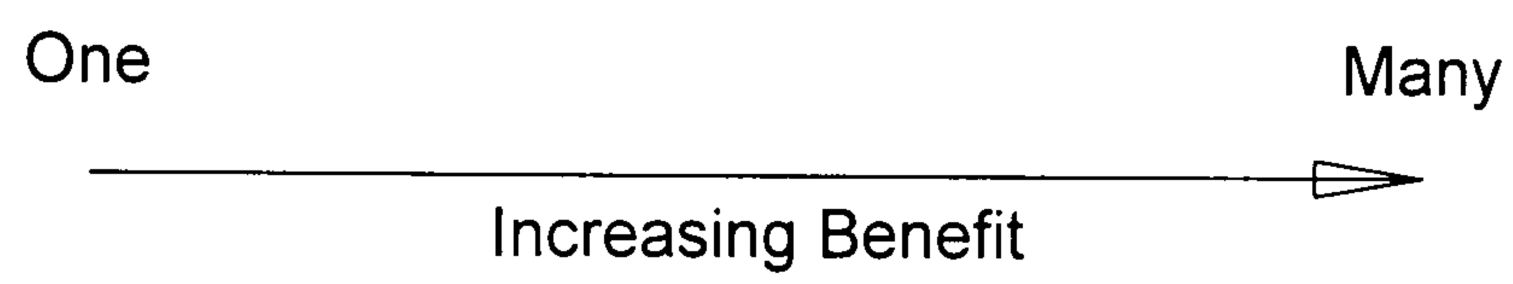


Figure 5.11 - Number of Locations

As this scale is intended to show that a higher number will potentially return a greater benefit from the use of Notes then there is no maximum number that can be placed at the right hand end of the scale, indeed smaller organisations will tend to place a small number of locations further to the right of the scale than would a larger organisation because of what this represents to them. Another problem with defining numerical values to be used for this scale is in the fact that an application with a high number of remote users could produce less benefit than one which involves only a small number of servers. Each server could be accessed by a thousand users and the potential audience is then increased a thousand-fold for each server involved whereas a remote user only adds one to the audience figure each time. By the same token, an organisation may gain more benefit from allowing one external organisation to contribute to the group process than it would by allowing every one of its own sites to contribute.

A better scale would therefore show the number of servers, remote users and external organisations that will use the application concerned, in relation to the total number of servers, remote users and external organisations that are available to the business, and could therefore be expressed as a percentage. This would then be valid irrespective of the size of the organisation, or the type of location being assessed.

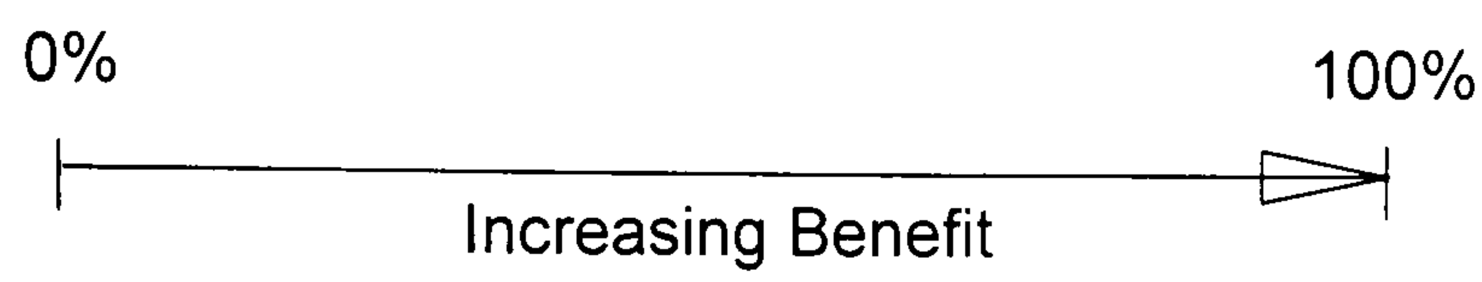


Figure 5.12 - Percentage of Locations involved with the Application

As with the issue of structure in the information, the fact that only one location is involved does not prevent the application from being implemented using Notes, many applications will only ever involve one location (Discrete - section 4.4.1). Perhaps a better measure would be the number of users who would require access to the system, provided that some definition could be made between the locations of all these users, as two users at different sites would represent more of a benefit from being able to share ideas electronically than two people working in the same office.

The number of sites involved could also represent a limiting factor to the application, as the replication process has to occur over a telephone line at some point and therefore a trade off is made between the cost of the calls and the frequency with which the replication occurs. Therefore the feasibility break point for rate of information change occurs at the longest interval specified for the replication process to occur. This is more critical where remote users are involved as the synchronisation of databases is not a controlled process but occurs only when instigated by the remote user.

5.3.3 Data Sharing

The fact that a Groupware system is being considered at all implies that there is a certain amount of data sharing in the application. With the seamless integration of e-mail in Notes the benefits of data sharing are increased where it is required to be shared between users in a controlled manner, a workflow application.

Every document which exists in an organisation, potentially has some item of information which is of relevance to someone other than the holder of the document, a situation which traditionally required that information to be copied and transferred physically, or transferred to an electronic media and mailed to those interested. Notes as a package is aimed at facilitating this transfer of information between the interested parties and therefore, by necessity, contains tools that make workflow applications one of the most powerful areas for development.

Workflow can be taken to mean several things, it can be applied to the simple mailing of information to interested parties, to the transferral of a document to another person who performs the next stage in the business process (approval databases provide the best examples of this type of application), to the posting of a to-do list to any employee who has been given an action based on the contents of a particular document. All this moving of information can be inherent in the design, with the work-flow being seamless and transparent to the actual users of the database. The case study presented in chapter 7 represents such a system, moving documents back and forth between several departments (regulating the access at each stage), but only requiring the users to edit information within the document.

Workflow is a very open definition within Notes applications, the 'doclinks' are used to reduce the redundant information which is transferred around the system. A mail message need only contain a summary of the details and an associated doclink, which upon opening will lead the user to the relevant document containing those details. Notes wins over traditional electronic mail systems in the fact that it is not only the recipients of the information that can have access to the details contained in the message, but anyone with the appropriate access to the database can also see the information. However, if the messages being transferred were long and involved, only having slight relevance to those not directly involved in the process, then they are unlikely to plough through the information. By having the information in the message summarised and including a doclink, the requirements of both types of reader are served, and the collaboration which is likely to occur is significantly increased.

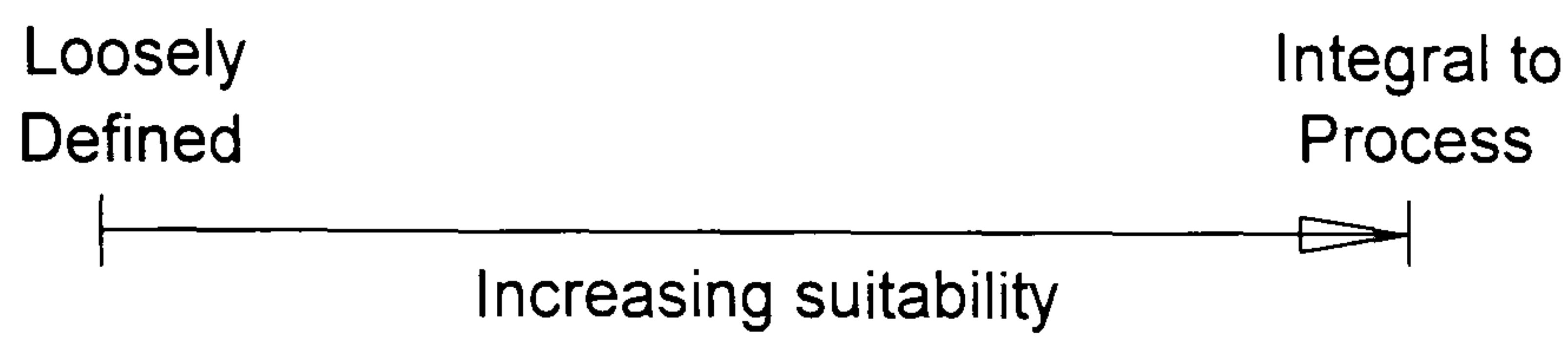


Figure 5.13 - Data Sharing

Where the inclusion of a large amount of workflow within the application may cause problems is where multiple sites are involved and the workflow takes the form of an approval cycle for time critical issues. For instance, if the company QA manual (to ISO9000) is automated using Notes then the approval cycle for policies and procedures would be the essential part of the workflow processing within the application. If the approver of the document were located at a different site (company headquarters) then even if they received the message (mail routing occurs immediately not on the same frequency as the replication process), they could do nothing with it until the replication brought the databases back into synchronisation, allowing them access to the document concerned. The same delay would occur for the approved document going back to the originating company. The above example involves information which is not particularly time critical, a delay of a day in the approval of a quality procedure should not cause any great problems within the system, however there may be other systems where this delay does cause problems, and this should be considered when auditing the application. The time critical nature of the information can be surmised from the rate of change of the core information and the response time required from the system.

5.4 Other Considerations

All of the points discussed above are related to the operational characteristics of the process, the nature of the data it will contain, the number of users involved and the way the information will be utilised by those users. There are also other factors which may make the use of Notes more or less feasible for the application under scrutiny.

5.4.1 Process Re-Engineering

It is very easy to utilise the design tools for Notes forms and views to develop an application very quickly. On top of that, the Notes system provides a selection of standard templates which can be modified and used to fulfil the identified business need. The ease with which the design of a database is built means that even dedicated applications can be quickly modified to incorporate the needs of a slightly different area within the business.

All this means that, with Notes, a large team of developers, working for several days, are not required, even for some of the more complex applications of which the system is capable. Indeed, the ideal situation, when Notes has been implemented and seen to provide significant benefit, is to have the users of the system develop small applications to automate as many of their tasks as possible, as is the case in Triangle (Brenner [1995]).

The consequence of this capability being that virtually any application can be developed, with the effects of failure being only the loss of a couple of hours rather than several days of expensive developer time. Obviously, the larger applications will still require a certain amount of 'expert' development, to realise the full potential inherent in larger groups, but a lot of quickly developed applications may well pay for the system anyway.

Where this Rapid Application Development capability may affect an individual application is in the amount of inevitable re-engineering that will be needed once the application is released for testing and initial use. With a dedicated system that has taken many developers a long time to design, the process specification must be as fully defined as possible before the development is started. With Notes this is not the case, it is very easy to modify the design after it has been released, leading to a system which will better suit the users and therefore promote better take up of the application.

Translating this into the graphical reference model results in figure 5.14, highlighting the fact that Notes can handle any level of process definition but becomes a more attractive prospect over other systems when there is likely to be a degree of re-engineering required.

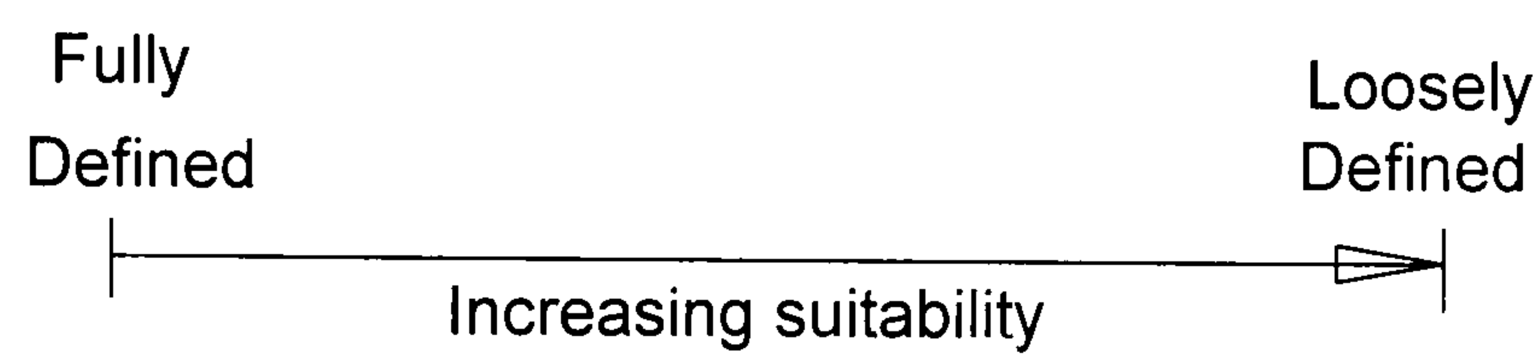


Figure 5.14 - Process Definition

5.4.2 Number of Existing Applications

The first application to be implemented within a company will be the hardest to justify, as the Notes champion will be looking for that 'killer' application that will impress as many people as possible with the potential capabilities that are available with the system. After this initiation of the users into the power of Notes, the range of applications will usually grow out from this core, and the justification of these applications will become easier and easier.

Many existing applications in industry today are multiple database applications, but they probably started out from a single database, with users themselves suggesting ways in which the systems could be extended to facilitate more of the process. However, as an application encompasses more and more databases within its boundaries, the potential headaches for the administration of these become heavier, especially where the application is replicated to many servers. Ensuring that every user of the application has access to all the necessary information for lookups and doclinks, and ensuring that they have the current replica will be a never ending task, unless the system has been developed in an organised way to extend its functionality.

Therefore, suggested applications that extend the capabilities of existing systems are not as ideal as they might at first appear, and the owners of the process should avoid 'bolting on' every small piece of Notes code that is suggested.

The implication is that there is a better chance of the application succeeding the more existing applications there are, but that this must be tempered against the fact that more administration will be required as the number of applications grows. Translating this into graphical format gives figure 5.15.

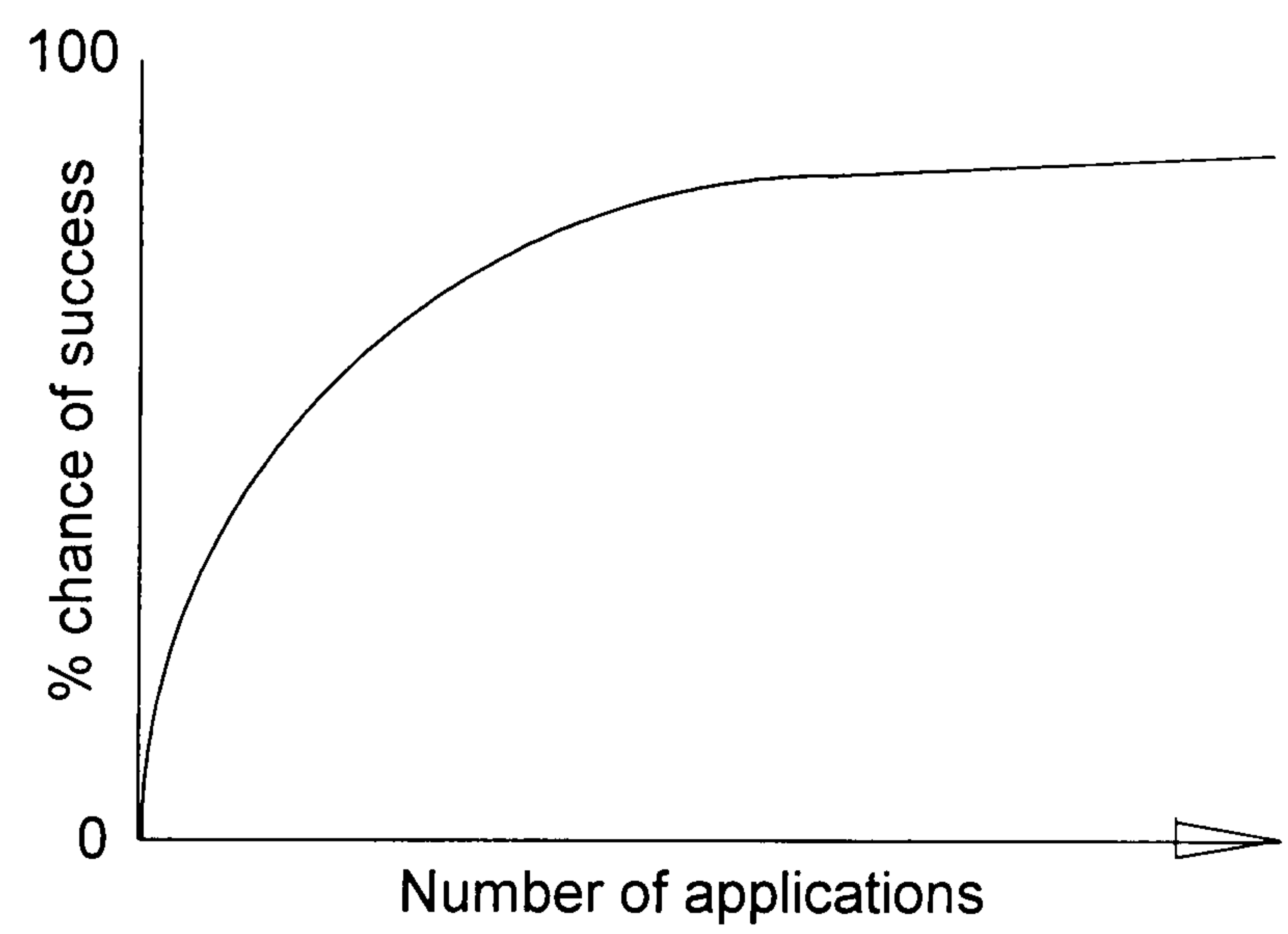


Figure 5.15 - Affect of the Number of Existing Applications on the % Chance of Success of a new Application.

Any defined scale to allow this measure to be included in the reference model must take this into account, in essence reflecting a logarithmic scale. A further problem occurs in assigning values to this scale, different sizes of organisations are likely to have different perceptions of what represents a large number of applications. One medium sized organisation investigated by the author had 11 servers situated around the world, which contained approximately 25 active applications 3 years after introducing Notes, with this number unlikely to grow significantly in the near future. However, provided that a new application was suited to Notes in relation to the other characteristics of the process, the chance of success was fairly high, due in some part to the fact that users were very familiar with Notes as a system.

This leads to the defined scale given in figure 5.16, however it should be noted that an increasing amount of existing applications does not automatically generate an increasing likelihood of success, many other factors which affect this have already been discussed in chapters 3 and 4, but it is the reported experience that with more successful applications already implemented within an organisation, some of the barriers to success are removed. One other point relating to figure 5.16 is that there is no end point, the scale can continue growing indefinitely although it is unlikely that any size of organisation will have thousands of separate business processes that can be automated using Notes.

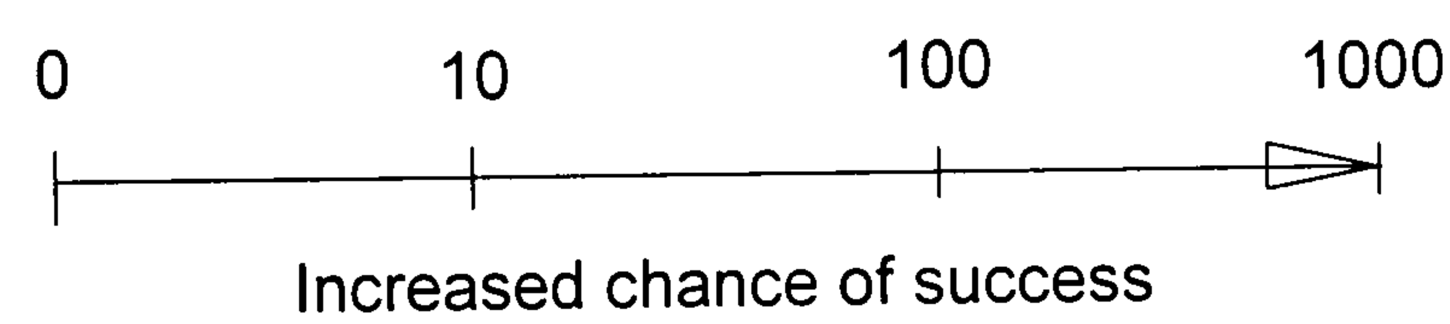


Figure 5.16 - Number of Existing Applications

5.5 Developed Reference Model

Collecting all of the discussion above together gives the developed Reference Model shown in figure 5.17.

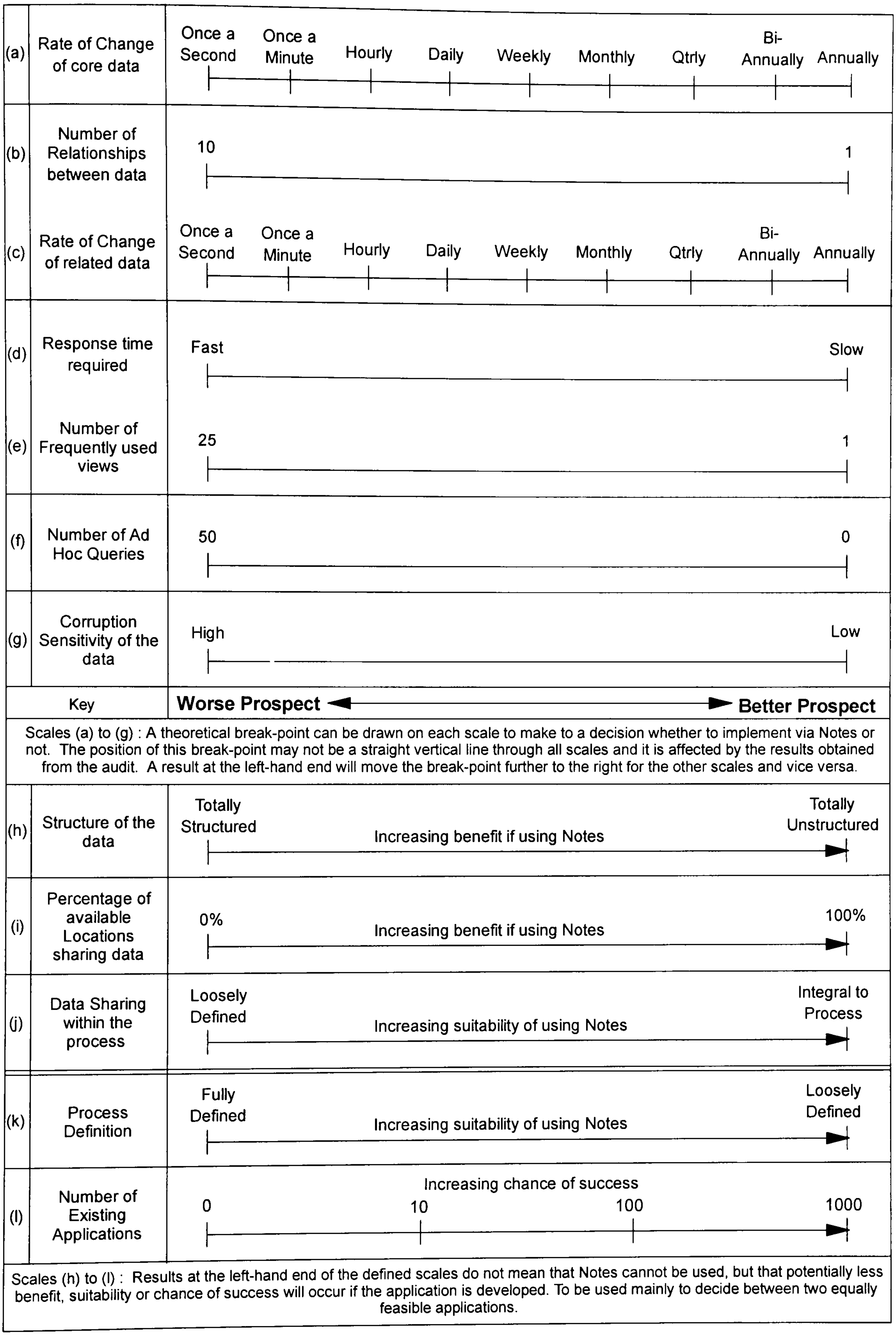


Figure 5.17 - Developed Reference Model

5.5.1 Audit Methodology

The reference model has been developed in a graphical format to facilitate the auditing of an application in such a way as to arrive at a decision as to whether or not to try and implement Notes to automate the process.

Any difficulty experienced in the audit process will be in classifying the characteristics of the specific application and assigning a value which places them at an appropriate point on the defined scale. It is often not until the design process is under way that a great many of these issues will be fully realised, but it could be argued that if the fundamentals of the application, when audited against the reference model, reveal that the application is not suitable for implementation then it is doubtful that any further detail added to the basic specification will change this result.

The actual decision as to whether an application is suitable for Notes implementation could also cause problems as there can be no defined point on any of the scales that represent the distinction between a yes or no decision. What is clear is that this point can be anywhere on the scale and each characteristic will be affected to a degree by all the other aspects of the system, no one scale can be examined in isolation to provide an answer. In general however, an audit which results in many of the characteristics being positioned towards the left hand side of the various scales will indicate that the application is not suited to implementation by Notes and another solution must be found. With many of the controlling factors being positioned towards the right hand end of the scale, the other factors relating to increase in the benefits expected and suitability will tend to indicate the level of success expected.

If the audit process reveals that one measure is positioned more towards the left of a particular scale, and all the others are towards the right, it may be feasible to implement the application. However for scales (a) - (g), the extreme left hand end of the scale represents a virtually absolute 'no', therefore any of these measures which fall on the negative side of a defined break point for a feasible application will have more of an impact on the decision that those that fall on the positive side.

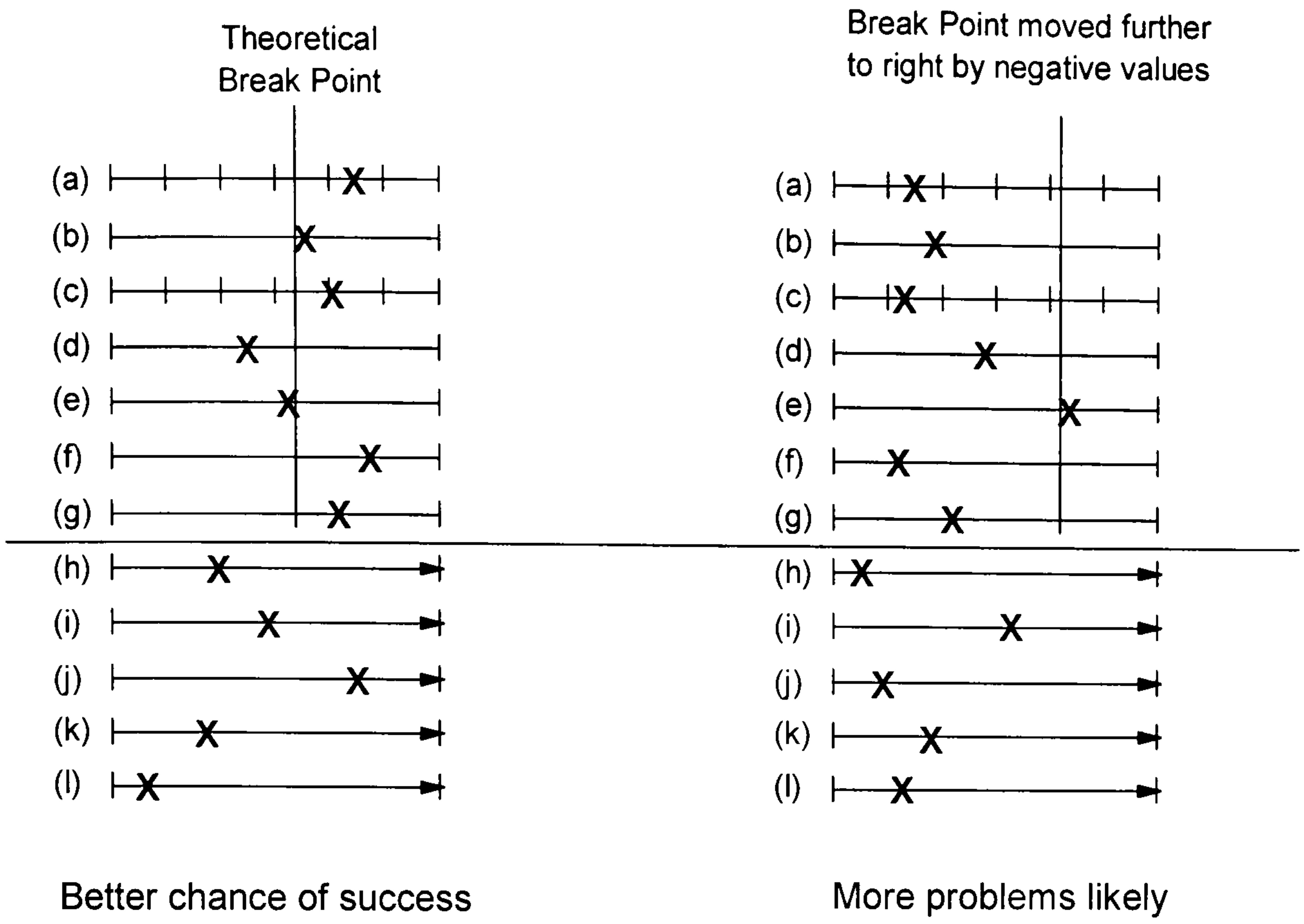


Figure 5.18 - Examples of Audit results

The above examples of the results one might expect from auditing an application should not be taken as the definitive outcome of the auditing process, in these examples the break point used as a decider is a straight line cutting the controlling measures (a) - (g), this may very well not be the case, a different break point being set on each scale. Each audit that is carried out will have its own idiosyncrasies and these should be taken into consideration when using the reference model as a 'rough and ready' indication of Notes implementation feasibility.

5.6 Conclusion

The hypothesis presented by the research is that the existing reference models of the ideal Notes application are not presented in sufficient detail to allow for a definitive answer as to whether Notes can be implemented or not, or in a manner that makes the determination of this easily achieved.

In this chapter the author has used the existing models and expanded on the ideas presented to look at the specific functionality of the software in order to determine the types of application that Notes is best suited to, whilst trying to present this analysis in such a way as to allow for the rapid and simple auditing of any process to make the determination of implementation feasibility.

The reference model presented in figure 5.17 defines a set of characteristics of a process against which any potential application can be classified. These characteristics are presented in a graphical manner that places the bias of a successful Notes application on the right hand end of a scale, the aim being to provide a rapid visual assessment of any process audited by the developed reference model.

The difficulty in using the model comes in trying to classify the characteristics of the process at the correct point on the scales to give a representation of the level of fit of the application to the ideal Notes solution. The research will attempt to clarify this point and validate the reference model through the use of three case study applications, providing working examples of the reference model in operation.

CHAPTER 6

CASE STUDY 1 - MANDATORY INFORMATION

6.0 CASE STUDY 1 - MANDATORY INFORMATION

6.1 Introduction

The area of research presented in this thesis is a direct result of introducing three Groupware applications into one organisation using release 3 of Lotus Notes. The size and complexity of the organisation is such that the design issues involved in each case were very diverse, so allowing a better assessment of the validity of the reference model and for more generic design guidelines to be developed.

6.1.1 Case Study Organisation : International Distillers & Vintners Ltd

International Distillers & Vintners Ltd (IDV) is the drinks sector of Grand Metropolitan, one of the world's leading consumer goods companies, and is the world leader in the wines and spirits industry. IDV controls some of the leading wine and spirit brands, with the full catalogue comprising over 50 recognised brands. The organisation has a corporate structure, linked by close interaction between the London headquarters and the International Brand Companies (IBC's), representing each major brand, and four regional centres (Europe, North America, Asia and Pacific, Africa and Latin America), which in turn manage the whole range of businesses throughout the world..

Figure 6.1 - The structure of International Distillers & Vintners

Figure 6.1 shows the structure of IDV and to a certain extent indicates the relationships that exist between the various functions. The strategic international marketing focus, for the management and development of international brands, is directed from the corporate centre in London through the strong working partnerships which exist between the IBC's and the National Marketing Companies (NMC's). The IBC's concentrate on 'protecting' their brands world-wide through the specification of products and packaging, while the NMC's utilise their local knowledge to implement sales strategies for the international brands. The NMC's may also use their expertise to develop national brands for their local markets.

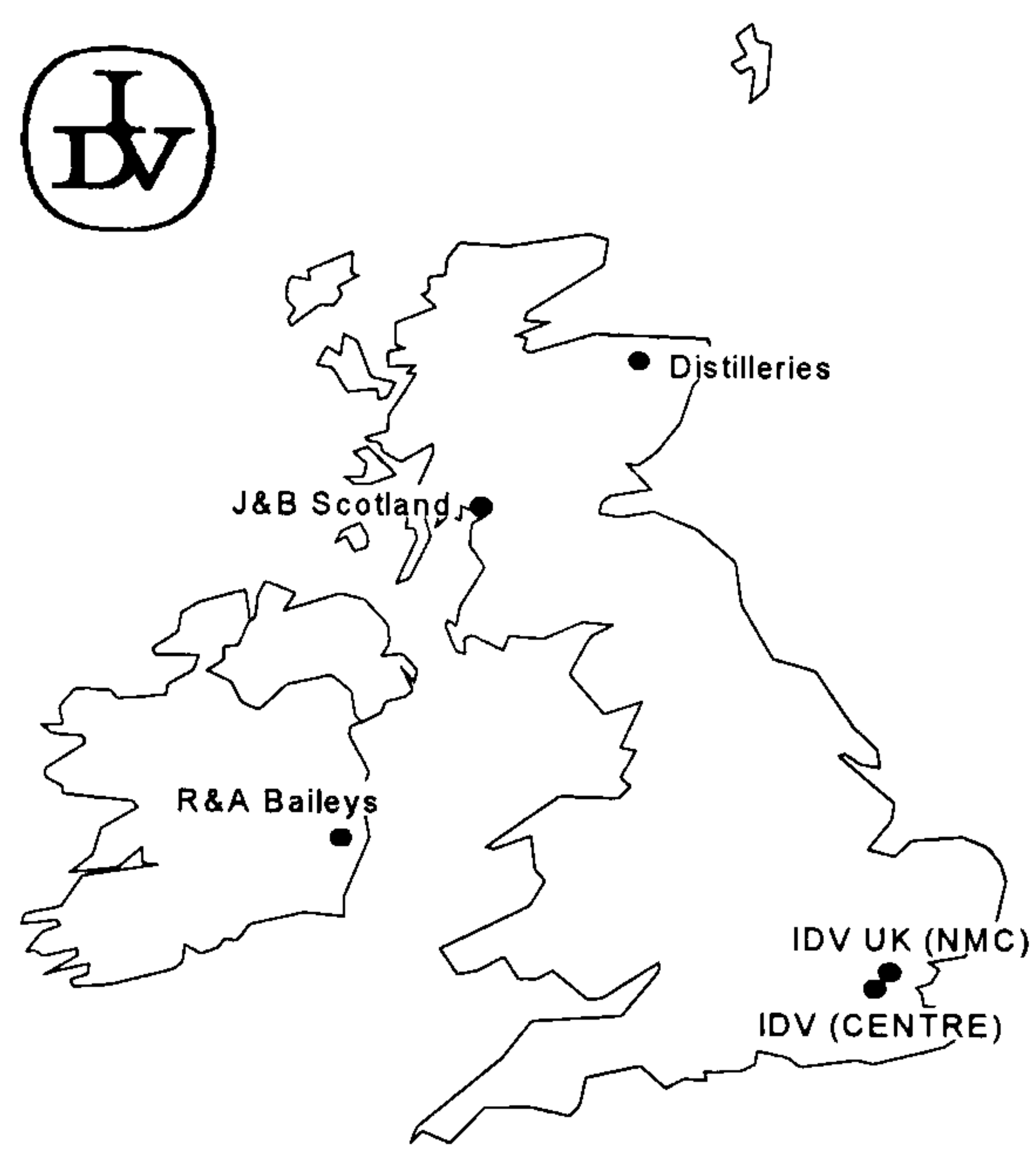


Figure 6.2 - IDV sites within the UK & Eire

The portfolio of brands controlled by IDV can be split into three broad categories, "National" brands which are sold only in one particular country, "Regional" brands such as Dunhill Old Master Scotch Whisky which focuses on the Far East and "International" brands which are sold globally, often in large volumes. The most successful of these international brands is Smirnoff Vodka, which in 1994 sold 14.8 million cases world-wide. The most successful brand of Scotch Whisky for IDV is Justerini & Brooks, which has enjoyed a steady increase in sales to just above 6 million cases a year and in distribution to virtually every country, making it the second most popular whisky brand in the world.

J&B Scotch Whisky is exclusively produced and bottled in Dumbarton, Scotland, using the packaging specifications devised by the IBC's and NMC's. J&B Scotland is the main production site for IDV, representing the largest bottling plant in Europe (if not the world), where just over 20 brands of brown and white spirits are produced, including Smirnoff Vodka and Dunhill Scotch Whisky.

All three case studies originate at J&B Scotland, but they do necessarily involve people from the other areas of IDV, personnel from the IBC's, the NMC's and other production sites.

6.2 Background

IDV's business is in selling alcoholic liquids to an international market, and as the liquids are effectively sold to the end consumer (the general public as opposed to bottling/retail companies) they are packaged in bottles of various sizes from 5cl to 3L. Each of these bottles must have a label attached to it, or be screen-printed with information, in order to tell the consumer three things :

- The product that they are buying (e.g. Scotch Whisky, Vodka)
- The specification of that product (e.g. 75cl of 40%vol. Whisky, produced in Scotland)
- The attractive aspects of the product (e.g. By royal appointment)

The first aspect ensures that the product will be placed on the 'shelf' in the right place so that people will buy it, the second keeps the product there as it is mainly prescribed by law and must be complied with explicitly if a 'legal' product is to be the result and the third hopefully moves the product off the shelf by inducing consumers to actually buy it. Therefore, in order to be as successful as possible, it is imperative for the various functions within IDV to get the balance right between including all necessary information without making the production process too complex to handle efficiently.

Despite the small catalogue of products bottled at J&B Scotland (23 Brands in 16 possible sizes), at any one time the production control system, lists close to 3,000 stock-keeping units (S.K.U.'s), i.e. finished goods ready for sale. This proliferation can be accounted for by the variations in the legislation of the individual countries which prescribes the legally required information for the label, and the marketing changes that are made to suit the individual markets.

Within IDV there existed a lack of a formal mechanism for determining the precise legislative and customary requirements relating to labels in individual markets throughout the world. Establishing such requirements was a time consuming and somewhat imprecise process, due in large part to the fragmented nature of the sources of information and the duplication of much of it. This situation has resulted in the identified product proliferation as well as, excessive time spent in specifying new labels and/or changes, and general confusion regarding what is legally required in a country and what is a market preference.

6.3 Objectives of the Project

The solution to this problem proposed by IDV was to create a single data source covering both legal and brand/market labelling information, with easy access available to personnel from the production sites, NMC's and IBC's, throughout Europe, if not the world. The specific objectives being to:

- Provide up-to-date information on the packaging, shipping and delivery requirements of each market, and each customer operating in that market, thus allowing the production sites to respond to customer orders effectively and efficiently.
- Facilitate rapid identification and communication of any changes in the requirements of markets and customers.
- Minimise the pack development lead times for new markets and/or customers.
- Identify and exploit rationalisation opportunities to minimise, as far as possible, the number of S.K.U.'s handled by the business, which in turn will ease planning and stock control problems.

6.4 Project Specification

Before utilising the Reference Model developed in chapter 5, it is necessary to draft an outline specification for the application, in order to clarify the situation and aid in the classification of the various characteristics onto the defined scales of the Reference Model.

6.4.1 Why Lotus Notes ?

At the outset of the project, it was thought that a simple central database system with centralised management would satisfy the objectives. However, as the project progressed it became apparent that, considering the structure and organisation of the company a centrally located and managed database would not be a practical proposition. Within the company each IBC operated as a separate entity, controlling its own products and markets, determining the packaging requirements for its own use alone, and hence specifying its own packaging. In addition, the international nature of the business (NMC's and production sites situated across the world) raised the following issues;

- Expertise on market and customer requirements is distributed across the world and that no one central organisation could provide all the necessary information to maintain the data. That is, the maintenance responsibility had to be distributed to the markets, whilst maintaining the integrity of the data for use world-wide.

- The data had to be accessed and used by various organisations, including third party distributors, located in various countries around the world.

An ideal database would allow for the communication of information between all these sites, but control must be exercised over much of these by a central function, in order to maintain the integrity of the database. Using a conventional database the communication between the individuals concerned would have to by conventional means, which would then require the information to be manually incorporated into the database. However, the company recognised that using the facilities of Groupware systems, the distributed updating of the database could be achieved, as any information which arises can be entered by whoever receives it, in the first instance, being communicated to an authorised person before final acceptance into the database.

The multimedia capability of Groupware systems (the ability to accept many different information types) is seen as an essential requirement for this type of application, as it is dealing with the specification and control of what are essentially visual assets of the IBC's. In many cases textual descriptions of the packaging and other related information would only be of limited benefit.

6.4.2 The Aims of the Application

When considering the design of any database system it is essential to first define the purpose for which it is intended. This can be done by looking at the type of application, the nature of the information to be stored and the use to which that information will be put. In the case of the mandatory labelling application, these considerations make it necessary to split the information into two distinct areas, (i) the legislation and (ii) the customary information.

6.4.3 Legislation

The legislation which is imposed on the labelling of alcoholic products is quite rigid and in certain countries subject to frequent change (especially South America and the Eastern Block countries), and the penalties which could be incurred by failing to comply fully with the legal requirements could be very heavy, with all products being blocked from export to a particular country. The control of packaging is currently the responsibility of a small section within each IBC, but the actual modification of labels can involve many different departments, especially those from the actual production sites. On top of this, new brands will also require labels to be developed, and this falls not into the realm of a specific IBC but the Brand Development centre. For these reasons the legal side of the application comes under the heading of a Broadcast application, as a wide variety of people, situated at various sites, need timely access to the most up-to-date legislation available, and need to be immediately informed of any changes in the legislation which may affect them. The legal database must also provide for the storage of this information so that it can be referenced at any time, by any interested party.

Legislation is often presented in the form of lengthy documents, which go into minute detail regarding the subject of that legislation. In terms of labelling, the legal documents may include details of the specific wording to be used, the fonts which the text must be written in, the positioning of various statements, any graphic symbols which are to be used (especially where environmental legislation is to be included, e.g. recycling symbols), etc. These specific statements are usually included into the legislative paragraphs and include a lot of explanation. The personnel who control the packaging specifications for the bottles are not particularly legally minded and only want a summary of the important information from the legal document, preferably in the format :-

"Alcoholic Strength : specified as %Vol, 3mm high in the bottom left corner of the label".

This form of statement should be enough to allow for a legally valid label to be specified, but it does not provide enough detail to justify the aspects of a label's design should they be questioned by the customer. However it is still not sufficient to include the legislation as it exists, and it must be summarised before it is included into the database. This 'detailed' summary of the actual legislation will also be of use when new legislation is included in a certain area, a brief specification is fine when designing a new label for an existing country, but new requirements need more detailed information so that the correct interpretation is achieved.

The diverse and volatile nature of the legal information coupled with the fact that it is being generated on a global scale means that one person sitting in a building in England (or any one country) could not possibly hope to keep on top of the whole range of legal information which is required to be stored (IDV export to over 150 markets world-wide). The obvious place to obtain the legal information is from the source and the closest people to the source are the distributors themselves. However, one of the reasons for the introduction of this application was to combat the problem of over specification of information on labels due to the requests of distributors for their own personnel marketing requirements. To allow the distributors to change the legislative information within the database would make it even easier for them to impose their own requirements on the packaging. But they still remain a valuable source of information which cannot be left untapped if the application is to fulfil its role to its full potential. What is needed is some way to allow everyone to forward information to a central department, when it doesn't already exist in the database or contradicts what is found there, as a separate document which can then be verified for accuracy before it is actually included in the definitive statements of legislation.

Looking at the above discussion the purpose of the legal database within the mandatory labelling application can be defined as :-

- provide a general query into the mandatory requirements of a particular country, when total labelling information is required. e.g. When labels are required for new markets.
- provide a specific query into a particular item of the legislation, when issues arise with distributors which require negotiation around the requirements or when new legislation is introduced in a specific area.
- allow the communication of new information from all users of the database, to ensure that the information contained is as current and accurate as possible.

6.4.4 Customary requirements

The customary aspect of the mandatory labelling application differs from the legislation as it does not relate to information which must be complied with, but to information that is included to try and make one particular product (or brand) sell better in one particular market. It is therefore more of a "Reference" database, containing useful information that can be accessed if desired by anyone with an interest.

At the outset of the project it was noted that the customary information is not recorded in any way other than for the interested party to keep a copy of the resultant label. A completely new label was then defined based on the historical records of labels used in production. If there was a request for a change to the existing label, the IBC packaging controller first had to determine which products were affected, which led to the identification of which labels were involved and thus an indication of what impact the change would have on the actual label and on the production facility (i.e. could the old label be used in the changeover, or if not how much existing stock had to be scrapped). All this involved several different departments and therefore introduced a delay in the determination of the labels which were affected. Because the IBC's who were carrying out the change were situated in London and dealing with the physical labels used in the production site in Scotland, there did exist a level of discrepancy between the files of labels held by the IBC's and those actually in use, which obviously caused a lot of confusion and error, especially for the larger brands where the number of actual labels used in production could number in excess of 1,000, all of which had to be stored and kept up-to-date with all the changes that were introduced.

The maintenance of physical files by each IBC promoted their isolation from each other and increased the amount of duplication of effort which occurred. J&B as one of the larger brands could be found in most markets and had over time built up an extensive collection of labels detailing the interpretation of the customary requirements specified by the distributors. The smaller brands such as Malibu, when considering entering into a market which J&B had already exploited, had no way of utilising this historical knowledge, thus lengthening the introduction time of the new Malibu product. As well as the interpretation of requests which were accepted and included into the design of labels, details of the rejected requests could also prove very useful for limiting the proliferation of label designs.

Taking into account the points raised in the above discussion, the functions required in the product database are :-

- provide a single central reference of the label images which are used for all brands produced at J&B Scotland, detailing the information that they contain and the products for which they are used.

- provide a facility to record the negotiations, and resulting actions, which take place to define the labels, indicating why something is done the way it is, why an item of information is included, etc.

Throughout the design of the mandatory labelling application these functions did not change, despite the radical changes that occurred in the structure of the application, which highlights the necessity of defining accurate and meaningful statements of the purpose of the database at the outset. In chapter 3, the issue of fitting the application to the organisation, rather than changing it through the introduction of the application, was highlighted. If the purpose is not correctly defined at the start of the design, taking into account the three important factors, then the risk of encountering this problem is increased dramatically. Therefore when defining the purpose of the suggested application, consider :-

1. The type of application being developed.
2. The nature of the information which it will contain.
3. The use to which that information will be put by all the potential users of the application.

6.5 Reference Model

The classification of the application onto the Reference Model is represented in figure 6.3. Using the alphabetical reference of each scale on the left of the model, the following discussion outlines the reasoning behind the classifications made.

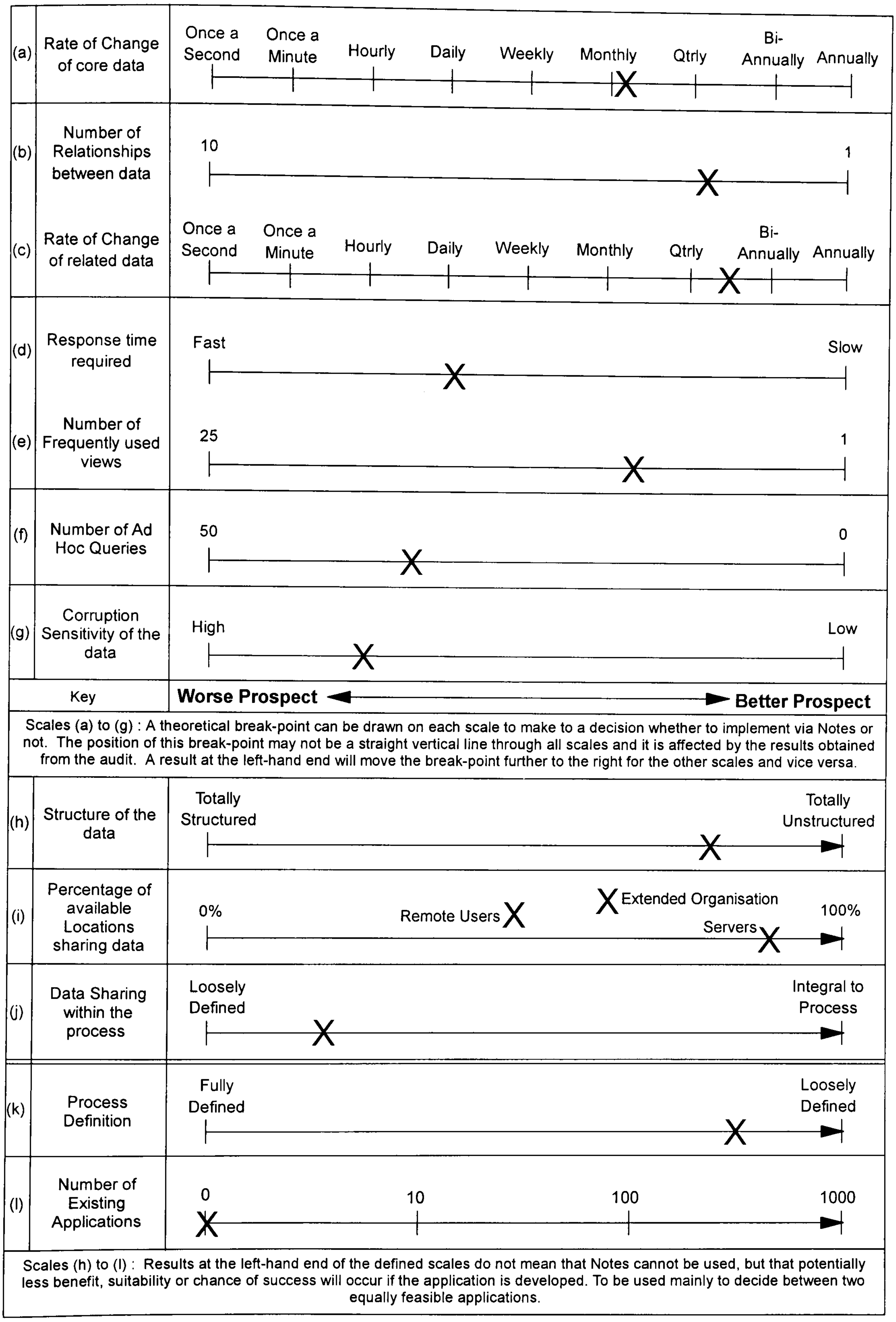


Figure 6.3 - Audited Reference Model for Mandatory Information Application

a) The application is designed to hold information relating to the mandatory requirements of bottle labelling. As this primarily involves legislation or some other bureaucratic process it is very unlikely to change more than once a month. This obviously depends on the country involved, at the time of analysing the application, Eastern European countries are beginning to develop their own legislation with the introduction of democracy and legislation for those countries can easily change more often than the norm.

b) Most of the data to be contained within the application will follow the standard hierarchical structure of Notes, but to allow for a label history to be developed within the application, a certain amount of non-standard relationships will have to be introduced into the product information (section 6.7.6.3.1).

c) The lead time for the introduction of a new label can be quite lengthy and so after the initial population of the database, the rate that the related product information changes will be very infrequent.

d) The main aim of the application is to speed up the response time for finding mandatory labelling requirements for a particular country or customer.

e) The database is intended to be used by many different departments within the organisation, so the information must be presented in a variety of different ways to suit all the requirements that people will make upon it. Therefore the number of views needs to be quite high to facilitate this, however each user will have a specific use for the database and they will only use a small percentage of these views on a regular basis.

f) The application is primarily intended to allow users to quickly find the information related to a particular country or customer, and one view cannot be designed into the application for each combination of these variables. Therefore users will be required to search the database on a regular basis to filter out the documents they require from the contents of the entire database.

g) The majority of the contents of the database will be legal documents and as such must be of the current revision and contain the exact information specified by law, otherwise the product label will not bear the requisite information for the point of sale.

h) Legal documents tend to be lengthy texts, and the other mandatory requirements will probably follow the same lines, therefore the documents within the database will be fairly unstructured, allowing for the lengthy and varied texts to be included easily.

i) Once the application is established it is intended that it be used by all the production and marketing sites of IDV, all requiring a Notes server at their location. The benefits of the application will be increased if the information it contains is entered at the point of origin, the government department or the customer. Therefore the salesmen visiting the relevant countries are to be able to add information remotely, and the NMC's who represent the main customers may well form part of an extended organisation as they are so closely linked to the IDV organisation. For product information, it makes more sense to obtain label images from the suppliers who have the graphical capability than to try and obtain a decent scanned image once the label is in production.

j) The application is situated somewhere between a reference and a broadcast application and so the sharing of data is very much the responsibility of the users to keep themselves updated on changes. However, as the consequences of legislation changes are so critical to business, the broadcast aspect of the application requires a certain amount of structured sharing of the information.

k) At present there is virtually no defined method of controlling this information, although inroads have been made by the Brand Development Centre, and so there is no process which must be adhered to.

l) Subsidiaries of IDV's parent company, Grand Metropolitan, are using Notes but this will be one of the first applications within the IDV group of companies.

6.5.1 Analysis of the Audited Reference Model

Examining the results obtained during the audit of the intended application (Figure 6.3), it would appear that the information to be stored fits very well into the developed reference model, any problems which are likely to be encountered will be experienced with the access to that information once it resides in the database, as shown by controls (d) - (f).

However, the necessity for some sort of database to record information that is currently gathered as and when required, and distribute this unstructured information across a widely dispersed user base should mean that any deficiencies in the data access capabilities are acceptable, in light of the other benefits resulting from the application. Combining the potential level of benefits shown by controls (h) and (i), with the fact that it currently takes a number of days to get all the information required, indicates that the application still represents an improvement in response time over the current process.

By carefully designing the structure of the information and the views that are used to access it, it should also be possible to limit the complexity of the searches that users are having to perform to find the documents they are interested in, and thereby reduce the significance of control (f).

One of the biggest influences on the success of the application will be control (l), the fact that the development is introducing a completely new technology into the organisation will require a lot of buy in from the users, and therefore the designed system must give them exactly what they are expecting.

6.6 Design Issues

The design and development of the mandatory application has been ongoing for just over a year and is now at the stage of roll-out to a wider audience within IDV, following a successful pilot implementation involving a limited number of users. Lotus Notes is often quoted as being a faster development platform than traditional database, but the time-span in this case would seem to indicate that this does not hold true. There are various reasons why the theory does not match the practice in this case.

6.6.1 Templates and Example Databases

The design of the database did not stem from one of the design templates or examples which are included with Notes, but from a completely empty database. There are a number of design templates which are included with the Notes software, covering a wide range of the potential applications for which Notes could be used. They obviously facilitate the rapid development of an application as the basic building blocks already exist and simply need modifying to suit the particular application. Notes also ships with some example applications, containing not only the design elements (as with the Templates) but also sample documents and demonstration scripts which can best illustrate how the database works. Again these can speed up the development of an application by either utilising the entire design structure or selectively using various functions which the examples perform.

By starting the design of the mandatory application from scratch, all the various elements had to be built from nothing, thereby lengthening the development time considerably, but it was felt that this was the best thing to do as no supplied template or example provided a close enough match to the requirements. If a template is used for any application where a large amount of redesign is going to be necessary then it is probably worth starting from scratch or the designer faces being led down a development route that actually detracts from the basic principles and purpose of the intended application.

6.6.2 Errors made by the Designer

Eric Rayl [1994] quotes a development time of less than a month for a Notes application that he developed to track bug reports received by a companies systems department. However, this is presumably after several years experience in developing Notes applications, finding all the problems and blind alleys that are all too easy to encounter when developing a Notes application for the first time, as is the case here. Not every error that was made during the development of the application can be put down to inexperience however, in several instances the author ignored the advice and wisdom of more experienced developers and tried to accomplish a revolution in the current practice by imposing a certain regime on users through the design. It is continually quoted by authors on the subject of Notes [Thorne et al] that it should not be used to re-engineer the business, but, more than any other available software solution, should fit the existing practice as closely as possible. If you want to re-engineer the business, do it prior to introducing Notes so that the developed application supports the newly implemented procedures and helps ensure that they succeed.

Notes is very good at supporting the storage of unstructured information and it is one of the main advantages that it has over traditional databases, however this does mean that it suffers in the manipulation of the data which is stored, requiring a lot of time and effort to devise a routine which will process often large amounts of data to give the desired analysis results. A great deal of time was spent in trying to accomplish a level of data manipulation through Notes alone, which in the final design was accomplished by a conventional database external to the application faster and easier than Notes ever could. The available import options to include external data in a Notes application should therefore not be ignored (as they were to an extent in this case), especially as many third party add-on products are now being developed to automatically transfer information between Notes and other, more traditional, systems.

6.6.3 Lack of Response from Pilot Users

The successful implementation of Groupware cannot be achieved by the developer working in isolation, especially if they are approaching the area of application from a previously unconnected position, as in this case. Therefore, to fully appreciate all the factors that affect the design and accommodate as many of the functional elements as possible, it is essential for the eventual users of the database to provide a contribution to the design and development of the database. During the period of development of an application, the designer will probably have only the one project (or only a limited number of Notes projects) whereas those involved will still be carrying out their functions in the running of the business and cannot devote a great deal of time to the trial of a system which is constantly changing and doesn't as yet improve the way that things work. Where the application has been suggested by the eventual users, they will probably be only too happy to try out the database, but as is the case for this application, users who have been conscripted by their managers to use the system will not be as willing to help.

6.7 Fit for purpose

The above considerations have looked at the general design issues which can affect any new application, the following sections look at the specific areas of development of the mandatory labelling application, introducing a more detailed look at the functionality of Notes and providing a greater insight into the capabilities and limitations of the software.

6.7.1 Legal documents

The defined purpose of the legal database indicates that the legal documents require *two displays of the same information, allowing for simultaneous updates from either display.* One of the displays must list the total legislation for a particular country in the form of a summary and the other needs to go into greater detail about a selected subject within the total legislation. In order to achieve this in the best possible manner, the database went through two redesigns.

6.7.1.1 Initial Design

The first incarnation of the database utilised the Notes function of being able to display the details of a document using different forms that contain the same field names as each other. In this case the legislation for a country was entered into a standard form which contained a field for the details of each subject specified within the legislation (e.g. alcoholic strength, quantity declaration, etc.). An "if" statement was used to display an index at the top of this document of the information which was available lower down the page. Should a user wish to view the complete legislation for a country, they simply had to scroll through this original document. Should they however wish to view the details of a specific topic contained in the index they could use the View menu presented at the top of the Notes window to select another form with which to view the document details. These other forms were headed by the topic and so easily referenced from the menu, and contained shared fields with the form containing the complete information so that as well as displaying the selected information, the details in both forms could be changed from within either form. By imposing procedures to limit the editing of information to the individual topic forms, an edit history could be added to the index in the full form, listing when each subject had last been altered. To avoid the display of blank spaces where legislation on a specific topic did not exist for a particular country, another Notes feature, that of being able to hide information when either editing or reading documents, was used. i.e. when reading a 'total' document only display those topics which include information. Figure 6.4 illustrates this design principle.

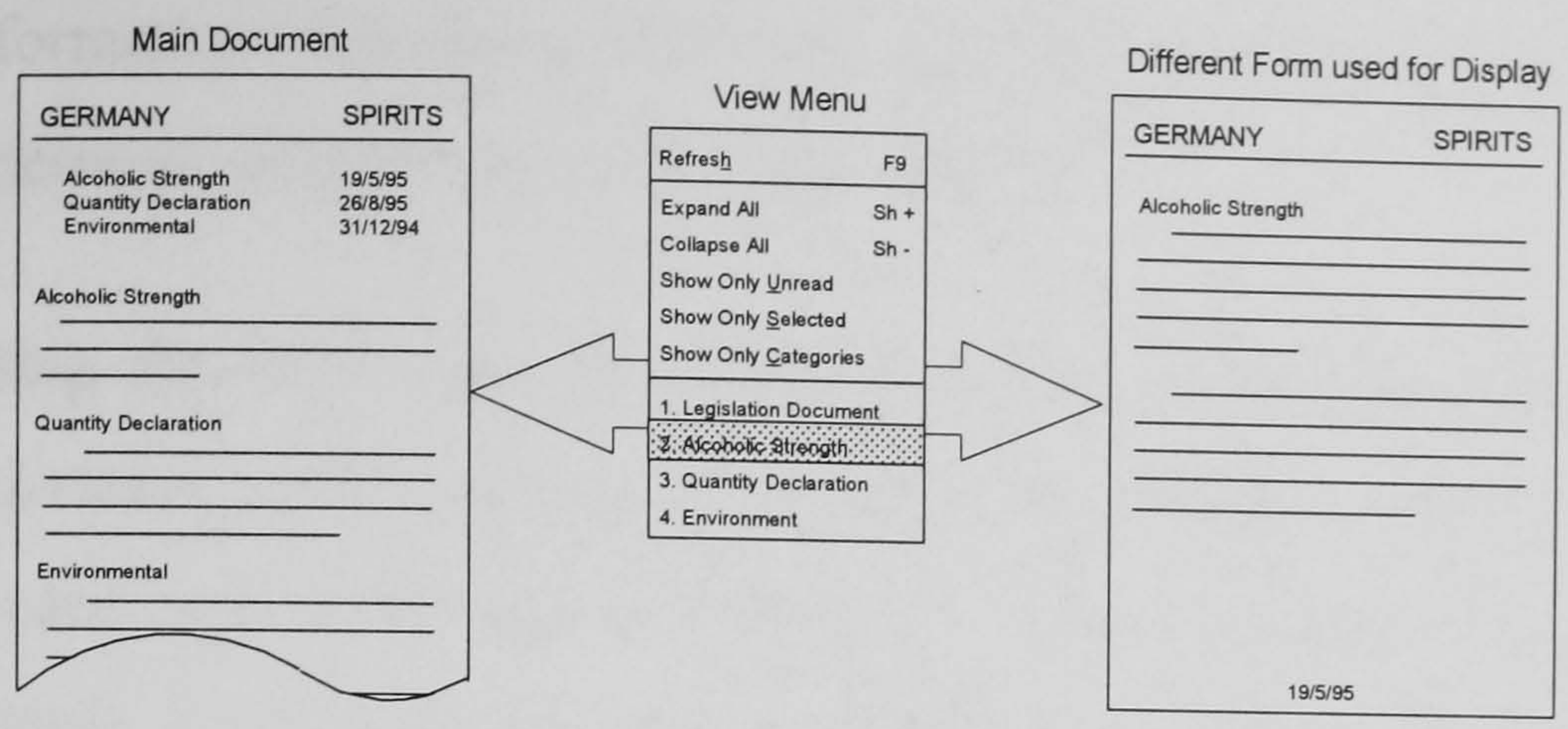


Figure 6.4 - Two forms displaying the same information, changed using the View menu.

After a review of the initial design and feedback from a presentation given to the steering group, several problems were encountered with this design :

(i) The document was only listed in a view once and upon opening should display the 'summary' document not one of the individual subject documents, but the editing of information from within the individual documents changed the value of the form field and hence the form used to display the document upon opening from the view. To combat this the Form Formula for each view in which the legislation document appeared, had to be specified so that it was always the summary that was displayed upon opening the document. This formula still had to allow the form to be changed when the document was open and this fact, combined with the number of possible subjects (and therefore corresponding individual forms), made the form formula very complex with little flexibility for the addition of further subjects at a later date.

(ii) As mentioned above, each subject listed in the legislation form, required another form to be set up for the display of the individual details relating to that subject. This made the inclusion of an additional subject at a later stage lengthy and complex. If that subject were only ever listed in one country then an extra form would have to be added which would only ever be used once. This problem of country specific information could be handled by introducing a form for "Country specific information" but this would have to be opened every time in order to determine what exactly it was referring to.

(iii) Using the view menu to switch the display from an overview to an individual topic could get very confusing when a specific query was needed into more than one subject. When looking at an individual subject, it was not necessary to switch back to the general form before displaying another subject in detail, but unless the index of available information had been memorised, there was no way of knowing that you were actually going to see any information for your new selection, and blank forms can get very upsetting for users in a hurry. This method of displaying different views of the same document also introduces bad practice and users would no doubt get very confused as to whether they were looking at a view or document, changing to something different from the view menu and ending up with a completely misleading screen display.

(iv) The index of subjects at the top of the summary form utilised a "Multi-value" field, compiled as a concatenated list of subjects for which information was listed in the document. The edit history displaying the last edit date for each subject used the @DbLookup facility, which allows a value to be extracted from a view using a specified keyword, and this had to be related to the appropriate subject in the compiled list. Multi-value fields are very useful but also very limiting and it is almost impossible to tally two such lists together and achieve the correct format for display, as happened in this case.

6.7.1.2 Major Redesign

The problems encountered in the initial design suggested the method that should be employed to achieve the necessary capability. What was needed was a system that allowed for easier referencing of the documents in a view, reduced the number of different forms that had to be included in the design and provided the means to easily determine the information that had changed (as automatic mail notification was not possible at this point).

The resultant design utilised the response hierarchy which can be applied to Notes documents, making the general document containing details of the complete legislation for a country the main document (or parent) and then adding a new document for each subject as a response (or child) to this main document. In order to facilitate the initial introduction of legislation for a new country, the response documents were composed from within the general document, using a Macro button which loaded the appropriate values into the response document before saving it and returning automatically to the general document for the next subject to be entered. Once all the information had been entered into the general document, a simple visual check could be carried out, utilising the @DbLookup function again, to ensure that every subject for which information was entered also had a response document listing the details for that subject. When new subjects occur for an existing country, it is a response document that is created as opposed to an update of the general document. The hiding of information when reading or editing a document was again used to remove some of the clutter from the general document. As can be seen from Figure 6.5, this redesign addressed the problems encountered previously.

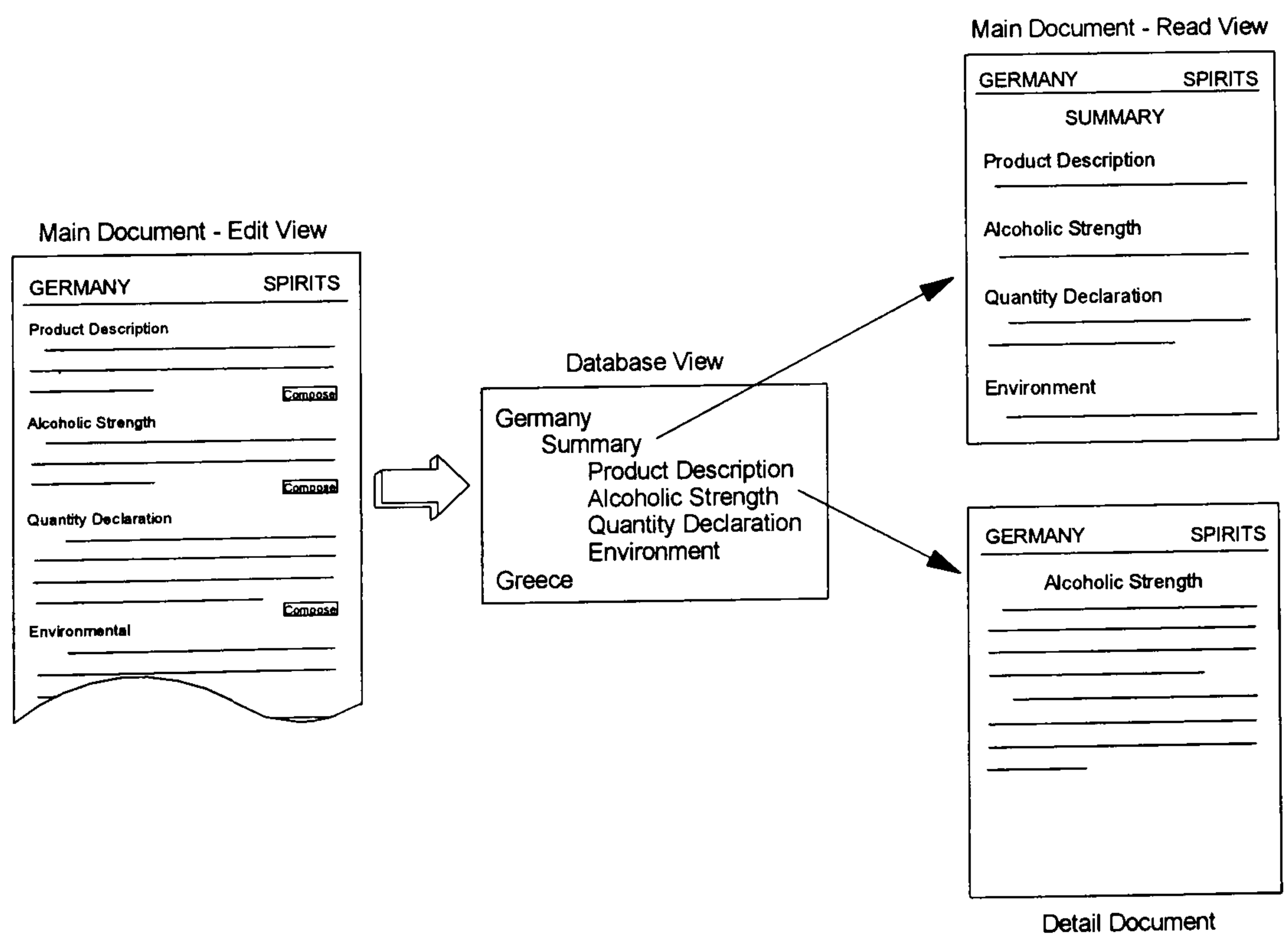


Figure 6.5 - The redesigned structure, showing the improved referencing and display facility.

This design for the inclusion of legal documents is the one which exists in the application at present, however there have been some minor modifications to it.

6.7.1.3 Tweaking the Design

6.7.1.3.1 Full Propagation of Changes to Legislation

The developed system should allow for the editing of information to occur in either the general document or one of the detail documents, with the change being propagated to the other one. Edits performed on the detailed documents did migrate to the summary document through the use of the @DbLookup function and a different display in the summary document, i.e. the summary document "read" display contained the results of lookups on the summaries contained in the detail documents. However the "edit" display was simply the display used when composing the document, with Macro buttons and details of legislation, and any edits performed on this document were not mirrored in the individual response documents.

To combat this a different form was used for editing and display of the summary details. The edit form was only ever displayed upon composing a new document and contained the full field list of all subjects and all the Macro buttons to compose the response documents. The display form contained the results of the lookups of summaries from the response documents, with the difference being that trying to edit the summary document revealed a message to the effect that it could not be performed through that form, and not the editable fields used for composing the details as before.

6.7.1.3.2 Split Legislation into Smaller Categories

The above change in the design meant that the composer of the information must complete the full details of the legislation at one go, or be faced with having to add the missed details as individual response documents one by one. In order to reduce the time that must be spent at any one sitting when adding the details of a new country, the legislation subjects were split up into five different categories. This added a little confusion to which subject fell into which category, but the inclusion of a full list in the on-line help document went some way to rectifying this.

6.7.1.3.3 Non-standard Subjects listed in Views

The summary documents now only contained the result of a @DbLookup formula of the summaries from the appropriate response documents, and by making these values only computed for display and not actually permanent values, two things were accomplished, (i) the summaries always represented the current information contained in the detail documents, and (ii) non-standard subjects could be included without specifying a dedicated field for each one. These so-called non-standard subjects are added by composing a new response document to the appropriate summary document (based on information category) and therefore appear in the legislation views, referenced by the explicitly defined subject, not simply "Country Specific Information" as before. One extra multi-value field at the bottom of each summary document collects together all non-standard entries for display.

6.7.1.3.4 Notification of Change

Each detail document contains an edit history, showing the date and person responsible for the three latest edits, which is automatically updated each time the document is saved. At the start of the project, IDV's central system function who had the most involvement in Notes development stated that integration with the electronic mail system in use in IDV was not possible, therefore the edit history was used to provide a bulletin board view of those detail documents which had changed within the last month. Recently, it has emerged that it is possible to integrate the e-mail system, and when a document is now edited and saved, a message is broadcast to all the users of the database informing them of that change.

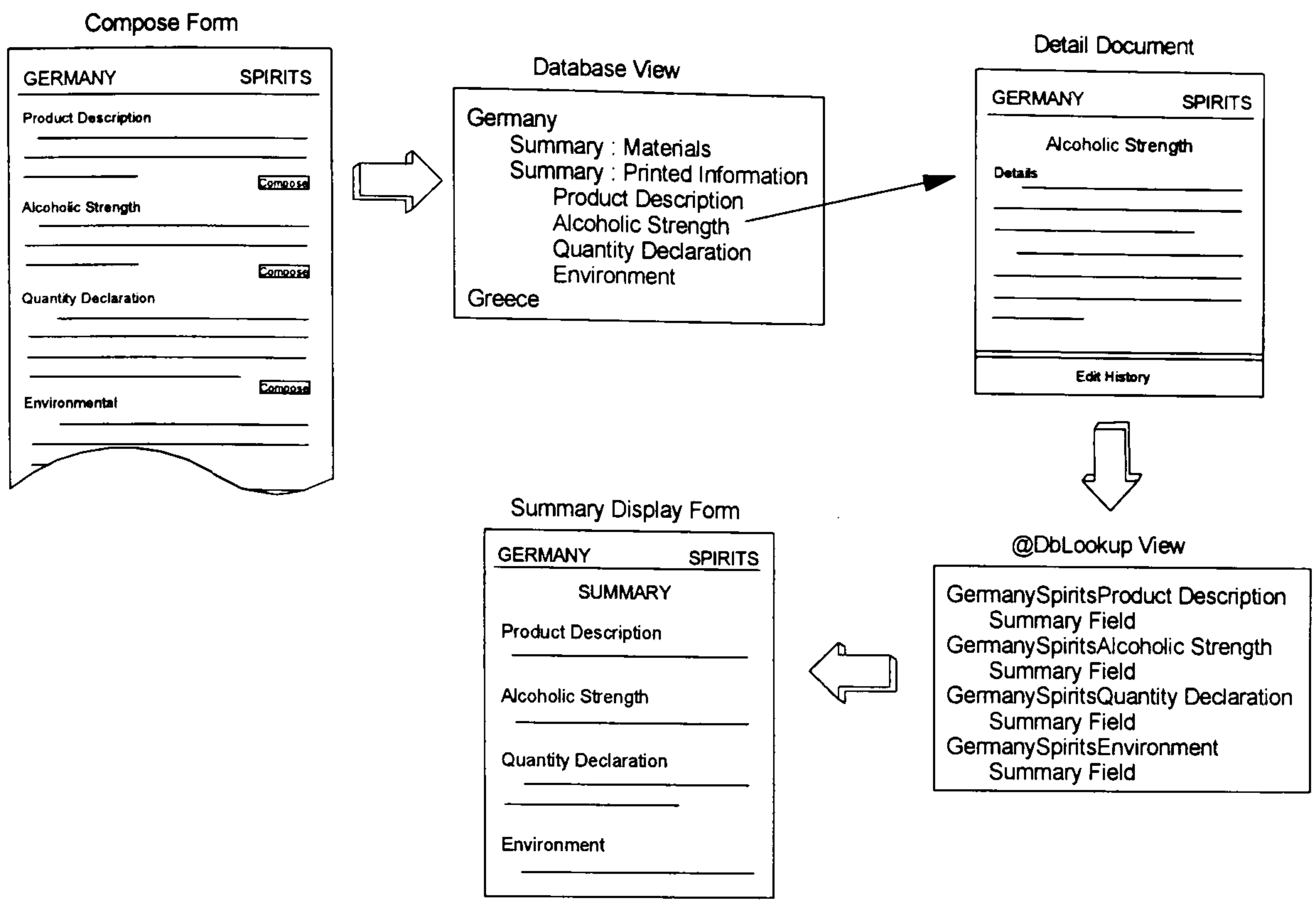


Figure 6.6 - Current design structure for the legal documents.

6.7.2 Pending Changes

During the investigation into the actual legal information available and the potential sources of it, it emerged that there is often news of up-and-coming legislation that would be of interest to the users of the database. It is necessary to have a distinct method of entering this information, and also of making it known to the users only when they need to know it. In terms of the design of the database this meant that we needed a method of *including related information from a new document into existing documents.*

At first the "Pending Changes" were included in the detail documents simply as another field which was displayed each time the appropriate document was opened, and could be included in the summary document using the @DbLookup facility as with the details themselves. On trying to implement this in practice, several drawbacks were found with it :

- A pending change which affected the whole range of legislation had to be included in the entire range of detail documents for the country that it affected, e.g. Australia and New Zealand are considering adopting common legislation between the two countries in the near future. To include this information in the database would require it to be entered into every detail document for Australia and New Zealand, either existing or newly added before the actual implementation date. It would also result in the same information being displayed against each subject in each of the five summary documents.

- A pending change could only be added where there existed legislation details. If the change referred to new legislation that might be implemented, or more likely in the early stages of the database's introduction referred to a country that was not yet included, then there was no obvious location for it within the database.

With these limitations of the existing design in mind the facility for including pending changes was modified so that a separate form was used to specify the details, details which could be referenced in all the affected detail documents using the @DbLookup function yet again. The difference in this case being that a change which affected a whole country was only listed once in the summary documents and yet still appeared in every detail document for that country, and a change that affected only a particular subject in one country, still appeared in the summary document and the detail document under the appropriate heading. Obviously, specifying these pending changes as a separate document meant that any country and subject could be specified, irrespective of what information already existed in the database. A separate view listed these pending change documents and the automatic mail notification facility allowed unconnected change documents to be made known even though they were only listed in the infrequently used "Pending Change" view.

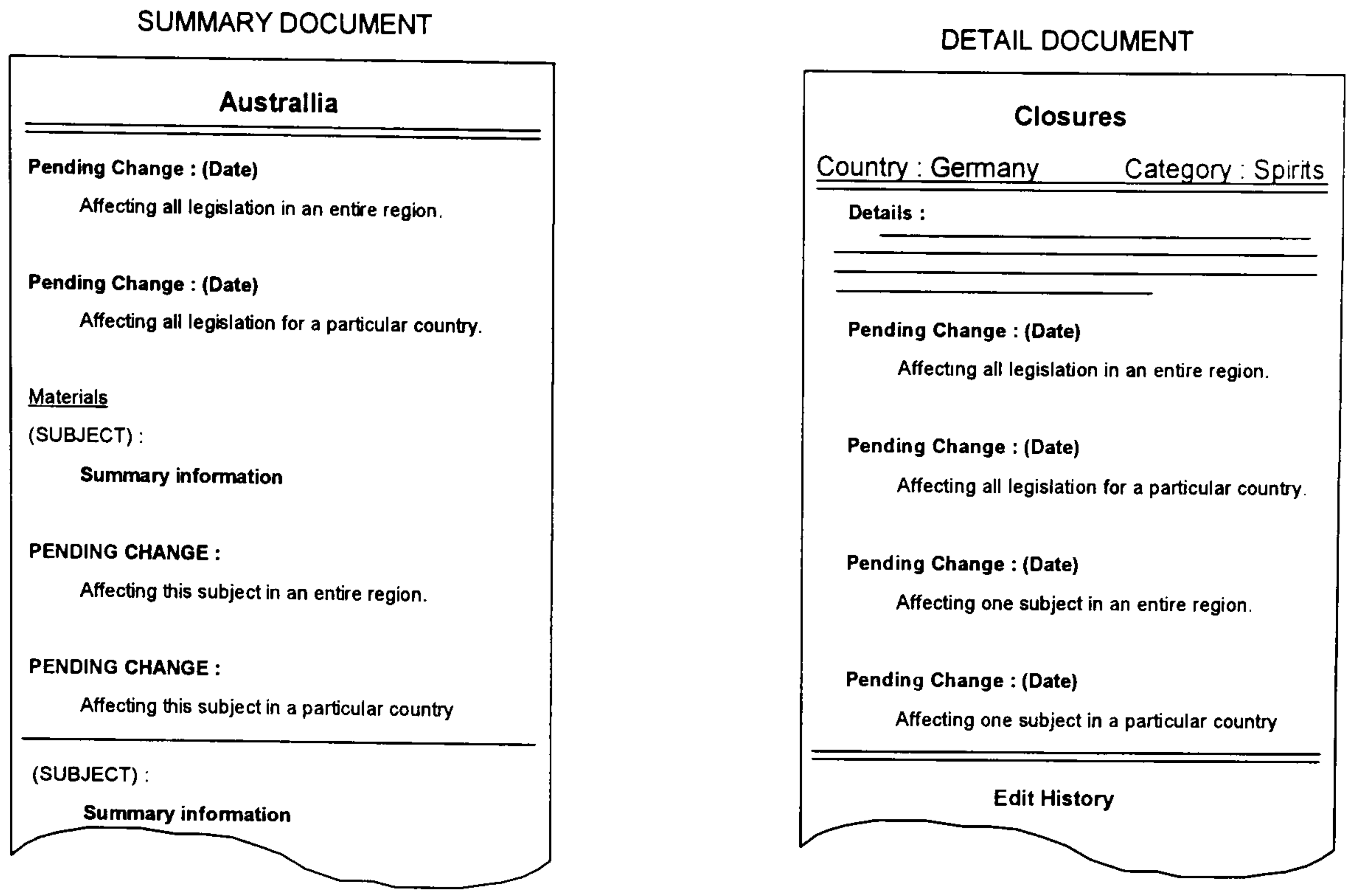


Figure 6.7 - The display of pending change information in all related documents.

6.7.3 Additional Information

It has always been the intention of the database to allow users to transmit any legislation that they become aware of directly to the central 'control' centre for verification. This could simply be performed via the existing electronic mail system, but utilising the power of Notes transfer, this additional information could be made available to all users thus allowing more of a discussion facility to be set up, i.e. any user with related information could attach it to the additional information document as a "Further Issue", the legal department responsible for verifying all information prior to inclusion in the legal documents themselves then had all available information to hand. If the process could cope with the three hour replication interval, then e-mail did not have to be used at all. The initial inclusion of extra forms to allow for the addition of this information, required them to be composed from within one of the legislation detail documents. e.g. I have further information regarding the environmental legislation of Germany, I will attach it to the details for that subject in that country. The response hierarchy which had been set up for the summary and detail documents, allowed for the natural progression of this additional information as a response to a response (a response to the detail document), but when listing the additional information in a view, it was decided not to include the summary document, making referencing of the appropriate detail that much easier.

Unfortunately, for a response hierarchy to work in a view, the parent (or main) document must be displayed otherwise the hierarchy facility must be "turned off" in order for the children to be displayed at all. The effect of not using the response hierarchy was to lose the format of displaying the additional information documents under the appropriate detail, and thus a *simulated response hierarchy* had to be developed.

6.7.3.1 Simulated Response Hierarchy

The sequence of events for additional information, first required the information to be entered into the database as a response to the corresponding detail document. The information was then viewed by the legal department controlling the database, and an action note was attached to the additional information (as a response document again), informing the originator of the status, either 'awaiting verification', 'accepted', 'rejected' or 'added to database'. Further issues and discussion could be entered into through further responses to the additional information document. The required display of this sequence of events, required in the views, is shown in figure 6.8.

Detail Document
    Additional Information
    Further Issues (Display Author)
        Verification Notice
            Further Information
                Rejection (Acceptance/Included) Notice

Figure 6.8 - The required display of the discussion documents relating to additional information.

In turning off the response hierarchy supported by Notes another "manual" system had to be introduced to simulate this. This involved capturing certain values of the detail document, upon saving it, which would uniquely identify that document. The way in which the details were added, the easiest information to capture was the country and information subject to which the detail document referred. Notes allows response documents to "inherit" default values from their immediate parent, and it is this composite identifier that is inherited by the additional information document. The same identifier could then be inherited by all subsequent responses to the original additional information document. By using a hidden column in the necessary views containing this value, and sorting on it, all related documents could be grouped together in the view.

In order to sort all the related documents into the required order, an extra character was added to the end of this identifier value. Each subsequent response document would isolate this end character and increase it by one and then add it to their own identifier value. The resultant view then displayed the required hierarchy for the additional information documents. The process used is shown in more detail in figure 6.9 below.

Sorted Hidden Column	Displayed information in correct format
[GermanyEnvironment]	**Detail Document**
[GermanyEnvironmentA]	Additional Information
[GermanyEnvironmentAA]	Further Issues (Author)
[GermanyEnvironmentB]	Verification Request
[GermanyEnvironmentC]	Further Information
[GermanyEnvironmentCA]	Further Issues (Author)
[GermanyEnvironmentD]	Rejection Notice

Figure 6.9 - Simulated response hierarchy using an inherited unique identifier.

Note that any further issues which are added by other users are also included into the simulated response hierarchy by adding yet another character to the original identifier in the document to which they are responding, thus ensuring that they are listed directly under the appropriate document. It is for this reason that letters are used as the extra character and not numbers (even though numbers are easier to increment) as "11" as the extension for further issues would cause that document to be listed in numerical order, after 2 (the verification request), 3 (the further information) and so on. Incrementing the letters is accomplished using the ASCII code for the extension, first converting the letter to its appropriate code, then adding one before reverting the new code back to a letter.

Despite the suitability of this system of simulating a response hierarchy, it was eventually scrapped, as it was realised that in the early stages of the database, additional information could well apply to countries and subjects that did not already exist in the database. The necessity to compose them as responses to existing detail documents, excluded any new items from the database. Therefore the system of additional information documents was separated from the legislation documents completely, and this meant that a conventional response hierarchy could be used to display the discussion thread for each issue.

6.7.4 Compositional Standards

The legal database was populated with information already existing within IDV roughly eight months after the initial start date of the design process. Several of the changes discussed above arose through the use of the system to include this existing information. Another issue arose at this time, in that the legal department held a lot of information relating to the compositional standards which apply to the actual liquids themselves, and there was nowhere within the database to comfortably hold this information. If the developed system was eventually to be the sole source of legal information within IDV, giving details of all aspects of the business, then this had to be added at some stage, therefore *database expansion* became an important issue.

Once the format of the information had been assessed, the inclusion of another form to hold this information did not really cause a problem, but during this expansion the other facilities of the database had to be considered, especially the method of displaying the pending changes in all affected documents. Pending changes could equally apply to compositional standards and so provision had to be included in the compositional standard form to use @DbLookup for this, and the pending change form had to be modified to allow specific compositional standards to be specified. Any further expansion of the database would also have to take into account these issues, ensuring that the design of existing forms changed to accommodate the completely new forms.

The resultant design structure (and the current one which is being introduced into IDV as the final product) is shown in figure 6.10.

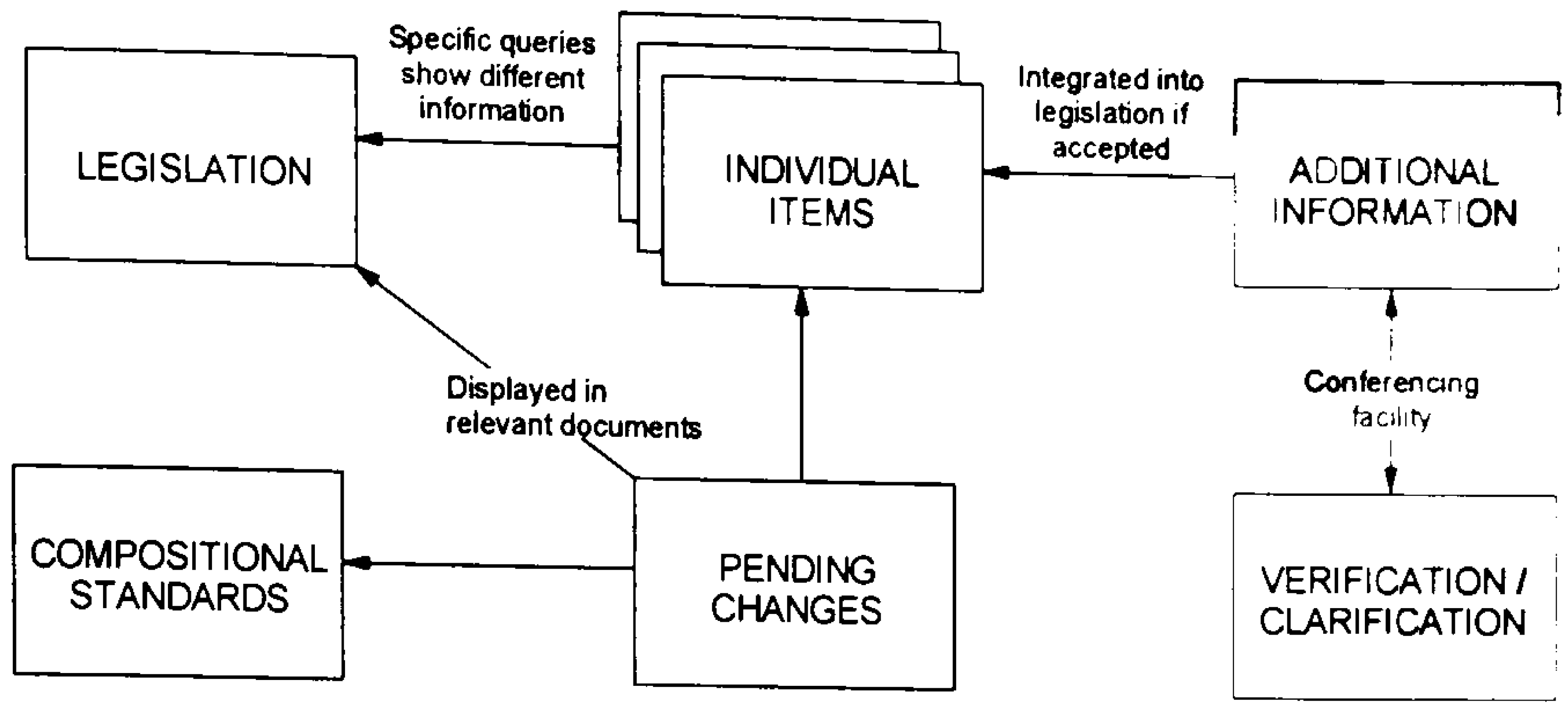


Figure 6.10 - The full design structure of the legal database.

6.7.5 Product Database

The first design of the database did not include direct product information, but instead only a profile of each brand that is produced at J&B Scotland and a textual description of the labels themselves, not linked to anything other than a brand profile. This profile was designed as a response to the legislation (when only one document existed for each country - see section 6.7.1.1), with the label specification, along with a form for the recording of the negotiations with customers that led to a finalised design, then being listed as responses to that brand profile. Obviously this structure required one brand profile per country, which may have required a large amount of duplication depending on the details that were recorded in the profile. It was intended that the issues which affect the brand in that country be recorded in the profile and this design made sense in that context.

Feedback received from the initial presentation to the project steering committee highlighted the fact that the most useful information that could be supplied, related to the actual products, was the "shopping list" which applied to each customer. It has been continually stressed in the above discussion that, in the initial stages of introduction, there will exist a lot of gaps in the legal information available. By making the inclusion of any product information dependant on the legislation being present limits the scope of the product database, therefore the application was split into two databases, one dealing with the legislation (relevant to the whole IDV organisation) and one dealing with the products themselves (relevant to one production site and any IBC's/NMC's dealing with that production site).

As already stated the range of products is very large, with close to 3,000 different SKU's being present on the production control system of J&B Scotland, and this information needed to be utilised by the product database, as well as relating it to customers and labels. The database thus needed to perform a great deal of *data manipulation* in order to best display the product information, and several revisions were necessary before the current design was acceptable.

6.7.5.1 The First Product Database

The product database which was developed from the splitting away from the legal information, closely resembled the structure that had already been proposed, with the main difference being that the Brand profile now assumed the role of the databases main document, to which all others were responses. Each of these brand profiles was related to a particular country and again contained details of the products of the specified brand that were supplied to that country. This was developed still further by splitting each country into the various distributors that operated in that country, and so a brand profile was specific to one country and one distributor. However, at this stage the author did not fully grasp the scale of the exercise in populating, and then maintaining, the product information for the whole range of distributors and countries to which IDV exported its products, and assumed that the information could be simply entered manually and be based on the knowledge of the individual users, i.e. they know what products they sell and where they sell them.

6.7.5.2 Utilising Existing Information

Obviously no one person can keep track of all the products that are sold to a particular distributor or country, even for the smaller brands. The more common distributors may stick in their mind, but no reliance can be placed on this for maintaining the database. It was found at a later stage that the information required was listed in two different computer systems used by IDV.

International Customer Service (ICS), located in the London office of IDV, are the point of contact between the customers and the production sites, processing the orders which then contribute to the total demand for any particular product. To do this ICS uses a common sales order processing (SOP) system, located on an AS400, which contains details of each customer and an associated shopping list, detailing the appropriate codes for the products which that customer is allowed to purchase. As discussed, many of the products are unique to either a country or a customer and so this level of control must be kept over the shopping lists. This SOP system doesn't go into any detail as regards the actual make up of each product, as this is not really necessary in the context in which the information is being used. However, in terms of the Notes product database, the full solution requires that each product be listed, related to country and customer, along with the associated labels which go onto that product. This then simulates the process that is currently used to determine the affect of legislation changes on existing labels.

The Bill of Material (BOM) information which lists all the items which make up a particular product is held on the production control system used at J&B Scotland (4th Shift), and the product code is the information which provides the necessary link between the two systems. Both of these systems allow for the generation of a spreadsheet representation of a specific query, and Notes allows for the importing of spreadsheets relatively easily, therefore this existing information was utilised to provide the required representation of product information in the Notes database.

The importing of a spreadsheet simply requires that a form be set up in the target database which contains one field for each of the columns held in the spreadsheet. Upon importing the data, one document is created, using this form, for each row contained in the spreadsheet. The initial redesign of the database to introduce this external data, had one form for the SOP information and one for the BOM information. Users of the system could then initiate a query into a specific country, customer and brand which would eventually result in the listing of either the products supplied or the labels used for those products. The developed system relied heavily on the use of the @DbLookup function and multi-value fields, making it very cumbersome in operation and producing a limited display.

- The shopping lists of some of the larger customers stretch to a considerable number of products, a list which first had to be determined by the system before the @DbLookup function then went and tried to find the associated labels. The performance of this facility suffered as a result, with some queries taking as long as 10 minutes to compile on a low specification machine.

- The returned list of products and associated labels had to be loaded into a multi-value field, or it would require the unfeasible solution of including one field for each returned value, up to a undetermined maximum relating to the largest customer. As mentioned earlier, multi-value fields make display awkward, as there is no satisfactory method of relating values from one list to the corresponding values from another list. The desired display was to list a product code with its associated description and then list all the labels that were part of the BOM for that product code below, before moving on to display the next product code in the list, and this proved impossible using the multi-value fields. Individual fields were tried in an attempt to overcome this problem, but this slowed down the processing of information even more.

6.7.5.3 External Processing of Data

While attempting to process the information within Notes alone, it was realised that what we were trying to achieve in terms of the display of the information, could easily be achieved in a view, and if all the information could be located in one document then appropriate views could provide the necessary information without the need to open a document at all. The systems director of

J&B Scotland also became more involved at this point, and suggested that the necessary cross-referencing of the two external systems could easily be performed by any one of the more conventional database programs.

Therefore the resultant method of including product information, relating it to country, customer and label, used a standard database package to process the output from the two existing systems, thereby providing a spreadsheet where each row represented a single item in the BOM, with reference to the product it was used on, and the customer who was allowed to purchase that product. The information would be maintained externally, by using the same system to compare the extraction from two consecutive weeks, determining everything that has been either added and deleted. After the initial population of the database, it is only these additions and deletions which require processing into the database. The external processing is completed as an automatic batch process, and the inclusion of the results into the Notes database takes at most, two hours to complete, with much of that time being only machine processing time requiring no human intervention. The brand profile form which was once the key to the product database has since lost its significance and now only relates useful information as a matter of interest.

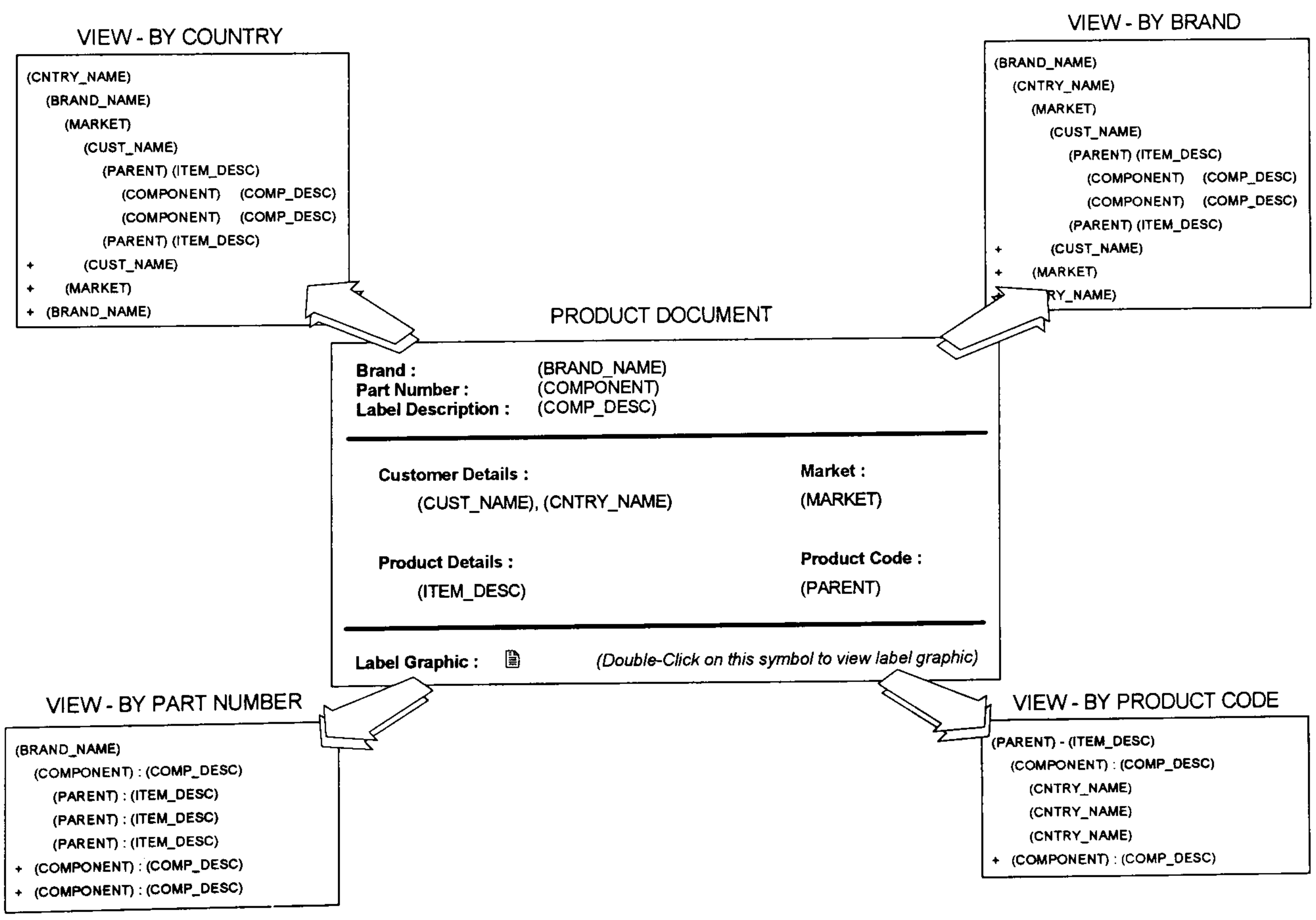


Figure 6.11 - The product information document, allowing flexibility of display.

6.7.6 Label Details

From the outset of the project it has been realised that any reference to individual labels held in the database will eventually have to include an actual image of the label, and Notes does provide the capability for this. At the present moment, there are nearly 9,000 separate product documents contained in the database, due to the fact that the same product may be bought by more than one customer. To provide the greatest benefit to the users of the database these product documents must be easily associated with the relevant label image, and the easiest way of doing this would be to include the image in the product document itself. However, graphic files can be very memory hungry and the inclusion of 9,000 images (a great many of which would be duplicated - there are only 850 separate labels listed for these 9,000 product documents) would increase the size of the database to an unmanageable level. Even 850 image files will represent a large database in terms of memory required and so what is needed is a method of *capturing images in small files* and *linking these images to all associated product documents.*

6.7.6.1 Capturing the Images

At this stage of the project where there is a large back catalogue of labels in existence, the only way to capture an image of all of these was to physically scan the label and use appropriate software to ensure that the resulting electronic image was of the desired clarity and size to satisfy the needs of the database. Images of labels did exist in electronic format with the label suppliers themselves, but they were contained on such proprietary systems that to ask for their conversion would be too expensive and time-consuming to consider. The existing labels were thus scanned into a MicroGrafx product, PhotoMagic, and saved as 256 colour .TIFF images of a standard 100cm x 125cm maximum physical size, resulting in image files that were on average 100Kbytes (considered manageable in terms of total database size and replication speed).

J&B Scotland have recently introduced an ISDN system for the transfer of image files directly between the packaging development department and the suppliers of the various items used in production that contain visual information (cases and labels). Although the scanned images provide acceptable quality for seeing the overall label, they will never replace a physical label for any purpose requiring closer scrutiny. However, the digital images that packaging development will be receiving via the ISDN link will provide much higher quality and allow for the actual manipulation of the image attributes, as well as facilitating the automatic inclusion of the images into the database without the need to physically scan and process individual labels. Therefore, it is the firm intention to utilise this link to label suppliers to develop and maintain the database in the future.

6.7.6.2 Adding the Images to the Database

Notes allows non-Notes data to be included into the documents of a database in five different ways, each method having its advantages in certain situations.

6.7.6.2.1 Using the Clipboard

The clipboard used for cutting and pasting information in a variety of packages can be used with Notes if :

- You can open the data file (you must have the source application available to you).
- The source application supports your operating system's clipboard.
- The data will not change, or it can be changed manually within Notes.
- You would have used DDE, OLE, LEL or Macintosh Subscribe, but the source application doesn't support it.

6.7.6.2.2 Importing Information

File-import allows copies of entire files to be made and translated in to the contents of a Notes document or view. Importing should be used when :

- The data is available, but not necessarily the source application.
- You want to edit the data in Notes, not the source application.
- You want to put the data in multiple Notes documents that are automatically listed in views (as with the spreadsheet based product information -see section 6.7.5.2).
- Users who want to edit the information, don't have access to the source application.
- You would have used the clipboard, but the file is too big or the clipboard is not supported by the source application.

6.7.6.2.3 Object Linking

Notes documents containing links reflect a change dynamically when the external information changes. External objects should be linked when :

- You can open the source data file (the source application and data file are available to you).
- The source application supports DDE, OLE, LEL linking.
- Potential editors of the data have the source application and file available to them (Readers of the data don't need either of these things).

6.7.6.2.4 Object Embedding

Information embedded into a Notes document can be viewed in its original format from within that document. Objects should be embedded when :

- The source application supports DDE, OLE, LEL embedding.
- Editors and Readers of the data have access to the source application (an icon may be displayed, instead of the data, which must be activated to access the data)

6.7.6.2.5 Using File Attachments

The entire file is attached as a separate entity onto a Notes document. This system should be used when :

- The data is not intended to be part of the Notes document.
- The data file is compressed, or is a system or executable file.
- Users want to use the file with its source application rather than Notes.

Taking these considerations into account, Importing is used to add the label images into the database, as they are not going to be changed by anyone once they are included and the size needs to be kept a minimum. The image files are imported into a separate label document in the database and linked to the product documents to provide the quick referencing facility required.

6.7.6.3 Introducing DocLinks

The resulting design of the product database now lists one separate product document for each occurrence of a part number, which can stretch to above 300 different documents if the label is used on a large number of widely available products, and one separate image document for each label. If, having found the labels affected by a change, based on details of the market which requested the change and the brand currently under consideration, the user then wanted to see the actual label, they would have to change the current view and find the relevant part number by which it is referenced. However, Notes includes a facility which removes this necessity to constantly keep searching through views to find documents based on the results of the previous search.

This facility involves the introduction of a "DocLink" in the source document (in this application, the product details) which when activated by a double-click with the mouse, automatically opens the target document to which it is linked (the label image file). If the label is used more than once, the same DocLink can be pasted into all the necessary product documents simply by using the clipboard.

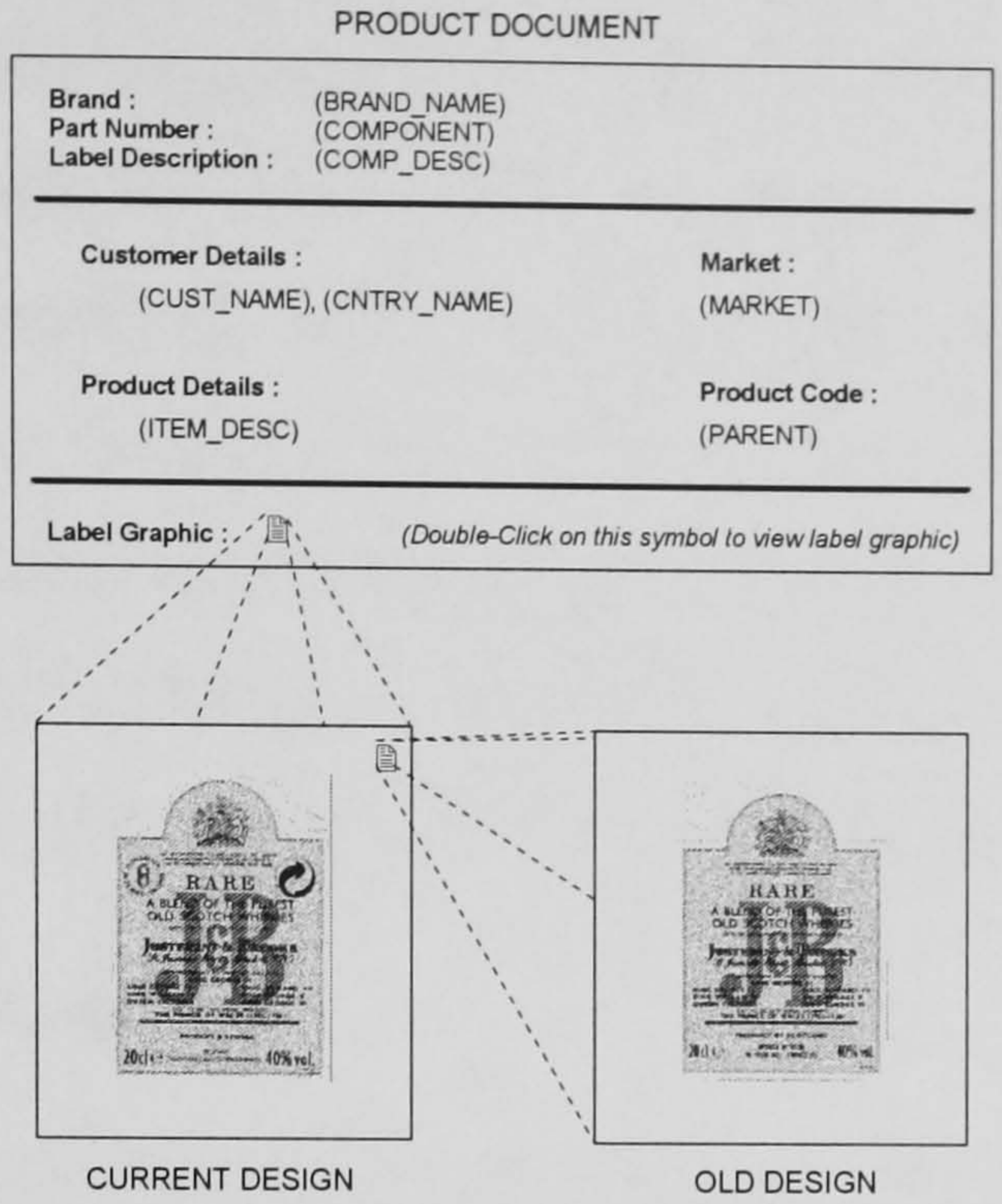


Figure 6.12 - DocLink connections between products and label images.

6.7.6.3.1 Label Change History

The use of DocLinks also provides a useful facility in recording the design change history for a particular label or product. Where the physical characteristics of an existing label are changed with no change in the part number used as a reference, then the new design can simply replace the existing image in the label file, thereby preserving the links that exist with all the product documents that reference that label. In order to preserve the history of the label, the old design is not deleted, but is moved to another document, which again uses the DocLink system to allow an old design to be easily accessed from within the new design.

Where a new label, with a new part number, replaces an existing label on certain products, then the links with the product documents must unfortunately be re-established with the new label image document. However, the advantage of being able to provide a DocLinked change history is still available, provided that the information regarding the changeover can be obtained easily. The information extracted from the external systems would not provide this facility, and would only show the change through the addition of the new label, and the deletion of the old label for a specific range of products. The replaced labels are actually only recorded on the form used to raise a new part number in the production control system, luckily this Bill of Material (BOM) system is one of those being addressed by Notes (see Case Study 2) and so the information can be extracted automatically from this completely separate Notes application when the image is added to the database. I.E. On composing a new label document, the product database uses @DbLookup to find that part number in the BOM database, returning a message to the effect of which label has been replaced in the top right corner of the new label document.

6.7.7 Customer Requirements

Because IDV products are exported on a world-wide scale, the variety of information that they can contain is enormous, especially when some of the mandatory requirements need to be printed in the native language of the destination market. For this reason, the marketing function in London did not try and explicitly define the requirements of a label, preferring instead to keep a hard copy of the final design, which after all contains the specification if only by showing what it is. The initial brief of the project stated that the database system to be developed should list both legal and customary requirements in full and in such a way as they were clearly distinguishable from each other.

The design of the database therefore reflected this by including the provision of forms for recording the actual request for a change to a label, recording explicitly the action that was taken (the specification), allowing for the detailing of requirements relating to the whole range of one particular brand, relating to one country or to one customer, and relating these specifications to the request that they originated from and a whole host of other functions for the recording of customary requirements. However, this was attempting to change the way in which people worked, never before had they recorded the label specifications in this way and the population of this section of the database would require a great deal of time and effort on the part of the IBC packaging controllers, the only people who had knowledge of all the issues and then recorded only in their heads. As stated before, one of the basic principles of a Notes database is that it should only support existing practices, not try and introduce new ones, and so this aspect of the database was doomed to failure.

However, not to provide any system for recording this information would seem to limit the usefulness of the developed system and so it has been agreed that where a label differs from the norm in an immediately obvious way, then the reason for that should be listed as a comment at the base of the image. It is by no means the ideal solution, but represents a compromise between the requirements and the acceptability of the application. The facility to store requests for changes which are received has also been retained, to provide a IDV-wide bulletin board of upcoming issues that allows a greater synergy between the IBC's.

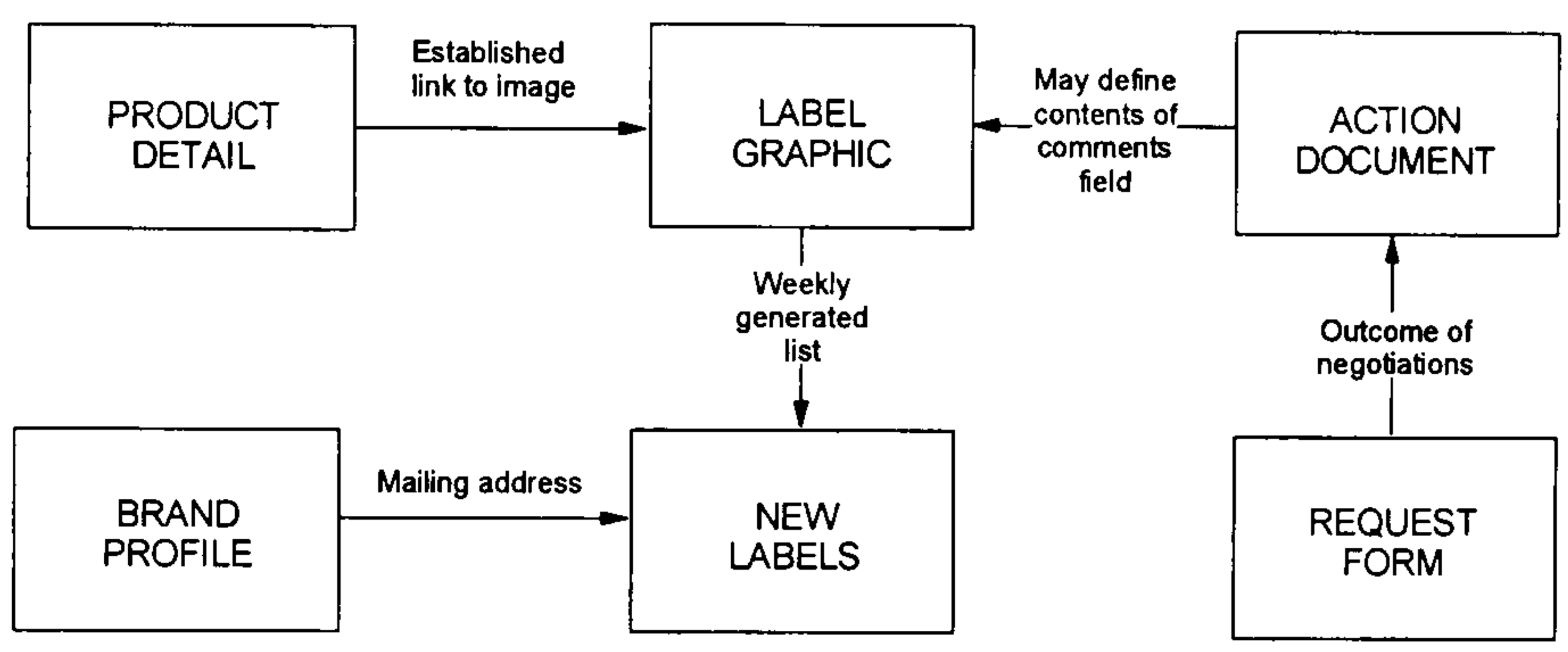


Figure 6.13 - The full design structure of the product database.

6.8 Discussion

Many of the benefits of this application are intangible, involving savings in time by making accurate information more readily available and removing the necessity for the duplication of effort in determining specific requirements, and it very difficult to quantify benefits of this type. The principal benefits are discussed below, and where possible an estimated cost saving is included.

- Less effort in determining information requirements, through ready access to a single, consistent source of data. This applies for all users of the database.

- A reduction in the number of different product codes which exist, through easier pack rationalisation and the provision of a firm basis on which to challenge the production of a unique market product. This leads to :

  - Fewer line changeovers, leading to greater production efficiencies. The time taken for a changeover can be equated to the number of cases that would be produced in that same time interval. By taking the contribution per case and the estimated reduction in the number of changeovers, a saving per week can be determined. J&B Scotland operate on a 48 week year, and so at 1 less, five minute (100 cases at £1.50/case), changeover per day, the estimated annual saving is **£36,000 p.a.**

  - Reduced unit cost of labels. With less market specific products, there is a reduction in the number of market specific labels that are required. Market specific labels are often more expensive than common ones, due to the small production runs that are required. With the volumes that J&B Scotland produce annually (6m cases of J&B Rare alone), this small 'on-cost' of unique labels can represent a significant cost saving. Estimated saving - **£10,000 p.a.** (100 million labels at £0.10 / 1000 labels).

  - Reduced levels of label inventory, producing a small saving in the costs of stockholding.

  - Reduced obsolescence of label stock, as labels can be used on several different products instead of only one. The costs of writing-off this obsolete material is then removed.

- Reduced lead times on changing existing products and bringing new products on stream. Each IBC can view all the labels of the others and use their example, along with a distinct specification of minimum requirements, to more readily change or create their own labels.

- Reduced risk of creating 'illegal' labels, which often lead to material write-offs, reworking of finished stock and import fines imposed by markets.

- Easier identification of alternative markets for products where forecast has exceeded demand, potentially reducing finished goods write-offs.

- Access to a comprehensive historical background of specific label changes.

- Greater synergy between different business units (IBCs, NMCs, etc.), for the first time sharing their experience and knowledge through a common, consistent source.

- Ability to collect and disseminate market information immediately to all those interested, ensuring valid products are always produced.

The mandatory labelling application has been through a pilot test, and much of the smaller developments have occurred as a direct result of this pilot run, and is now at a stage where it is being rolled out to the IDV organisation on a larger scale.

6.8.1 Legal Database

The legal database is potentially of use throughout the entire world-wide organisation, and consequently the roll-out will be a lengthy process. Presentations of the legal database have been made to various sectors of the business, and the feedback received has been very positive. However, these presentations were very much introducing the concept of the database, with the actual design not coming under close scrutiny. Feedback received from the Baileys production site in Dublin, who are the first people outside the pilot test group to really use the system, related a lack of detail and an apparent similarity between much of the information (when looking at the EC this is not really surprising), both issues with the information contained in the Notes system and not the system itself.

It therefore seems apparent that the success of the legal database rests on the way the information is presented within it, if this does not provide the users with the necessary capability to control the packaging to the desired extent, then it will fail, irrespective of the system used or its design. Certainly the database design allows for the inclusion of information in whatever format is decided upon, even to the extent of allowing legal documents to be scanned into the Notes documents (something that the pilot group didn't want, as they would have to read through the entire document, and understand it, to eventually decide that it doesn't affect their products anyway), thus providing a degree of flexibility that would not be possible, to the same degree, with other types of system.

The future development of the control procedures is planned to detract from a central control centre, processing all information on a global scale, as this is an unfeasibly large task. The design of the database supports this fragmentation, with the organisation of the world into different regions, which can be utilised to control editing access (i.e. one region, one local editor), and the additional information documents providing a means for all users to supply legislation which they become aware of, without even knowing who is responsible for the country or region concerned, the correct routing being built in to the automatic mailing facility included in these documents.

The legal database covers only labelling, but there are many other issues for which the appropriate legislation is required. In the area of packaging, there are issues regarding the cases that the bottles are packed in, any individual gift cartons, tins or boxes, and even the pallets which are used. But there are also other issues, shipping documentation, advertising restrictions, etc. and the structure of the database allows for the expansion into these areas, simply by including further forms for the summary and details related to these pieces of legislation.

Now that the information is provided in a single, consistent system, it is up to the individuals to define the uses to which they will put the information. A request has been received to set up remote-users, having access to, and being able to supply, current legal information from within the markets themselves, a function made easier using selective replication. i.e. the sales person replicates only the information related to the countries that they are visiting before their next return to the office. They thus reduce the memory needed to store the information on their portable PC's, remove the necessity to search through mountains of information that they don't really need and considerably reduce the time taken to replicate with the central server whilst they are in the actual market (if this is considered necessary).

6.8.2 Product Database

Due to the fact that the product database is relevant only to the products bottled at J&B Scotland, the number of potential users of the system is much smaller than for the legal database, and it is now virtually at full implementation, with only the procedures to maintain the image library needing to be finalised. Everyone who has so far had a chance to look at the results that have been obtained, has expressed the favourable opinion that the database will allow them to perform their functions much better, providing a much improved reference facility. The rum and flavoured spirits group (Malibu, Archer's, etc.) were embarking on a project to control their packaging through a paper-based system of bottle screens and labels related to actual products, but have abandoned the idea in part due to the introduction of the database, as it provides (or has the potential to provide) all the information that they need, and more besides.

Smirnoff have production sites around the world, each of which has an inventory of labels different to the others, and the IBC has taken the design of the product database and commissioned a similar system to store and control their entire catalogue in one application, linking into the J&B Scotland based product database as appropriate.

Although the current database only relates to the production of J&B Scotland, the design and the principles of data collection can equally be applied to the other production sites. The customer information is all contained in the systems of ICS (they provide a "one-stop shop" for customers), the labels are obviously available and the product related information is undoubtedly held in a system of some description (indeed an IDV-wide project is currently underway to standardise the whole range of systems used throughout IDV). If the procedures could be set up in the relevant departments in the likes of Baileys, Metaxa and Cinzano then the design of the product database could be used to store and display all their product information, to any interested party within IDV.

The images themselves are of sufficient quality to provide an adequate reference of current practice, but they do not allow for the quality checks that are performed, or for the redesign of labels via this stored electronic image. The ISDN links which are being established with label suppliers will rectify this problem and expand the facilities of the product database still further.

6.8.3 Barriers to Success

Lotus Notes has been identified as one of the most suitable systems for this application and the design has been agreed to provide the necessary capacity and functions, to store and manipulate the information required, however the application will still fail if certain issues are not addressed in the near future.

- The potential user base for the group is so diverse that a central support centre is required, to maintain the consistency of the database, the help that is available and the training that is given. At the present time, Notes is a new development within IDV and the resources have not been committed to providing this level of systems support, with the result being that each application must be heavily justified in order for the existing small department to consider taking it on. If this situation is not improved, then it almost becomes a lottery as to whether the support will exist into the future, with the applications that shout loudest being given priority.

- The situation discussed above highlights the need for the continued and strong support for the application concerned, which in this case is now being addressed through the steering committee who are drafting a business case for submission to the systems directors of IDV. Presentations given by members of the steering committee to more senior personnel have obtained a strong commitment from these people for the continued success of the application.

- Only if an application continues to meet the needs of the organisation and provide a considerable contribution to business improvement, will it continue to provoke this level of commitment and support from senior personnel. Therefore, it is imperative that the design of an application continues to evolve, maintaining its "fitness for purpose".

- It is not just Lotus Notes that is a new system within IDV, Microsoft's Windows was only widely introduced during the two-year term of the project, and so any application is being used by a user community who are perhaps unsure, and a little wary, of any new system. If their applications were to continually change significantly, then those systems would undoubtedly fall into neglect. Therefore the development and support of an application must strike a balance between continued provision of a beneficial system and a consistent 'feel' to the application.

6.8.4 Validity of the Reference Model

The discussion presented in section 6.5.1 highlighted the areas of potential problems within this application by analysing the findings of the Reference Model audit. Through several redesigns of the system, the impact of these problems on the success of the application were minimised as far as possible.

6.8.4.1 User Queries

The main area of concern was in the response time that could be expected from an application that would require the database of label images to be accessed many times with the same sort of query ; "Show me the labels for .... ". However the specifics of the search will change, therefore the performance of the application in returning the desired subset of images would have been slow, as the views were continuously rebuilt and refreshed. By making extensive use of the categorisation available in Notes, and by carefully designing the views to allow subsets of the entire set of data to be found easily and intuitively using the hot key function, the need to rebuild entire views was minimised and the response time increased to a more acceptable level as a result.

Previously this information was obtained by first asking one department to supply a list of products, then asking the production company for the labels used on those products, a process which could take several days. With this in mind, the users considered that a small delay of less than a few minutes was an acceptable level of performance compared to the previous system.

6.8.4.2 Data Corruption

The legal documents contained in the application have to be correct and of the latest revision. The label images have to represent the current revision level of the actual labels used in production at the time. Both of these features are very sensitive to data corruption, but by enforcing strict levels of security, allowing only authorised editors to make a change to the actual details (other users being allowed to supply market intelligence using a different form), the chances of corruption were reduced as much as possible.

6.8.4.3 Data Relationships

Although not highlighted in section 6.5.1 as a potential problem, the number of relationships within the product database could cause data to become corrupted due to the large volume of information involved. The documents within the label databases contain links to the actual image documents and for some labels there are many products linked to that label. This means that a change in the design of such a label would mean that the links had to be recreated for all the products, in order to reference the correct version of the label. In order to overcome this potential problem, a comprehensive revision process was set-up (section 6.7.6), utilising macros to move the old label into a new document, and replace the image in the document to which all the linked products pointed. Although this resulted in a rather cumbersome and complicated procedure for label revisions, it did prevent this issue restricting the success of the application.

6.8.4.4 The Number of Existing Applications

As predicted by the model the initial level of resistance to the new software application was quite high as the users were unsure of the system and its use. so did not immediately grasp some of the more complicated aspects of the developed application, resulting in an early disillusionment with the system. As more information was added and these same users saw the amount of useful information that they could access quickly and easily from their own desk, then this resistance reduced considerably, backing up one of the statements made by Coleman [1995] in his 20 rules for success - "Make sure the first win is a big win".

6.8.4.5 Is the model Valid ?

What the above text shows is that the developed model only provides a guide to Notes implementation potential, not a definitive statement. If the overall bias is towards a successful application, then the developer should be able to provide routines which will overcome the drawbacks imposed by those features which seem to indicate an unsuitable application. In this case, the main impetus for implementing Notes was the fact that several sites needed access to the same up-to-date information, and Notes is the best software available for achieving this.

6.8.5 Summary of Design Issues

Having arrived at an application design that provides the necessary functions of the proposed system, it is pertinent to draw conclusions from the design process which can be used in the development of generic design guidelines, that will allow future designs to be achieved in a shorter time.

6.8.5.1 Constant Purpose for the Application

At the outset of the project, the necessary objectives and functions were defined for the mandatory labelling application and this led to the definition of the "purpose", or aims, of the databases that made up that application. It is significant to note that this defined purpose is still matched almost completely by the design of the database, despite the fact that the current design and the initial design bear almost no resemblance to each other.

The purpose is defined by examining the current practice for the system being supported by the introduction of Lotus Notes, in terms of the information which is needed and the use to which that information will be put, as well as the type of application that is being developed.

6.8.5.2 "Group" Design for Groupware

The above discussion has highlighted some errors made by the designer which slowed down the development process for this particular application. A proportion of these errors can be attributed to the designers unfamiliarity with Lotus Notes, leading to assumptions as to functionality that did not hold true when trying to implement certain features, but a lot of time could have been saved had the designer had more consultation with the potential users of the system during the development phase.

The original design of the application attempted to define new practices for the business process, and continued to try and push the users into this for a very long time, whereas the current design accepts that it will take more than a new system to change the methods of working, especially where the users have not been involved in defining the proposed changes.

The availability of external information, and the capability to process large amounts of this at fast rates, was originally overlooked, resulting in firstly, a rejection of the system because it did not provide enough information and could not be verified as accurate, and secondly, time being spent in trying to achieve "relational" capabilities with software that was not designed for it.

Both of these errors could have avoided had the design and development been a group exercise, involving the identified pilot group more deeply in the actual development process. The ideal design philosophy, that would allow for the consideration of all the issues of information availability and location, group dynamics, current practice, etc., would have the pilot user group design and develop the application, with the Notes designer simply providing the interface that defines the 'code' used within Notes. In practice, it is undoubtedly impossible to achieve this, due to constraints of available time and geographical location, but every effort should be made to get as close to this ideal as possible.

6.8.5.3 Functions Included in the Application

The functions that have been included in the design of this applications will be discussed in more detail in chapter 9, relating the general principles behind them to the possible design guidelines which could be used for any application, however it is pertinent at this point to highlight the major functions that have arisen from the mandatory labelling application.

1. Variations in document display - all the legal documents use the facility to hide certain information depending on whether the document is being read or edited, and the summary document uses a different form for the display of information. This is very useful in making the information as tidy as possible, whilst facilitating easy compiling and editing. The use of different forms for display introduced a new level of security not considered by the development reference guides (this security feature is discussed in more detail in Case Study 2).
2. "Relational" database - by allowing flexibility in the format of documents, Notes loses some of the advantages that are provided by more conventional databases in the manipulation and interpretation of data using the relations that are set up between various items. However, both databases in the application use the @DbLookup function, which provides

a certain degree of relational capability, but in both cases the amount of information to be processed is limited as much as possible.

3. Simulated hierarchy of documents - the response hierarchy which Notes can provide is very useful in keeping all related documents together and in displaying them in a meaningful way in the database views. However they do enforce certain restrictions on the contents of views, which may make them more cumbersome in operation, as they have to include documents which are possibly not related to the view itself. Although, the design of the legal database was changed so that the established hierarchy of documents could be utilised, it did lead to the development of a simulated response hierarchy which could be used if necessary.

4. Simplicity in operation - The way that the information is stored within the product database almost eliminates the possibility of displaying the product and the label documents in the same view, whilst still categorising them in a meaningful way (i.e. by country, customer or even product). If the DocLinks were not used in the product documents then the users would be required to use the Window menu to switch between views each time they wanted to view an image of the identified document. Where one image is concerned , this is not a problem, but many design issues don't involve only one image. Therefore, the DocLinks provide a simplicity to the retrieval of information that should aid in the general acceptance of the database.

6.9 Conclusion

The findings of the audit performed against the developed reference model proved to be mostly correct for this application, the model providing not only an indication that the application is a suitable candidate for Notes implementation, but also an indication as to where the designer should concentrate the most effort in overcoming the more obvious drawbacks of a not quite ideal fit to the Reference Model.

What also came out of the case study is that the reference model cannot be used immediately in the application evaluation stage of a project, the analyst must first clearly define the basic outline of the project, thereby providing some guidelines as to how the auditing of the Reference Model can be achieved, especially in the exact classification of the various measures involved.

With regard to the audit methodology, the fact that this was the first case study application made it difficult to determine a suitable position for the application characteristics on each of the defined scales, some isues cannot be fully appreciated without further experience of Notes development. However when analysing the resulting reference model, most of the issues relating to the process are known and it is quite easy to take each measure in context with the potential suitability of the application.

CHAPTER 7

CASE STUDY 2 - BILL OF MATERIALS

7.0 CASE STUDY 2 - BILL OF MATERIALS

7.1 Background

J&B Scotland operate an MRPII (Manufacturing Resource Planning) system to control the production of the large volume of products which are shipped to customers world-wide every year. The operation of such a system requires that each individual SKU (Stock Keeping Unit) be represented by a Bill of Material, specifying each different item which makes up the finished product along with the necessary quantities of each of these items. The organisation structure which supports the generation and maintenance of the Bill of Materials for the 3,000 active SKU's, is comprised of a small department who have the responsibility to ensure that the information is correct at all times.

The Bill of Material function is vital, as the information is used by :-

- Purchasing and Procurement : to raise purchase orders and arrange material deliveries based on the products which are planned only as a product code (i.e. each individual items lead time is used to ensure that all materials are available for the planned bottling of those products which require that item).
- Materials and Production : to ensure that the correct items are used, and are available on time, for each of the products which are being bottled.
- Quality Assurance : to allow for the inspection of products and individual items against a master specification.
- For periods of high demand (e.g. in the run up to Christmas), J&B Scotland also use subcontract bottlers, and they obviously need to be supplied with all the correct material.

New products are raised in response to customer requests received by the customer service department, either at J&B Scotland (for the major markets) or at the London headquarters of IDV. The generation of a new BOM for the requested product involves not only the Bill of Material department but the purchasers (who specify the individual parts which make up the product), quality (who supply weights and measures information once the parts have been specified) and finance (who need to agree that the generated standard cost is correct).

The existing method of raising a new BOM is to physically send a proforma to everyone involved, asking them to fill in the relevant section and then pass it on to the next person who has a contribution to make. As with all paper systems, there is a tendency for the proforma to be misplaced at various stages in its route, delaying the raising of a new product which is invariably marked as urgent by those requesting it.

New products can not be planned into production until the BOM is complete, and so any delay in the generation of the information in the computer system is potentially losing the company a lot of money, through lost sales, customer dissatisfaction and a resultant decrease in the market share. On top of the delay imposed by the use of the paper-based system, the BOM departments job is continually made more difficult as the requesters of delayed products try and find the status of their urgent requests, often requiring the BOM personnel involved to physically visit the department where the new request is delayed to try and find a piece of paper which is at the bottom of a large pile of other documents on someone's desk.

7.2 Objectives of the Project

At one time the forms were set up in the electronic mail system used by IDV, so that all the routing of forms to those having an interest could be performed electronically. However, electronic mail has several drawbacks in this type of process, mail documents would need to be either sent to each person involved, resulting in multiple copies of the same product request, or forwarded by each person once they had added their details, which doesn't really solve the problem of delays in obtaining the information. On top of this, the unstructured format of electronic mail systems, in terms of the inbox which new messages are sent to, means that the requests would be buried in among all the other documents which are sent back and forth in the company, so they could get equally as lost as the paper based forms.

What was needed was some way of modifying this electronic communication, which would undoubtedly remove some of the delays which occurred in the current process, so that all those involved were aware of exactly what they were required to provide and were allowed to provide that contribution as soon as possible. The specific requirements of this electronic system were to :

- Ensure that the originator of the request supplied sufficient information for the generation of the correct BOM.
- Store and transfer the documents to those who are required to provide a contribution, under the control of a central function.
- Allow simultaneous updates of any one document, by anyone with a contribution to make, eliminating the compound delays which occurred with the physical transfer of a proforma.
- Provide an explicit statement of the status of any request as it progresses through the necessary departments.

7.3 Project Specification

With only a brief examination of the above requirements and the knowledge gained in the development of other applications, it seemed immediately obvious that Lotus Notes provided the capabilities to improve the system dramatically. The developed Reference Model can be used to prove or disprove this assumption, but first a basic outline of the application is needed, in line with the conclusions drawn from chapter 6.

7.3.1 Capturing and Controlling the Information at each Stage

The layout of the form which is used to collect the necessary information in the current 'manual' process, lends itself to inclusion in Lotus Notes in an almost identical format, reducing the time that it will take for users to get used to a new system. The present form allows every contributor to add their information in the appropriate place, however there are no restrictions on what can be entered and no means of ensuring that all the necessary information is completed at each stage.

For instance, the originator of the document will often specify the product code to be used, based on their assumptions and knowledge of previous products. However, they have no way of knowing whether this is a valid product code or not, it may already exist, and only the BOM department have the authority to allocate product codes for this reason. The form then requires modification and rapidly becomes very confusing as to the information which is actually applicable to that new product. At the other end of the scale, the current proforma includes "check boxes" against each commodity type (i.e. Bottles, closures, labels, etc.) in which it is intended for the originator to indicate the general make-up of the new product (i.e. circle the type of material that is required for each commodity). Very often these are not filled in and the other users need to almost guess as to the material to be used.

Using the security features of Lotus Notes to provide or limit access to sections of a form, for a specified group of users, the problem of over specification (and subsequent modification) is removed. The inclusion of compulsory fields is also easy to accomplish using the validation formulae of the selected fields, if there is no value in the field when attempting to save the document, an error message can be displayed and the save process aborted until a value is entered. These features remove a lot of the backtracking that occurs with the present system, in determining the exact specification for the new product, and subsequently speeds up the entire process.

7.3.2 Electronic Storage and Transfer

The size of the production facility of J&B Scotland and the organisation of the various departments meant that all requests for new products, whether they be from J&B's shipping department or the London based customer service division, arrive at the BOM department by fax. It is this fax which is then passed around the various departments who are required to contribute, via the internal mail system which can be quite slow, before being filed upon completion. The resultant documents are often damaged to a certain extent, and can often get lost or misplaced as they move about.

By transferring the system to Lotus Notes, the documents can be composed by anyone with access to the database, and they are immediately available to everyone (or immediately after the replication with the server on which there were composed). Because Notes locates its documents on a server, they are then not actually passed around, but are simply made available to different people as they progress through the stages of compiling the BOM. They can then not get lost, and certainly can't get damaged.

By utilising the integrated e-mail facility available with Notes, a message could be sent automatically, at various stages, to :

- Inform the BOM department that a new request has been raised.
- Inform contributors that there is a new request requiring their attention.
- Notify the originators of the document that the request is complete.

The resultant completed document could be printed out directly from the system, to provide the necessary paper files for the requirements of the quality system and to reduce the amount of memory taken up by the application. Obviously documents which are printed out and immediately filed will be in much better condition than a fax document that has been passed around at least ten different locations.

7.3.3 Simultaneous Updating

The need for documents to be physically passed between contributors results in a compound delay, which adds together the delay that each individual introduces as they either determine the information to be added or forget about the document altogether. By storing the documents on a Notes server, multiple users can access, and provided that they do not change the same information.

edit each document, reducing the delay in completing a new request to that imposed by the contributor who takes the longest time. This introduces a form of performance measurement, so that the reasons for the long delays can be investigated and tackled more efficiently.

Because the security within a document can be controlled to sectional, or even field, level, the document can be accessed by multiple departments as well as multiple users in the same department. Therefore, users can process the request as soon as the information that they need to do so is provided by the other contributors.

7.3.4 Tracking the Progress of Documents

It has already been mentioned that the storing of documents on a server means that they can't get lost. This statement can be extended by analysing the information which each document contains, to not only provide the ability to find a document but also to determine what stage it is at in the compiling of the information. Using various techniques to control the Work-Flow of the documents, it can be determined who has entered information, and who is still to enter it, how long particular people have had access to a document, what information is required, etc. The constant "progress check" telephone call from the originator of the new product request document should then become a thing of the past and the visits to the purchasing department to unearth requests from the bottom of a pile of paper will no longer be necessary, as the status of any request can be determined from any interface into the Notes system.

7.3.5 Other Documents

Having determined that Notes provides the facilities to be able to better control the generation of new BOM's, further investigation revealed that certain other documents used by the BOM department lent themselves equally well to the application of Notes, and could therefore become part of the same system.

The individual parts which are included in the BOM for each product are also contained on the MRPII system, specified by the purchasing department and controlled by the BOM department. Again a proforma is used to transfer the necessary information, and again the current process has many drawbacks, similar to those encountered with the product request form. Changes to existing BOM's also involve the interaction of these two departments, with a form again being used to specify the product that is changing and the new part which is to be used.

By including as many of the forms that are used as possible, the justification for developing a Notes application is easier to define, as the subsequent benefits which can be achieved increase.

7.3.6 Reference Model

The Reference Model produced by the audit on this application is given in figure 7.1.

A discussion of the classifications made on the defined scales is given below.

(a) The system is intended to be used by the entire purchasing department within the J&B Scotland production site and new documents will probably be created on a fairly regular basis. As the application includes a large degree of workflow functionality, the status of existing documents will also be changing on a regular basis.

(b) As the data is intended to eventually be included into the MRPII system, the data entry stage is required to be controlled so that information can be standardised as much as possible. This represents a need for keyword fields to relate to previous entries made on existing documents, giving users a standard list of options for a particular field. In the case of the creation of a new Bill of Material, the lookup fields will eventually represent the individual items that have also been raised within the system.

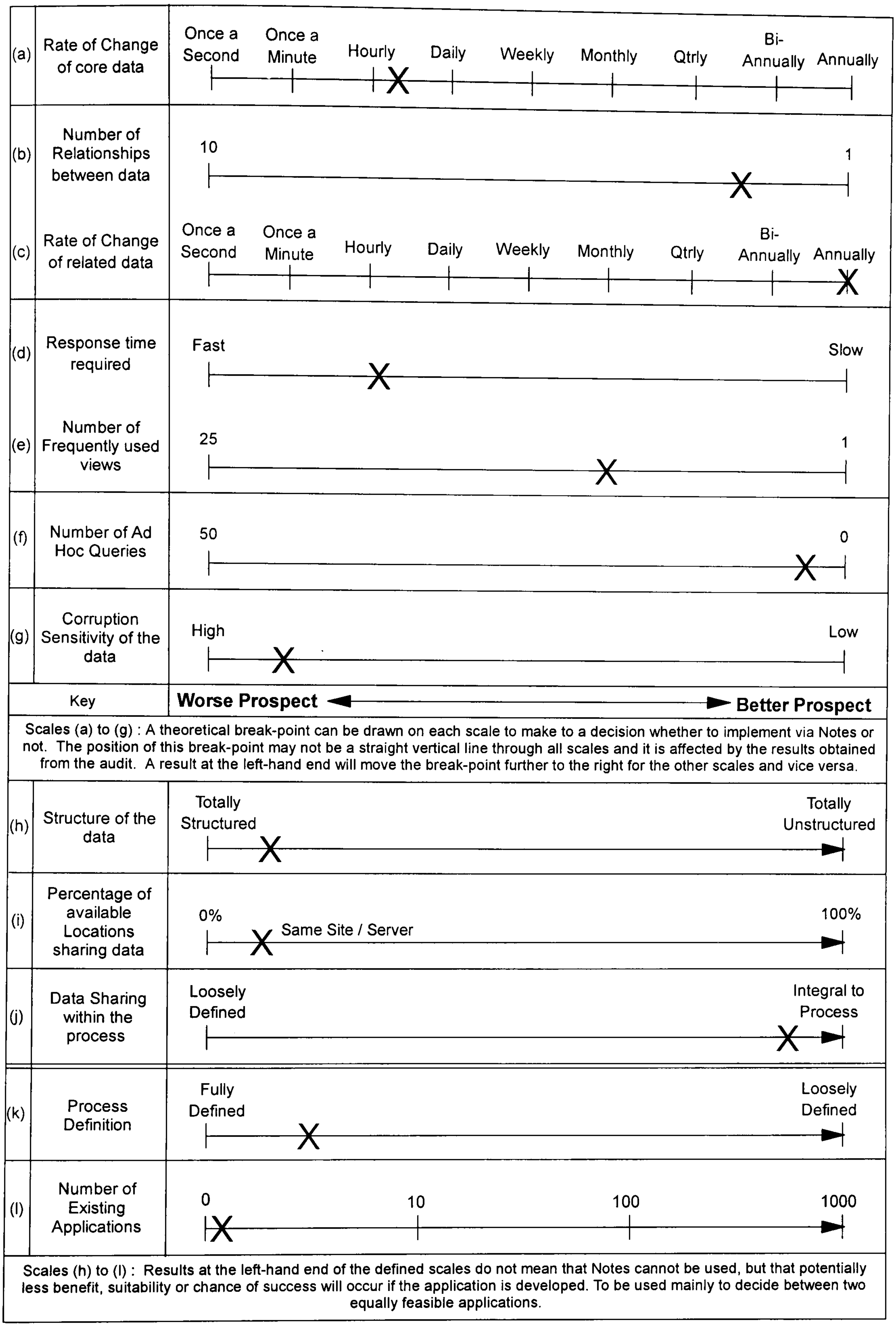


Figure 7.1. - Audited Reference Model for Bill of Material Application

(c) Once the information is entered using the keyword lookups described in point (b) it will never change.

(d) The information transferred between the various departments will eventually be used to control the items used within the high volume production operation, and so data must be finalised, accepted and transferred into the MRPII system as quickly as possible requiring a fast response from the system.

(e) To control the workflow process, one view is required for each status that the documents pass through from creation to completion.

(f) The main aim of the application is to control the creation of new parts and bill of materials for the MRPII system, the only ad hoc queries that are required will be to provide a level of traceability if problems occur in the resultant information transferred between systems.

(g) The information transferred into the MRPII system must be as accurate as possible, otherwise the processing of orders and costings within that system will return spurious results.

(h) The MRPII system is a traditional database that separates the contents of each record into well defined fields. As the application is intended to support the creation of these records the information contained in the documents will have to reflect this same structure.

(i) The application will only be used at one production site (although the same basic design could be used at any of the IDV production facilities using a similar production control system), with access to the same server. However, the physical size of the plant means that the different departments involved are quite well dispersed in terms of physical distance.

(j) The application is a workflow application, moving documents along a prescribed route as an essential part of the process.

(k) The application is a conversion of an existing paper based system that used the same routing of documents with the production facility, therefore the process is already well defined and should be supported by the application, not changed by it.

(l) The only other Notes application in place at the J&B Scotland site is the Mandatory Labelling application detailed in chapter 6.

7.3.6.1 Analysis of the Audited Reference Model

The fact that the information generated by the application is eventually to be transferred into the production control system of the plant, obviously makes the control over the data a critical issue. This is highlighted in the reference model by controls (a), (g) and (h).

In the general context of the developed Reference Model this would tend to indicate that the application is probably unsuitable for Notes implementation. However, combining this with the fact that this is an existing workflow process that is clearly defined in terms of a paper based system, a simple transfer of existing routines into electronic format should be able to overcome the problems represented by the nature of the data. It is known who should have what information when and in what format it should be presented.

The other area of concern could be in the response time required of the system, but again the fact that the application is a defined workflow process alleviates this to a certain extent. The information is routed at the appropriate time by the e-mail system, there is no need for the user to continually access the views provided by the system. Response time is defined by the frequency that the user checks their e-mail, not by how fast the Notes application can rebuild the appropriate view.

Again the number of existing applications within the organisation may cause a problem with the buy in to new software, however the application was actually requested by the departments concerned once they had seen the capabilities of Notes through the Mandatory labelling database (chapter 6) and so acceptance of the application should be almost automatic provided that it replicates and improves the existing process.

7.4 Defining the Application

It is obvious from the above discussion that this application falls into the category of work-flow automation and it has been continually stressed that any Lotus Notes application should not try to change the existing process. Therefore to define the general aims of the Notes application, it is vital that the existing process be investigated and documented.

7.4.1 Bill Of Material Request

Each product is identified by a unique ten digit number, giving encoded details of the brand and alcoholic strength of the spirit, the pack size (often including details of special items which are used in the assembly), and the country and customer to which it is supplied. Therefore most of the product codes are unique to a particular customer (this eases the warehouse management and shipping problems), and both the decision to target a customer with, and a request for, a new pack configuration will necessitate the setting up of a new Bill Of Material in the MRPII system (J&B Scotland use "Fourth Shift").

The result of this is that several different departments will raise a request to set up a new product and associated BOM, and the proforma which is currently used for this is given in figure 7.2, however every new request then goes to the BOM department. The originator of the document should fill in all the details in the top section of the proforma, except the product code which can only be determined as a valid entry by the BOM department. However, IDV UK, the UK based distribution company allocate their own six digit product codes which are simply sequential numbers. In this case BOM only add the two digit brand code and "XX" to the front of the product code, thus requiring that any home trade product have the sequential code specified in the form.

REQUEST TO RAISE BILL OF MATERIAL

TO : BOM Admin, J&B Scotland. Fax : 01389 742511 DATE : ____

Originator : ____ Product Code : ____

Commodity Code : ____ Replaces Code : ____

Commercial Desc : ____

Special Instructions : ____

Product Details

Gross Weight : ____ Net Weight : ____ Cube : ____

Dimensions : Height Width Length ____ Equivalent cases : ____ Stock Unit : ____

Country of Origin : ____ Warehouse : ____ Exporter : ____

Materials Required

	Part Number					
Bottle	____	GLASS	PET	ROUND	FLASK	
Closure	____	STELCAP	NR	C/C	ROPP	POURER
Label Face	____	CODED	GX	DF	MARKET SPECIFIC	
Back	____	CODED	GX	DF	MARKET SPECIFIC	
Neck	____	YES	NO			
Foot	____	YES	NO			
Top Strip/St. Stamp	____	YES	NO			
Ind Sticker	____	YES	NO			
Case Sticker	____	YES	NO			
Individual	____	YES	NO			
Division	____	YES	NO	SLEEVE		
Miniature	____	DISPLAY	CLUSTER			
Case	____					
Pallets	____	NONE	STANDARD	EURO	OTHER	

Financial Details

Standard Cost ____ Bottling Charge ____

Spirit Charge ____ Line Number ____

Manning Level ____ Cases per Day ____

Details Copied From ____

4th Shift Completed ____ Date ____

Dunedin Completed ____ Date ____

Dunedin Approved ____ Date ____

Finance Approved ____ Date ____

Figure 7.2 - Request to Raise Bill of Material Form

Of the product details, the weights and dimensions of the product will be determined once the items, which comprise the product, have been specified, but all the remaining entries in this section must be specified. Again there is a complication with this because J&B Scotland provide warehousing and distribution facilities for other IDV brands, and these must be set up in the system as well in order that the warehouse management system can accommodate them. Where the product is not produced at J&B Scotland, the weights and measures information must be supplied by the originator of the request.

In order to give as much information as possible to those who have to specify the parts to be used for the product, the originator of the document should indicate the type of commodity for each of the various classes of item listed in the Materials section of the form. The check boxes are used to make this as easy as possible, as they only require that the originator make a selection from a predefined range, before highlighting that selection.

Once the request is received by the BOM department a standard list of codes is used to allocate the new product a unique number, which is then validated in Fourth Shift. The part completed proforma is then transferred to the purchasing department for the specification of the part numbers relating to the individual items which will comprise the final assembly.

The purchasing department at J&B Scotland is arranged so that each purchaser deals with a different set of commodities split as follows, bottles, closures, labels and cases/cartons. The purchasing of cases and cartons is further split relating to brands, as brown (Whisky) and white (Vodka, Malibu) spirits. Therefore each new product request must be processed by every purchaser in turn, except for cases and cartons, and it is checked in and out of the department by the administrative assistant of the purchasing department as a form of control should requests be 'lost' at any point. Weights and measures information is related to cases, and so once the part number for the case has been specified, the weights and measures can be included in the form. Where an existing case is used, the BOM department can look up their files of information and enter the appropriate details. Where a new case is specified, the weights and measures information must be determined by the quality department, before it can be added to the product request form, and this is often performed when the part number is raised on the system (section 7.4.2).

When all the parts have been specified on the proforma, it is returned to the BOM department for inclusion into Fourth shift. The overnight processing which occurs automatically within the system then calculates a standard cost for the new product, taking into account the various materials that are used and the labour costs that apply. The warehouse and distribution system is not connected to the production control system and yet the new products must be set up in both, therefore there is a delay of one day from the completion of the BOM to the availability of the new product for shipping. In order to provide a check on the details that are entered by the BOM department, finance need to approve each new product once the costs have been calculated by the system.

This process is indicated in figure 7.3 below.

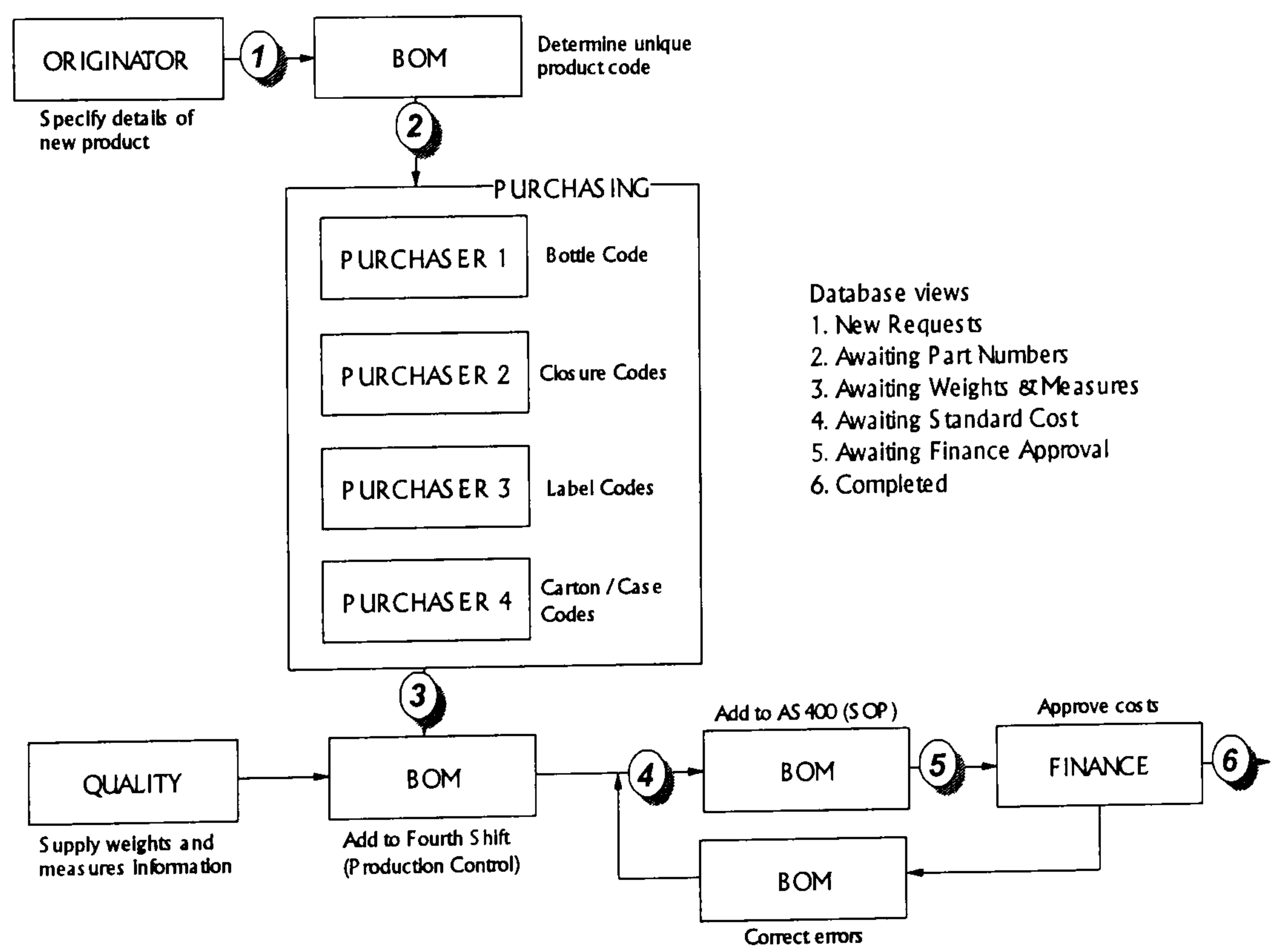


Figure 7.3 - The process of compiling a bill of material for a new product specification.

The Notes database which will replace the paper based system, must not change the nature of the database, and the advantage of utilising the same design for the proforma has already been discussed. The purpose of this aspect of the database is thus :

- to allow for the specification of all the necessary information for the raising of a new BOM, ensuring that the necessary details are as complete as possible at each stage.
- to monitor and control the new product generation process by providing a view of documents at each stage (figure 7.3 indicates the views that are included in the database and their position in the process of raising a new BOM).
- to automate the work-flow by moving documents to subsequent views when all the necessary information has been supplied for each request.

7.4.2 Part Number Request

All the items which go into the BOM's of the new products must also be raised in the MRPII system, including details of the unique part number which will be used to identify it, the cost, the lead time for obtaining the part from the suppliers (J&B Scotland buy all of their materials from external suppliers and simply assemble it all together to make the finished product, so there is no manufacturing lead time, only a time from the placing of the order to the availability of the material) and information regarding any old materials that may have been replaced.

Again it is the BOM department who have the responsibility for controlling part information in the computer system, but in this case all the information comes from the purchasing department, who source and order all the items used in production. It is therefore a much simpler task to control, but there are certain problems involved with the process, that must be identified and tackled in the Notes system.

MEMORANDUM

To : Bill of Material Administrator

From : Date :

PART NUMBER REQUEST

ITEM DESCRIPTION ____________________

REQUESTED BY ____________________

REASON FOR REQUEST ____________________

ESTIMATED IN-EFFECTIVITY DATE ____________________

STANDARD COST ____________________

QUANTITY REQUIRED PER PRODUCT ____________________

BUYER CODE ________ PROC. CODE ________ COMM. CODE ________

LEAD TIME ________ RUN ________ FIX ________ INSP ________

LOT SIZE DAY ________ LOT SIZE MIN ________ LOT SIZE MULT ________

WEIGHTS & MEASURES WILL CHANGE YES / NO

REPLACED ITEM CODE ____________________

FLAG ITEM AS O OR P ____________________

OBSOLETE QUANTITY ____________________

VALUE OF OBSOLECENCE ____________________

WRITE OFF REQUESTED ____________________

BILLS OF MATERIAL AFFECTED ____________________

____

____

PART NUMBER ALLOCATED ____________________

MAT A/C NUMBER ____________________

BOM ADMINISTRATOR ____________________

COMPLETION DATE ____________________

Figure 7.4 - Part Number Request Form

The form used to raise a new part number is given in figure 7.4. and the relevant purchaser is required to fill in as many of the details as are necessary for the particular part. Upon receiving the part number request from purchasing, the BOM department then allocate a unique part number, using a standard sequence where possible (e.g. all J&B Rare labels begin with '"66" and have five digits in total), and determine the material account code from a standard list based on the brand for which the part is to be used.

The major problem which occurs is where the costs of the new part are not yet known, but the purchaser needs to be able to order the item from the supplier. To do this the part must be raised in the computer system. BOM are then required to keep a check on all those new parts that do not yet have a cost and chase up the relevant purchaser as necessary (with no cost, the material cannot be booked into stock).

What is needed in the Notes system therefore is :

- a proforma for part number requests which matches that already used in the paper based system.
- a method of highlighting to purchasers which parts are still requiring a cost to be added.
- a notification of those parts which were awaiting costs and have now had cost information supplied.
- a control system which allows for the monitoring and control of these documents at the various stages.

The Notes application which has been developed, at this stage only includes these two documents. As discussed above, there is at least one other document which could be incorporated into the system (Bill-Of-Material Change Request), but these other documents are a simple transfer of information from one department to another, therefore not requiring any special design except in transferring the existing proforma onto the Notes system. The development of the application will only expand to encompass these other documents if the pilot on the Product and Part Number requests is seen as successful.

7.4.3 Modification to Existing Theories

In the previous case study it was identified that the purpose of a Notes application should be defined by looking at the type of application, and the nature and use of the information that the application will hold. During the development of this work-flow application, the purpose was defined by looking at the existing process and mimicking that in the Notes database. This is not a deviation from the previous theory, but the definition of nature and use is interpreted slightly differently.

- The nature of the information determines who should supply it, and is used to control the layout and security of the forms used. The necessity to supply information has also had an affect on the organisation of the views in the database, providing a "To-Do" list for each of the contributors of information.

- The use to which the information is put defines the route of the documents through the various stages of the process and controls the timing of the transfer of documents from view to view.

Therefore in a work-flow application, the nature and use of information is rolled together and represented as the business process which is being automated. The purpose of the database is then simply to support the workings of the process being automated.

7.5 Design Issues

The design and development of this Notes application has been ongoing for just over six months, and in this time has included much less actual design work and more proving and testing with the users involved. The main reason for this reduction in development lead time is the designers familiarity with the capabilities and limitations of Lotus Notes as a development architecture, providing a better insight into the methods to be used to achieve the desired functionality in the database. However, there were other factors which affected the development lead time, not all reducing it, and it is pertinent to discuss these at this time.

7.5.1 Existing Business Process

This application is only intending to support an existing business process, which although having certain problems, does meet its objectives. Much of the design work therefore involved simply transferring the existing proforma documents into the Notes database (there were certain problems encountered in this which will be discussed later), and the design effort was concentrated on controlling and monitoring the routing of documents through the established process. Obviously, if this were a database for a new process, then the forms would have to be designed from a blank page and the development time would be lengthened considerably through the need to establish the information that is required in each case.

7.5.2 Example Database

In the first case study, looking at mandatory information, it was discussed that the use of standard templates and examples could speed up the development time of a database considerably, by providing a structure which could be modified to suit the specific application. In this case, it was not the actual design that was utilised, but rather the concept behind one of the example databases.

A "Travel Authorisations" database creates a central repository for the creation, approval /rejection, and tracking of requests for travel authorisation. This is a obviously a work-flow automation application and the process flow involved is :

- The originator of the request fills out and saves a Travel Authorisation Request. A notification message is sent, via the e-mail system being used, to each person on the approval list when the request is saved. This message will inform them that there is a request for their review.

- The notification message contains a doclink to the request. The approver double-clicks on the doclink, and the Travel Request document is displayed. The approver then edits the request document and marks it as either approved or rejected by clicking on the appropriate button. When all approvals have been received the status is changed to 'Approved'.
- When the request is completely Approved or Rejected, a macro sends a notification to the traveller and the originator informing them of their request disposition.
- Each day a macro will update the age of all "In-Process" requests.

Looking at figure 7.3, showing the process flow of the BOM request documents, it can be clearly seen that the above design closely resembles the requirements of the BOM Notes database, with New Product Requests being raised and sent to various people for information to be added (with notification by mail), before returning to the originator as a completed document. Even though the design is not used directly, the concept is so similar as to point the developer in the right direction to achieve the necessary work-flow automation, and in some cases the formulas behind various fields and macros could be copied into the new application. All of which means that the development lead time is reduced considerably, as much of the thought behind the automation processes has already been performed by someone else.

7.5.3 Dangers in Early Release

It was decided by the steering group for this particular database, that the initial pilot database would use only the part number request form as it was a much simpler form, involved less people and would serve as a good introduction to the use of Lotus Notes for the users involved. However, the main benefit of this application is in the BOM Requests, and the introduction of part number request actually increased the amount of work for (and paper generated by) the BOM department. The design of the database was also rushed to get the part number request into pilot as soon as possible, and did not include the required functionality to meet the needs of all the users.

The result of this being that those involved in the pilot became somewhat disillusioned with the system, making the generation of timely and constructive feedback difficult to induce. If not for the fact that the application is being pushed into general use by the managers involved, then it is doubtful that it would be in use today. The problems involved in the draft design have been solved to a certain extent, and the BOM request has been introduced into the pilot database, making the Notes application more acceptable to those users who had initially expressed their reservations about its use. Even though the implementation may now be more successful, the damage to users perception has been done and any take-up of the application will progress at a slower rate.

7.6 Work-flow Automation

It has already been discussed that the major design effort involved the control and routing of the documents through the identified stages of the established processes. The main issue, is the trigger that initiates the transfer of a document to a different view in the database. The following discussion, deals with each form in turn, going through the various views that the document may appear in, and specifying the triggering information in each case.

7.6.1 New Product Requests

There are six identified states for these documents (see figure 7.3), resulting in the six views listed below.

1. New Requests

   Each freshly composed request appears in this view, which is categorised by brand to suit the way in which the BOM department is organised (i.e. each member of the department deals with a defined range of brands). This view is effectively an In-tray for the BOM department, and so the trigger to transfer the document to the next state is the entry of a ten digit product code. The form used for new product requests does not allow anyone but this department to enter a product code (except the six digit home trade codes) and so only they can move the document to the next state. No new request is missed, and they always have a monitor on the work that they still need to do.

2. Awaiting Part Numbers

It is the responsibility of the purchasing department to add the part numbers to each new request, and this view is categorised by the individuals in that department, again giving each member of the team an In-tray of documents that require action by them. Each document is required to be actioned by multiple purchasers, and is therefore listed more than once in this view. The explicit specification of brand in the initial request allows for the determination of all the purchasers that are involved (i.e. the responsibility of cases and cartons are split into brown and white spirits) and this can be compared to an edit history, compiled as each purchaser adds their contributions to the document, to remove a document from under those purchasers who have already actioned it. Once every identified purchaser has added their part numbers, the document will be removed completely from the view. Therefore the trigger in this case is an exact match between the edit history and the identified list of purchasers who are required to contribute to a document.

3. Awaiting Weights and Measures

The weights and measures information of any product is determined by the case which is used in the BOM, and therefore any request which has had the part number for the case specified is listed in this view.

irrespective of whether it is still awaiting other part numbers or not. If the application is to fully realise the benefits of Groupware in the future, then it may well be the quality department, and not BOM, who enter weights and measures information. In anticipation of this, the view is categorised by brand to make referencing easier for everyone. The document will disappear from this view when the weights and measures information is added, but it will not transfer to the next view unless all the parts have been specified.

4. Awaiting Standard Cost

Once all the part numbers have been added (i.e. all the identified purchasers have made their contributions) and the weights and measures information has been provided, the new product can be raised on Fourth Shift. As discussed above this system must process the new product details overnight to arrive at a standard cost for the new product, and so the Notes document is sat at "Awaiting standard cost" while this happens. The obvious trigger to transfer this request to the next view is the addition of a standard cost value. This trigger also automatically sends a cc:mail notification to the originator of the document, as to all intents and purposes, the product is now ready for use.

5. Awaiting Finance Approval

The addition of standard cost is the final stage in the processing of the document by the BOM department unless the finance department find an error, but the document can only be moved to the completed view when Finance have approved the product requests. An electronic signature from the appropriate member of the finance department will move the document to the completed view.

6. Completed

The final repository of all the Product request forms upon final completion and approval. At the present time, the documents will not move out this view, however in time, some form of archiving will be necessary to reduce the amount of memory required for the database.

Most of the triggers used in the database to move the form through the various views listed above, revolve around the existence of a value in a particular field and this can be used to provide an overview of the status of any new request. Therefore another view is included which lists all the current product requests, using a formula in one of the columns to calculate the status based on the states that the triggers are in within that document. e.g. if there is no standard cost value and all the specified purchasers have added their contributions, and weights and measures have been added, then the status is awaiting cost. If there is still one purchaser to add the necessary details, then it is awaiting part numbers, and so on.

7.6.2 Part Number Requests

The above design for controlling the work-flow of the documents is sufficiently rugged to allow for a similar principle to be used to also control the part number requests. The various states of these documents has been discussed in the above text, and is represented in figure 7.5 below.

It can be seen from figure 7.5 that there are four views required for these documents to reflect the status of the part number request and these are discussed below.

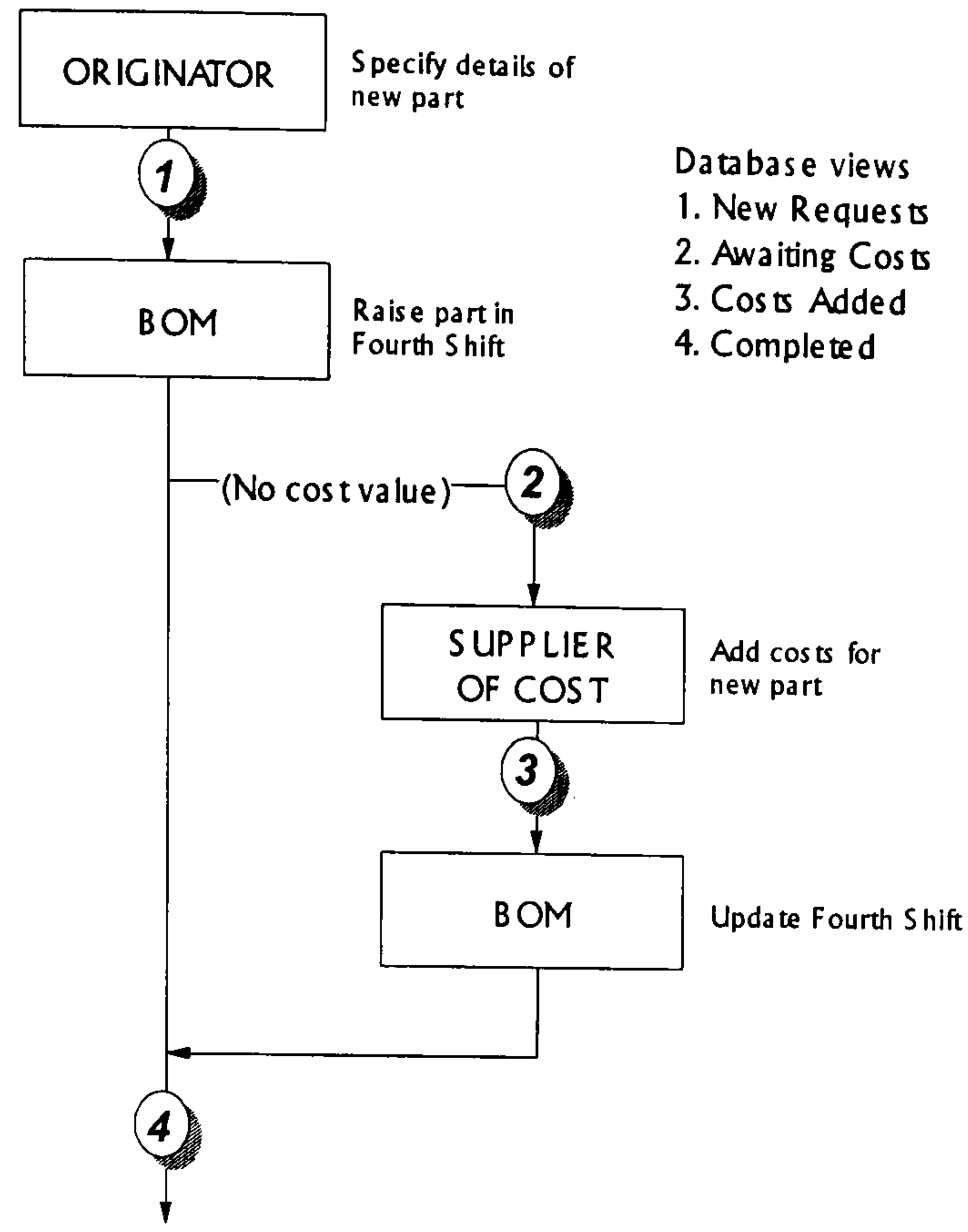


Figure 7.5 - Work-flow routing for the part number request form

1. New Requests

New part numbers can be raised by many different people (mainly purchasing, but packaging development and planning can also raise new parts), but they are all dealt with by the BOM department who, as already discussed, are split into responsibility for a selected range of brands. Therefore all new part number requests arrive in this view, categorised by the brand which the new part is to be used for, thereby allowing each member of the BOM department to quickly find those requests that require their attention. Some of the purchasers control their own part numbers (i.e. labels), but in most cases the requirements on the BOM department are to determine and assign a unique part number to these new items, and then enter all the specified details in the production control system. The trigger which moves the new requests to a different view would, at first glance, appear to be the addition of a part number. However, where the purchasers control their own part numbers, this cannot be used and so the trigger has to be the addition of the details to the production control system. For this reason a button is added to the part number request form in Notes, to allow the BOM department to indicate (by pressing it) that the details have been added to Fourth Shift. Once the button has been pushed, the document is moved to a different view. By using sections within the form to control the access to the button, only the BOM department can move a request from this New Request view to another one.

2. Awaiting Costs

In certain cases, a new part has to be raised in the production control system before the final costs have been determined. In this case the standard cost field within the form is left blank (any editor of the document is asked if this is the case upon saving the document, to prevent inadvertent omission of cost information). When the BOM department indicate that the details have been transferred to the production control system, a check is made on the existence of a value in this field, if there is no value then the document moves to this "awaiting costs" view. The documents in the view are categorised by the person who is to add costs to the requests, in most cases this is the author, however packaging development have the ability to able to specify a particular purchaser who is to determine the costs (a mail message is sent by the system to alert them of this situation). Whatever the case, each user of the database is then presented with a list of the documents that require costs to be added by them. The addition of a value in this field then acts as the trigger to move the document to the next view "Costs Added".

3. Costs Added

In the existing system, the BOM department are required to maintain a log of those parts which are still awaiting a cost, so that the information can be added to the item details in the production control system.

For the same reason, those requests in the Notes database which were "awaiting costs" cannot be moved to completed immediately that a cost value is added, and this view provides a means for the BOM department to be alerted when a cost has been added to a document that they have already processed. The view is therefore categorised by the member of the BOM department who initially processed it, providing a "To-Do" list for each of them. Again the trigger to move documents from this view to the next one is the addition of the new details to the production control system, and the same button is used, as was used to move the document from the "New Requests" view. However, in this case the formula which the button activates contains certain checks which will ensure that the correct work-flow is achieved.

4. Completed

Any new request which is processed by the BOM department and includes cost details is automatically moved to this view. Those documents which are in the "Costs Added" view and are then further processed are also moved to this view. It therefore represents the final repository of part number requests, and as such is categorised by Brand to make queries into completed requests easier. Again, as the database is used more and more, some form of archiving will be required to reduce the number of documents that this view contains, especially true in this case, where redesigns and changes in requirements continually replace many of the existing parts.

As with the New Products requests, the triggers are mainly concerned with the existence of values in certain fields (the button which is used to indicate that the information has been transferred to the production control system, assigns values to background fields to indicate status) and so a Status Monitor view can be added, listing all new parts by the number which has been assigned, and calculating a status value using the fields that control the work-flow of the documents. By sorting the documents by the part number a "Hot Key" can be used to find any particular part quickly from the large selection available in this view. (i.e. typing in the part number will cause the selector to jump straight to the typed in part).

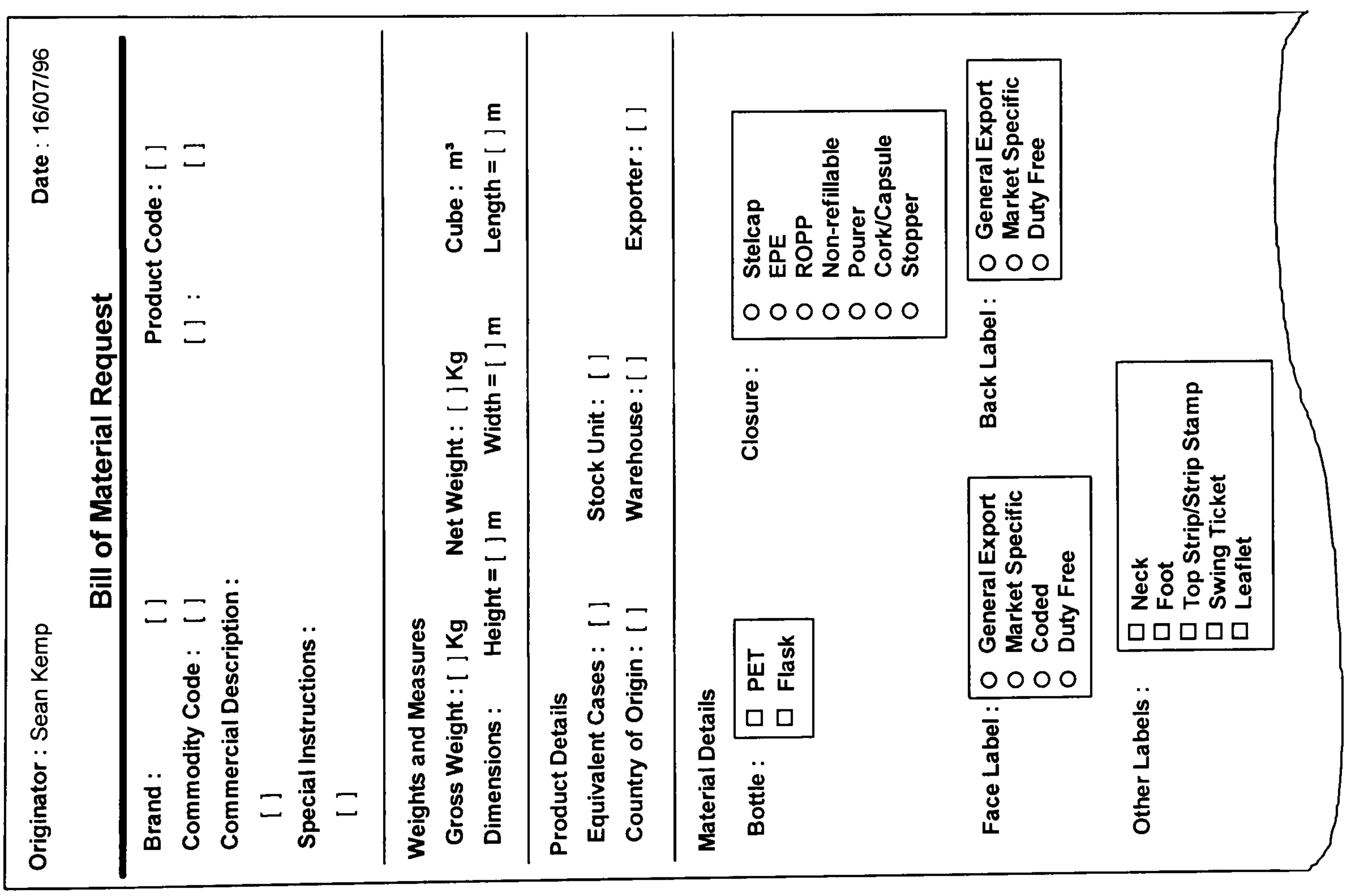
7.7 Further Design Features

The specification of the various views and the movement of the documents to the appropriate view constitutes the major design feature that is included in this database, however the functions required of the system (and indeed the control of work-flow) also necessitated the inclusion of certain other features which are worth discussing at this stage.

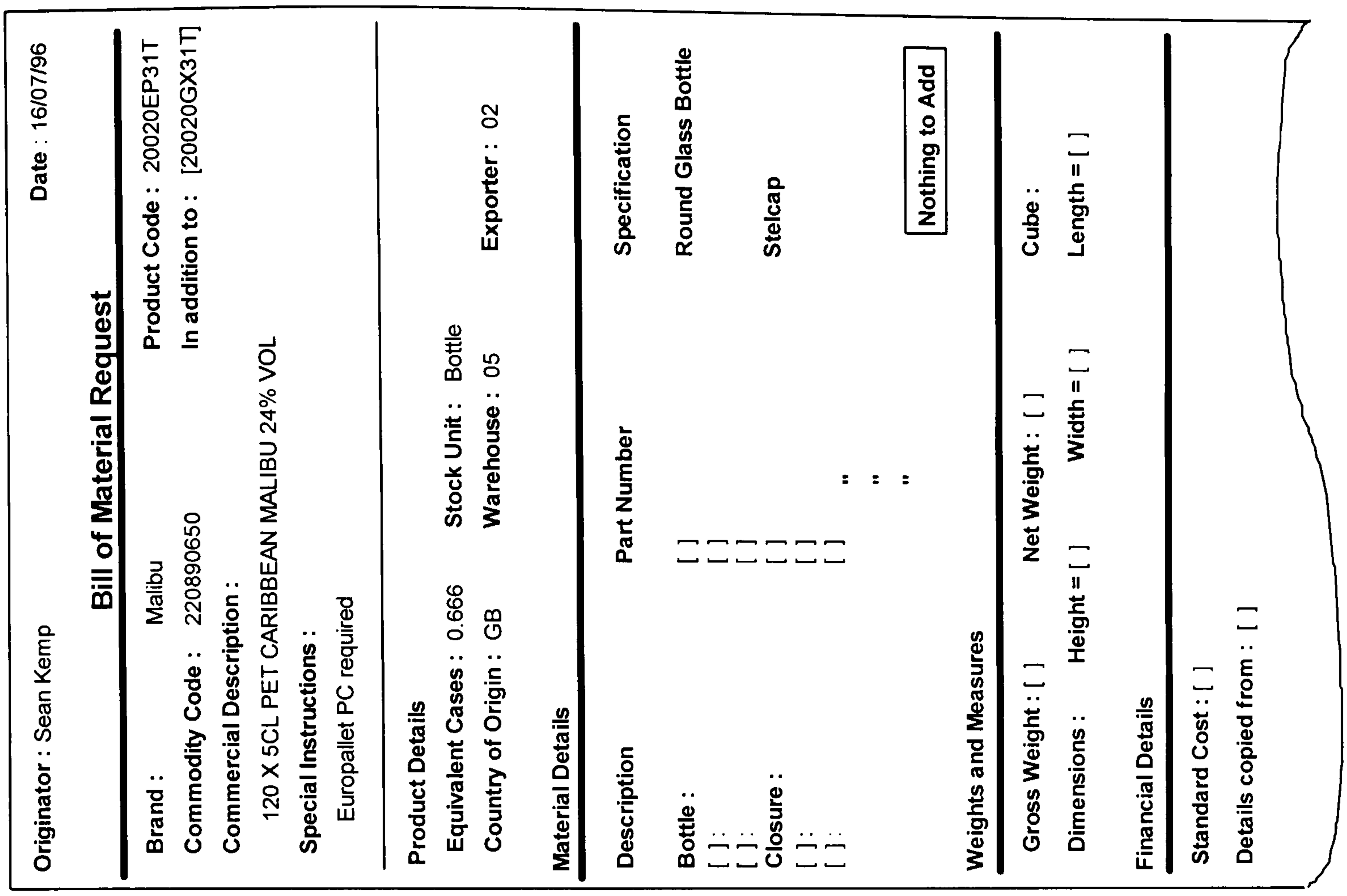
7.7.1 Two Different Forms for Product Requests

The proforma shown in figure 7.2 for the raising of new products, has included in the material details section, provision for the originator of the document (or the BOM department) to specify the type of material that is required for the new product in the form of checkboxes. Alongside this is the space for the appropriate purchaser to specify the precise part number to match this specification. Both of these sections must be available during the editing of the document, although at different times and to different people.

The required level of security control in the form therefore requires that these two areas be split up into different sections of the database, making the form very long and complicated to edit. The ideal situation in the filling in of these forms is to not allow purchasing to add any part number details until the BOM department have processed the new request (and moved it to the appropriate view), a situation which is difficult to control by having both sections included in one document. The solution which has been adopted in this case is to have **two** *documents set up, with automatic transfer of information between the two at the appropriate time*. Figure 7.6 illustrates the layout of the two documents.



Initial form for composing new requests



Form used to edit the details in any document with a valid product code

Figure 7.6 - Two layouts of the same document

The initial form which is seen upon composing the new request allows for the specification of only those details that are needed by the BOM department to set up the new product code, and those that identify the types of materials that are to be used. These material details mimic the checkboxes that are used in the existing proforma, with a slight modification allowed through the use of a computer system (i.e. Yes/No boxes can be replaced by a list of items which can be checked or not, indicating yes or no as appropriate). These are the only details that will be seen or accessible to anyone looking at the new document, and the use of a section at the top of the document limits the editing of the details to either the originator of the document or the BOM department.

Any document within a Notes database can be viewed using any form in the database irrespective or whether it was used to compose it or not (however the original form name is retained in a hidden field within the document), and provided that corresponding fields exist in the form used for display, the information will be available in a different format. It is this facility which is used in this case, i.e. when the BOM department specify a valid product code in the appropriate field, the hidden value which stores the name of the form used as a default for the document is changed to reflect the other form used for these requests. Thereafter the request is displayed using the second form, and the purchasing department have access to a section in which they can specify the part numbers of the items to be used.

7.7.2 Controlling Access using Sections

Notes includes several levels of security to control the access of various users to the documents contained in the database. At the form level, the most useful of these is the *Section*, which acts like a form within a form. At the top of the area requiring security control (e.g. in the product requests form, part numbers are only added by purchasing) a field is added and defined as a section. Every field after that is then only available for edit to those specified in the Section field (provided that they are listed as editors of the database as a whole) This can be either computed, specifying predefined editors, or editable, allowing the composer of the document to specify who is be allowed to edit that section. This security control applies either down to the next section in the form or to the bottom.

The control of work-flow not only involves the routing of documents to the intended recipients, but also in the prevention of errors by not allowing unauthorised users to edit information that they should not have access to, and sections have been used extensively in this database to provide this feature.

7.7.3 Copying Existing Documents

The diversity in the number of products and different parts used at J&B usually means that a change in the requirements or the design of packaging results in many new parts being raised which have very similar details. In many cases it is only a different size and part number that differentiates one from another. In order to alleviate the necessity for the purchasers to recompose the same document over and over again, filling in the same details in most fields of the form, Notes allows existing documents to be copied to the Clipboard and then pasted as duplicates into the Notes database. The purchaser then only needs to edit the necessary values to raise a completely new part.

A problem was encountered with this, in that copies of documents which were marked as completed in the database remained at this status, despite the fact that they were actually new requests. At first a series of validation formulas and reset fields were set up within the form to change the status back to "New Request" when the details were changed on a duplicate document. However, this caused many problems with editing documents (a necessary process where costs were added at a later date) resetting values when they shouldn't be and vice versa.

Notes actually provides the ideal solution to this problem but this was overlooked in the first instance. The system now includes a *Paste/Mail-in Macro* which operates on every document which is pasted from the clipboard into the database, resetting those fields that are necessary to indicate that the document is a new request. The macro is automatic (users are not even aware that it happens) and it does not affect existing documents, thereby providing the ideal solution.

7.8 Discussion

As with many Notes applications (and indeed those discussed in the other case studies), the benefits of introducing this system are largely intangible and as such it is very difficult to attach a value to the saving that is being made by improving the efficiency of a business process that is, in isolation, non-profit making. The only cost involved in the process is the potential damage which could be done if the system were not maintained to the correct standard, as in this case virtually all production data stems from the BOM of each product. The principal benefits of supplementing this essential process with a Notes database are discussed below :

- Remove the need to physically transfer documents between departments and business units. Some of the unnecessary delay is removed as the system is no longer relying on the internal mail system. There is also no danger of documents being lost, forgotten or damaged at any point in the process. Therefore new products and parts are added to the system as soon as the need for them arises and the information is physically available from outside sources.

- Make the raising of new products and parts easier and therefore quicker, freeing up the users to perform other more labour intensive tasks. i.e. much of the physical filling in of forms is removed by automating information entry as much as possible, and providing a better , more intuitive, interface than can ever be possible with a paper form.

- Instil a consistency in the filling in of forms to ensure that new requests are progressed as rapidly as possible. By making the filling in of certain fields compulsory, the next contributor to the form is assured of having all the necessary information to hand as soon as they receive the document.

- Provide a monitor for the status of documents, for both the originator and the BOM department whose job it is to control the process. The originator is kept informed at all stages, and is hopefully therefore happier that the "Urgent" request is being dealt with as quickly as possible, without having to bother anyone else. The BOM department can keep much tighter control over the process to ensure that everyone is able to perform the tasks required as efficiently as possible. For instance, a noticeable delay in the return of information from an individual may be the result of unavoidable outside influences. By being aware of this delay, the reason can also be made apparent and overcome if possible.

- Allow for the setting up of performance measures to improve the business process, by automatically generating "timeliness" data. This is similar to the point discussed above, but in this case it could apply to a department as a whole, providing valuable data in the setting of individual objectives and in the better integration of the business through increased awareness of the problems of others within the organisation.

This database has been through a pilot test with the part number request form only, with many improvements being made to the initial rough design of this aspect. The current status of the project is involved with piloting the BOM request form, with the shipping function of J&B Scotland, assessing its suitability before rolling out the application to the Customer Service division located in London.

7.8.1 Success of the Application

The Notes application has been developed from an existing system, where possible retaining all the elements of that system, modifying their structure and principle only where the use of a computer allows improvements to be made which will streamline the process. Therefore, the acceptance of the system, and thus its success in use, should in theory be easy to obtain. After all, users are only filling in an electronic version of a paper based form that they would have to fill in anyway. The reduction in the time for information to be transferred between functions and the better control that is available for the process, should mean that the Notes application is quickly able to realise the benefits that were proposed at the outset of the project, highlighting these benefits to the users of the system. However, there are various factors which will possibly detract from the benefits that are accrued through the introduction of the system.

The lack of control on a paper form (users can add as little or as much information as they like) means that it is open to abuse. For instance, one member of the purchasing team took to raising new part numbers using just one form for several similar parts, thus making it very difficult for the BOM department to interpret the information they were being given. With the introduction of the electronic form, this abuse is not possible, only one part can be detailed in each document. This would have meant that the purchaser concerned would rebel against the new system as it was forcing a method of working which didn't agree with them. However, the reasoning behind this multiple part form was the amount of time it was taking to fill in similar details for a number of parts on separate forms. With the facility to be able to copy existing documents with similar details, and the automatic determination of much of the information contained in the forms, this shouldn't be that much of an obstacle to acceptance by the purchaser concerned.

There is a general unfamiliarity with computer systems within the company, indeed the Windows operating system was only introduced to the whole organisation less than two years ago. Users of the system are now being given a system with which they are totally unfamiliar and in the early stages of implementation it is still much easier to pick up a paper copy of the form and fill in the details. To the credit of the managers concerned, they have forced the users to adopt the new system and they have rapidly come to appreciate the benefits in its use. Without the backing of management, it is doubtful that the same level of acceptance would have been achieved, i.e. given a choice the users would have kept the old system.

This not only applies to the contributors of much of the information, but to the BOM department as well, who are supposed to be the ones who are to gain the most from the new system. The main reason behind their disillusionment is the separation between the Windows based Notes system and the DOS based Fourth Shift production control system. Any document which they received in Notes, had to be printed for the transfer of the details to Fourth Shift. In the original pilot release of the database, the views for part number requests were not as well organised as they are today, and a log had to be kept of the parts that were awaiting costs. Once costs had been added, it was quite a task to try and find the appropriate document for the editing of the information. The solution which has been adopted is to allow them to access Fourth Shift through Windows (a situation which initially caused the systems department considerable problems) so that both can be displayed as windows on the screen, the information being read from one for transfer into the other. The redesign of the views for part number requests has also alleviated some of the problems that were being encountered and the BOM department are now appreciating the improvements that the system is adding to their function.

Since the first release of the pilot database, including only the part number request, many changes and improvements have been made to the design which have increased the likelihood of acceptance, and therefore success, of the database. With the introduction of the product request form (and possibly other forms used by the BOM department at a later stage), which is thought to provide the largest benefits to all the users, many more redesigns will be needed and the eventual system should be very successful, providing that the changes to the design are not major, as too many problems in the early stages will disillusion users who are rapidly being won over now that the part number request has been finalised.

7.8.2 Validating the Reference Model

Looking at this application purely from the way it was positioned in the reference model seemed to indicate that it was a 50/50 split between being suitable for Notes and having too many potential problems. However, the application was implemented and proved to be successful, despite the fact that the reference model would seem to suggest a 'risky' application.

The reason for this was that the 'for' arguments were much stronger than those 'against', i.e. it was thought more important to ensure that the documents arrived at the correct point with the necessary information when needed, than it was to precisely control the content to the exact specification of the manufacturing system. The drawbacks could be overcome by the developer, if the effort would prove to be worthwhile, and this was the case in this instance.

As predicted, the fact that the process was already clearly defined both in terms of document contents and routing provided a useful guideline as to the fields needed and the natural breaks in the process where the document routing had to occur. As with the mandatory application the controlled process could be achieved using the security features in Notes.

Any conclusions about the validity of the reference model are the same as in chapter 6, the arguments need to be taken in context to determine exactly what decision should be made regarding the feasibility of using Notes.

7.8.3 Expanding the Design Theories

In the other case studies, the discussion included several design issues which could be taken and applied to other databases. Some of those principles were used in the design of this database, and as would be expected some modification and expansion of these issues arises from their application in practice.

7.8.3.1 Work-flow Automation

It is very important to begin the design of a Notes application from an existing system which performs the required functions of the business process. If the existing system is deficient in any way, then the first task in the implementation of a Notes database is to redefine the process so that it is as efficient as is possible with a paper based system. Once the process is acceptable, the design of the Notes application can be completed very quickly, using the following principles :

- The forms used in the existing system should be converted directly into the forms comprising the Notes database. Where the use of the electronic media allows, improvements in the design can be performed, but they should not change the overall 'feel' of the forms.

- The layout of the forms and the security which exists within them in the form of sections, should allow only the appropriate users to add as much information as is needed to allow the next person in the process to perform their task.

- Wherever a document is moved to another person within the group for information entry, a view should be developed which organises the documents in the best way possible for the function which is to be performed at that stage.

- The triggers for the transfer of documents between the developed views should mirror those which occur in the physical system, utilising the automatic checking and validation formulas that a computer system can provide, to perform these transfers of documents as a background process.

With a work-flow automation database, there will always be more than one user of each document, and only they will understand all the issues involved in the information which they are to provide. It is therefore of utmost importance that the design of the database be performed as a group exercise, utilising the knowledge of each individual to ensure that the developed system provides all the necessary capabilities and features. The group design should not involve each member contributing individually in turn, but should be a true group discussion. It may well be that certain members do not fully appreciate the consequence of their actions, bringing everyone together at the same time to develop the database will not only result in the most acceptable design but may actually improve the business process at the same time. As discussed in chapter

2, this is described as the Hawthorne effect, where the research process itself actually improves the function under research. It is not a bad thing in itself, but the Notes system can no longer take all the credit for the improvements that have been realised.

7.8.3.2 Design Functions

The design of this database has mainly led to the formulation of general design principles for the control of work-flow automation, however there are certain other features which have been included, and these are discussed below.

1. Document display - both of the documents use a different format for the reading/printing and editing of information, to make the forms both easy to edit and tidy in display. However, the product request form also utilised the ability to display information using different forms so that a new level of display and security control could be achieved. This was necessary due to the number of users who had to supply information and the constraints on the printed copy of the form being one page of A4 paper (for ease of filing and reference).

2. Sections - both forms used sections to control the access to certain fields within the form, ensuring that only those people who were supposed to contribute information were allowed to do so. In a work-flow automation application, this is imperative as some of the supplied information may act as the trigger to move the document to the next view. If this were an unauthorised move, then control would break down completely and the system would be no better than the existing paper based one.

3. Paste/Mail-in macros - where the status of various documents is used to track the progress of documents through the work-flow application, the copying of existing documents to make life easier can be very dangerous, i.e. the status of the copy is the same as the original, unless some background process can reset the copy to a freshly composed state.

Paste/Mail-In macros provide this facility without much trouble to the designer.

7.9 Conclusion

The results of the audit against the reference model seemed to indicate that the application was only partially suited to the implementation of Notes, and had the very real possibility of failure if the development did not address the negative issues revealed by the analysis.

In practice these issues were actually addressed by the type of application, in that a clearly defined workflow already existed, meaning that by ensuring that the development followed this existing process then what seemed like a potential failure did in fact turn out to be a substantial success.

The conclusion that can be drawn from this is that certain factors identified in the reference model have less of an impact on the feasibility of the application for Notes development, depending on the type of application being developed. In this case the need for fast system responses where information changed fairly frequently and needed to maintain its integrity throughout these changes, was addressed by the fact that a workflow system controls the contents and movement of data to a much larger extent than other types of application.

Applying this theory to the case study presented in chapter 6, the main area of concern highlighted by the reference model audit was the response time required from the system, but the combination of a reference and broadcast application overcame these issues by allowing users access to all the information whenever they wanted it, but also providing them with e-mail summaries of changes in the time critical data.

CHAPTER 8

CASE STUDY 3 - CODE OF BUSINESS PRACTICE

8.0 CASE STUDY 3 - CODE OF BUSINESS PRACTICE.

8.1 Background

Up until the middle of 1994, the National Marketing Companies (NMC's) controlled by IDV, liaised with the International Customer Services (ICS) function situated in London for all requests for new products. The information was then passed from London to the relevant production site (J&B Scotland, Baileys, etc.). It was recognised that transferring information in this way caused unnecessary delays in the processing of orders and dilution in the information flow, with the result that the entire communication process between customer and supplier became overly complex.

The perceived solution was to eliminate the 'middle man' and introduce direct communication, for order processing and demand management, between each NMC and the production unit (initially at J&B Scotland). To achieve this a new function, Customer Services, was created within J&B to provide this direct interface with the NMC's. The ultimate aim of this new function was to :

- Facilitate direct communications between the Production Site and the marketplace.
- Recognise the satisfactions and dissatisfactions in both sectors.
- Monitor and measure progress
- Formalise the process by defining best practice and the vision for the future by means of the Code of Business Practice.

The Code of Practice represented a series of question and answer forms which would eventually detail the way in which J&B and the NMC's interacted to perform the various processes involved in the day-to-day operation of each unit. The forms involved were :

Agenda

This document details the aims of J&B Customer Services, the methods to be used to achieve their aims and action points for long term vision and improvement opportunities.

Service Level Agreement

Guarantees the number of days for despatch of goods to the NMC from the receipt of an order.

Forecasting
Ordering
Production Plan
Production
Shipping
Feedback

These documents have a series of questions on what or how various aspects of each function are carried out, which are then discussed with (and answered by) the NMC.

Items for Consideration

This document is used to log any suggestions on how the current processes could be improved.

A Code of Practice was established with each of the 14 NMC's (The 12 members of the EC in 1994, as well as the USA and South Africa), using a variety of flow charts, created in Lotus 1-2-3, which the NMC would require to refer to for a visual representation of the information flow for the various processes. Additionally a feedback file was developed to encourage a continuous two-way dialogue between customer and supplier, highlighting areas of dissatisfaction in a formalised way, and prompting the customer to provide the exact information required on product and service. The feedback file also provided the information to allow J&B to measure their performance in handling customer complaints.

8.2 Objectives of the Project

Initially, all Codes of Practice for each of the individual NMC's were set-up as Word documents and flow charts of the business processes using Lotus 1-2-3. Printed booklets were compiled, with the flow charts being included as appendices, and distributed to the various users within the relevant NMC (each Code of Practice differed, in some degree, from all the others). Each Code of Practice required the approval of the Logistics Manager in the NMC and the Customer Services department at J&B every time changes were made to any of the main documents. The manual system did achieve the objectives, however it did have limitations in that each time changes were made to the documents, the booklet required reprinting and distribution to all holders of the Code of Practice, after obtaining approval for those changes from the two areas mentioned above.

The new Customer Service function also regularly updated a spreadsheet which held information on the product lines shipped to each NMC. This was electronically mailed to the relevant NMC on a weekly basis. Additionally, NMC's were encouraged to communicate feedback relating to any product received which did not meet the specified requirements. An investigation into the complaint would then be carried out by Customer Services, relaying the findings back to the appropriate NMC after satisfactory conclusions had been reached. Some of the issues which arose through this process could take several months to fully investigate, with the NMC's only being aware that it was 'being looked into' during that time.

The obvious answer to the problems inherent in the paper based system was to create an electronic copy of each Code of Practice in a system which would allow users on-line access to the most recent revision of the documents, notifying them when changes occurred. The objectives of the automated system were to :

- Ensure that only Customer Services in J&B had the rights to create and update the Code of Practice documents.

- Allow the NMC's to query any of the documents and provide any additional information required, on-line.
- Enable the NMC's to create feedback files and allow for the affected personnel to respond to them.
- Monitor feedback status and notify the NMC's of this.

8.3 Why Lotus Notes ?

From the objectives of the project discussed above, it seems clear that the electronic system required closely resembles the type of system which has become readily available over recent years to control the quality manuals of an organisation, in line with the requirements of a formal quality system. The benefits that these systems bring is in the elimination of multiple copies of the quality manual which have to be maintained as the most recent issue, with all updates being controlled through a procedure in their own right. Using an electronic system, only one copy of the manual is required, with the users being given access to the articles which affect them. Any updates are made to the 'master' copy and are immediately available to the users of the system, when they next view the documents. All that is then required is notification of the change, which does not have to be as strictly controlled as the distribution of the actual documents themselves.

Where this particular system differs from the typical 'quality manual' type documentation, is in the geographical dispersion of the NMC's and the fact that each Code of Practice has a certain number of unique elements, albeit that all documents are in the same format. There are also some elements which are common throughout all the NMC's and any system would have to cope with both situations, containing one manual per NMC, distributed to all relevant personnel in that NMC, and linked to a common collection of appendices. Notes lends itself to this application in that every manual can be controlled on the Notes server of J&B, along with all the common appendices documents, with the NMC's then having a replica of the database on their servers which contains only those documents relating to them, utilising the selective replication feature of Notes.

The NMC's act as customers of the production sites and yet they are also part of the IDV group, which means that there are already electronic links established between most of them. Utilising these links, and introducing a Notes server in each NMC, not only can the manuals be distributed and maintained in the most efficient way possible, but they can also be linked to the existing e-mail system to generate notification of changes to the documents in the database.

Much of the discussion between customer services and the NMC's also occurs via the e-mail system, with spreadsheets and documents going back and forth on a regular basis. By utilising Notes, a structure can be imposed on the messages and files that are transferred, ensuring that all related issues are always kept together, allowing anyone with an interest to examine the status and actions involved in the investigation of feedback issues, thus supporting the analysis and reporting of performance of the relatively new department.

At the time that the project was put forward as a potential Notes application, much of the work to compile the Codes of Practice had been completed, and the handbooks had been approved and distributed to the appropriate NMC's. By using Notes, it was possible to directly transfer these existing documents, diagrams and spreadsheets into the system, with the only delays in implementation then being the setting up and configuring of the various pieces of hardware needed to support this truly global Groupware application.

8.4 Functions Required

In the previous case studies, the theory has been put forward that the general purpose of an application can be derived from an examination of the type of application, and the nature and use of the information which it will contain. The defined purpose then forms an invaluable design aid, as it does not change throughout the development of the application, and each design change which occurs, only represents a new technique to accomplish the functionality defined in the purpose statement.

Many of the Code of Practice documents, the question and answer forms, the flow charts and so on, are intended as a reference for anyone within the production site or the NMC that has a role to play in the movement of goods from one to the other. This main part of the application can thus be viewed as a **Reference** application, representing a library of procedures and processes that should be referred to, and followed, throughout the business process concerned. However, the application is also intended to provide a media for the discussion of any issues which arise through the day-to-day running of the procedures contained in the Codes of Practice, going away from the reference type of application and straying into the territory of a **Discussion** application, supporting the structured and unstructured group communication and discussion on points of common interest which are involved in ensuring that the established Code of Practice meets the needs of both parties in the most efficient manner possible.

There is absolutely no reason why an application cannot fall into more than one of the five identified categories of Notes application, and this also need not be only when the application is comprised of multiple databases. This highlights the grey areas which exist between the classifications of applications that have been presented in the above text, and gives a good example of the flexibility of the Lotus Notes system.

Much of the content of the application will be in the form of external files, added into the Notes documents to allow for their update at a later stage if necessary, whilst maintaining the original format and allowing for the speedy and direct transfer of the existing system into Notes. What is also needed is a method of discussing the content of each of these external files, attaching all the relevant contributions to the relevant document within Notes for reading and further comment by anyone with a valuable contribution to make in defining the best procedure possible.

The application is also intended to allow for feedback in terms of how each procedure is being met, i.e. if customers are dissatisfied with the level of service agreed in the Codes of Practice, then they have a forum to raise that issue with the customer service department at J&B. By including this in Notes, it is then also possible for the details of any investigation and action to be detailed as a response to the original feedback, so that the originator is not only aware of the status of their feedback, but also of the exact issues which are involved, with the ability then to jump into the investigation at any point and make further contributions to clarify issues or steer the action in the desired direction.

Taking the above issues, the required functions of the database are easily defined :

- Provide a single, consistent copy of the Code of Practice for each NMC, in a format that best supports the information being presented.

- Allow for the organised communication of issues arising and feedback dialogue between the NMC and Customer Services.

8.5 Reference Model

Having defined the objectives of the application and the functions required, the resultant audit against the Reference Model is presented in figure 8.1.

(a) Although the development of customer codes of practice is new to the organisation, it is thought that once they are established for each major NMC, the details will not change that much.

(b) The structure of the documentation fits very well within the standard Notes hierarchical structure, closely resembling the structure of a Quality Manual for ISO9000. Any relationships that do exist will be to tie together standard reference documentation, such as organisation charts and so on (i.e. only need to exist once within the database).

(c) The contents of these standard reference documents will also change very rarely.

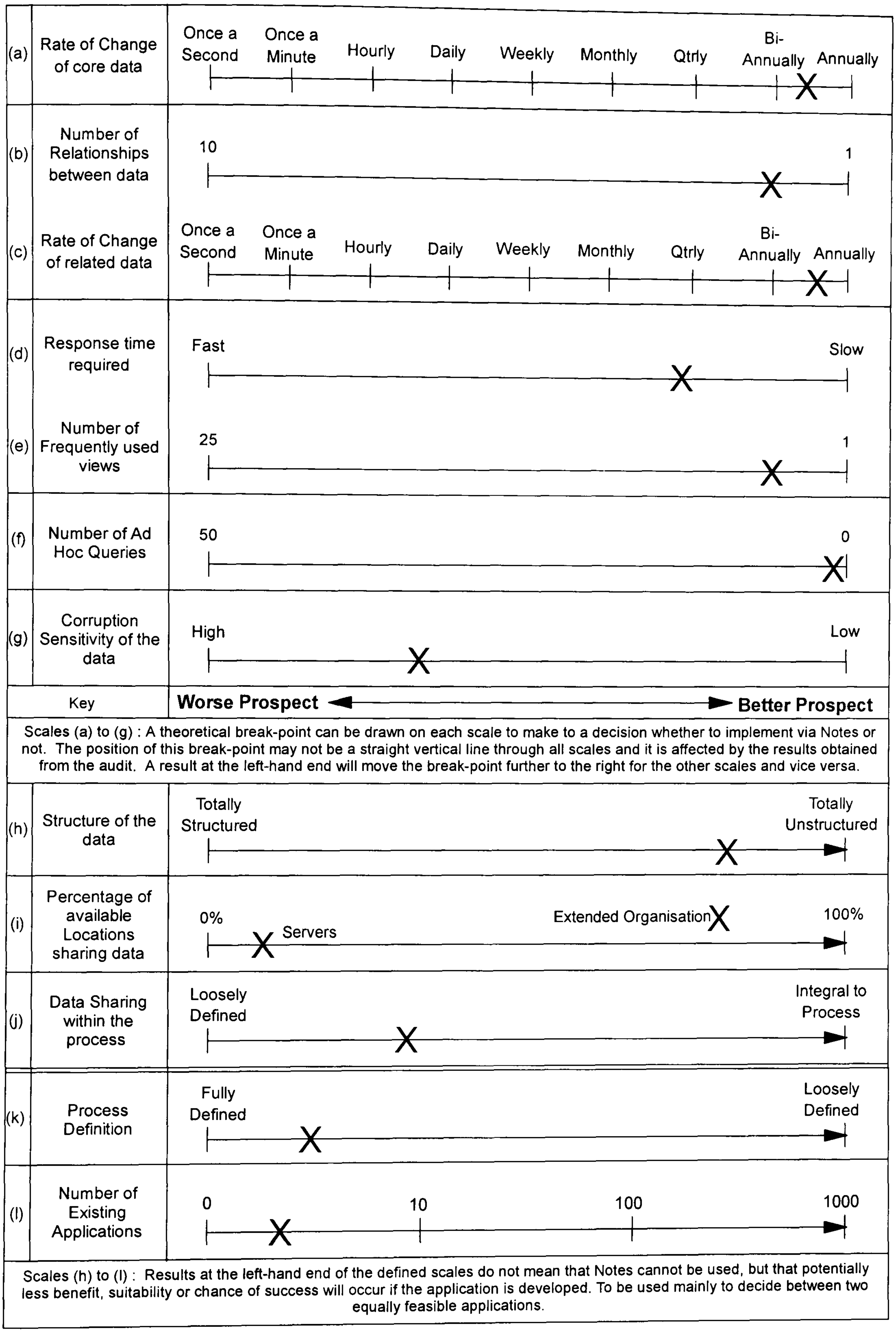


Figure 8.1 - Audited Reference Model for Code of Practice Application

(d) The main classification of the application is that of a reference application the users will only access it if they need to check up on the details of the Code of Practice, therefore the response time of the system is not a critical factor.

(e) The simple structure of the documents contained within the database means that only a few views are needed to provide users with all the information they may require.

(f) By having standard, easily referenced views there will be no requirement to perform complex searches on the information.

(g) As the data represents a form of contract between the production site and the customer, the contents of all copies of the data needs to be of the same revision.

(h) The documents are likely to be mainly textual in nature and have only a few standard fields to provide easy categorisation and revision control.

(i) Once in place the system will be used by all of the NMC's throughout the world. The issues involved will also affect the various production sites and the same system could also be used by them.

(j) The application is a reference application and as such the data sharing is only defined in terms of who should have access to that information throughout the various sites.

(k) The application will hold data related to an established Code of Practice, therefore the process is already clearly defined. However it is a relatively new process and could well be subject to change in the future.

(l) There are very few applications in place within either the production sites or the NMC's.

8.5.1 Analysis of the Audited Reference Model

It would appear from figure 8.1 that this application is almost perfectly suited to the implementation of Notes, the only possible drawback being the need to control the revision level of each of the documents within the application. However, the development of the other case study applications has revealed that this is not a major problem and it quite easy for the designer to provide the necessary level of document control in the application.

Where problems may occur in this area is in the dispersed nature of the users of the system, document changes will only be distributed to the NMC's at the time of scheduled replication, so potentially two people could be looking at two versions of the same document with the system saying that both are the current revision. By tightly controlling the revision process and building in integration with e-mail to distribute changes the effects of this problem can be reduced.

As with the other case studies, the number of existing applications could represent a barrier to acceptance of the system as users are being asked to use a very new system. However, as with the case study presented in chapter 7, this application was suggested by the main users and so the significance of this is reduced.

8.6 Design Issues

This Notes application is very much a simple translation of an existing paper based system into electronic format, with the selection of Notes resting on the geographical dispersion of the potential users. Therefore, the resulting design was virtually a copy of the existing forms and documents which comprised the code of practice, with the addition of a discussion facility to facilitate the communication and storage of issues arising with the contents of the documents. Having said this, there were still some areas of the design which presented some design problems and which are worth discussing in the context of this research.

8.6.1 Embedded Objects

Much of the content of the codes of practice which existed at the outset of the Notes implementation, already resided in electronic format, utilising the standard office software tools of word-processing and spreadsheets. Also within the appendices were contained flow charts and organisation diagrams that were intended to map out the processes to be used in certain circumstances, for instance the complaints procedure, with a diagrammatic representation of who the complaint should be addressed to, what should happen after that and so on. The diagrams intending to provide a quick reference when these situations arose.

It therefore seemed appropriate to simply transfer these documents into the Notes system using one of the techniques listed in Case Study 1 (section 6.6.6.2) for adding the label images to the database. In this case, *embedding* was selected as the method to be employed as the spreadsheets used in the application were intended to be dynamic, reflecting the full range of products that were taken by the particular NMC, with sales figures input at regular intervals. Calculations were to be carried out on this information and it is more advisable to use the spreadsheet to do this than to try and get Notes to do it, especially when it involves a large amount of information. Embedding was selected instead of linking in this case as the potential editors of the information, located in the NMC's, would not have the source file available to them. The embedding of objects also suited the other file formats very well, but it did present a significant problem which could have very serious implications in the future development of the application.

The flowcharts used for each code of practice were modified from standard templates, to reflect the exact situations of each of the NMC's. The use of standard templates meant that the future consistency of the modified diagrams could only be guaranteed if the form used to compose the document were stored as part of that document. This option has two adverse effects :

- Any future design changes to that particular form will not be reflected in existing documents, possibly leading to confusing views and the omission of old documents from any processing that utilises fields added after their creation. An example of this came from a large insurance firm, whose developers were attending the same Notes training course as the author, who in the early stages of development elected to store the appropriate form in every document in the database. The system was launched and a huge number of files were loaded into the database, basically transferring all the existing records into the system. As the application was used more and more, further developments were suggested by the users to improve the functionality, developments which could not be seen in the existing documents stored in the database because they used and stored the old design. With no easy way of rectifying the situation, the company were faced with having to totally repopulate the system.

- The size of the each file in the database is increased, as they are not only storing the field values but the design as well.

Therefore before utilising this facility it is imperative that the design is as complete and stable as possible, and that the number of documents in the database will reach a known level which is acceptable. This particular application suits these criteria as, it is a direct translation of a tried and tested system and it will only ever involve 14 different codes of practice (14 NMC's). The size of the eventual database is also reduced by placing all common files in a separate view, which then acts as appendices to the NMC specific documents, allowing access to them through the use of DocLinks.

8.6.2 Electronic Signatures

The code of practice documents represented controlled procedures, affecting the working relationship between the NMC's and the production site of J&B Scotland, and as such required to be signed off by the appropriate manager in each location. Using a paper based system this is relatively easy, but the anonymity provided by a computer system makes the approval of documents much more difficult to control. Fortunately, Notes provides the facility to allow for electronic signatures using *access controlled sections*.

A section acts like a document within a document, and the access can be controlled for that "sub-document" in exactly the same way that the access to individual documents can be controlled, i.e. by specifying the designated readers/editors in the appropriate access control list. The access control applied to a section within a document, affects all the fields down to either the next section or the bottom of the document (whichever comes first).

In this case, the name of the approver was loaded into the access control list of the section by the composer of the document, thereby allowing the signing off of documents to be accomplished only by those with the authority to do. Once the section is in place and the access control assigned, all that is needed to indicate a signature is a simple field with the authorisers name in it, and an optional field to indicate the date that the document was signed. Provided that no-one else has access to the ID file of the authoriser, everyone reading the document can be assured that it has been signed by the person authorised to do so.

8.6.3 Selective Replication

Each code of practice is unique to an individual NMC, and yet they must all be controlled by the Customer Service department of J&B Scotland. Therefore some users need to see all the entries in the database, and some require only to see one set of documents, possibly with the control that they can't actually see anything but their own unique code of practice. Notes allows this level of control through *selective replication.*

The master copy of the database is located on the server of J&B Scotland, allowing access to all the documents which exist within the application. The replicas which exist on the Notes servers of the NMC's only ever replicate information relating to each particular NMC, and of course any generic appendices which are required. Therefore, users at the NMC's are not even aware that any other documents exist within the application, other than those relating to them specifically.

8.7 Discussion

As with most Notes applications, the benefits which have been achieved or are expected, are all related to the improvement in performance of individuals and not really to any quantifiable areas of the business. The existing code of practice system had its own associated benefits, and it is not fair to try and attribute all the benefits of the system to the Notes implementation. What can be claimed is the obvious reduction in the amount of paper which is travelling between the various sites, the better control that a single consistent source of the codes of practice provides, (i.e. no controlled paper documents flying about, which must be destroyed when a revision is circulated and so) and the obvious reduction in the ambiguity which could exist through being unsure as to which is the current agreement. The benefits that this can generate reside in the avoidance of errors and complications in the supply chain process, streamlining the operation and giving everyone more time to look at continuous improvement rather than firefighting the problems.

8.8 Current Status

The code of practice system itself has only been fully implemented in a minority of the NMC organisations, and the resultant take up of the Notes application reflects this. However, the systems are in place to implement the system as soon as an agreement can be reached on the mechanics of the code of practice system.

The forerunners in the implementation of the Notes application are the Germans, who are not only impressed with the functionality of the system and the benefits that it can provide, but are now pushing to try and get everyone to use it, and hence develop it further, so that the entire supply chain organisation of IDV can begin to communicate more effectively, and co-ordinate their activities towards a common goal.

The barriers to this sort of implementation are in the cultures which exist within the NMC's, many of the people involved are frightened of sharing their information on a system such as Notes, as they feel they will be held up to scrutiny. The culture that the code of practice is trying to implement. will indeed scrutinise the business process involved, but with the aim of improving the functionality of that process, not criticising the work of individuals. The change in culture which is required is possibly even harder to achieve because of the different countries involved, each with their own particular methods of working.

Until these barriers can be removed and users can be coerced into trying the system to see what it provides, the full implementation of the Notes system will have no chance, once again enforcing the theory that Notes can only thrive if the processes are first changed to suit its introduction.

8.9 Conclusion

The fit with the ideal application represented by the reference model was so close in this case that the system virtually could not fail. The level of success of the application in practice also supports the statement, regarding the reference model, that the closer that each characteristic is placed to the right hand end of the scale, the more benefit will be gained from the use of Notes to facilitate the business process.

CHAPTER 9

GUIDELINES FOR THE DESIGN OF NOTES APPLICATIONS

9.0 GUIDELINES FOR THE DESIGN OF NOTES APPLICATIONS

9.1 Introduction

Designing a Notes application is very similar to designing any software application that supports a business process, providing that the development team can get their minds around the fundamental differences between Notes and other software tools. With this being the case there is very little difference in the techniques which should be used, and many notable authors have published prolific works dealing with a variety of structured techniques for systems design. By the same token, the actual mechanics of design, in terms of the fields, forms and views which make up a Notes database have been the subject of many books and developer guides. It is therefore redundant in this text to repeat any of this information.

Whilst involved in the design of the case study applications, issues arose within the design process which were noted as having an effect on the potential success or failure of the application. This chapter examines these issues in greater detail than many of the published works, maintaining a close relationship with the developed reference model from chapter 5. The hypothesis being that after the reference model has classified the application using the defined measures, a better understanding of the design issues which relate to the particular characteristics of the reference model will hopefully focus the developer on the correct path towards a suitable design.

9.2 General Approach to Design

From the development of the three separate case study applications, it can be seen that the basic design process for Notes is no different to any other software tool, there are three basic steps which need to be followed to ensure that the design results in an application which meets the needs of the process that it is intended to support.

1. Selecting the application (Reference Model - chapter 5).

The benefits to an organisation which can be achieved through the implementation of Lotus Notes are almost always hidden within improvements to individual and group performance that result from streamlining the process involved. As such it is very difficult to provide a quantified justification for the application of Notes in any given situation.

It has already been discussed that every Notes application must follow on from a certain degree of Business Process Re-engineering, and this will obviously introduce its own improvements to the process (at least it should), and it is very difficult to isolate the benefits that are then being accrued by the implementation of Notes to the improved process. Taking the Code of Practice example, even the instigators of the system could only see a benefit in the removal of paper at this stage, the actual code of practice system which had recently been introduced provided the real return on investment.

In chapter 5, the characteristics of a process which made an application unsuitable for Notes were discussed. If given a list of potential applications for Notes, only those which were truly unsuitable could be determined, no priority or preference could be assigned to those remaining, and no cost justification could be accurately drawn up to make the decision any easier. In order to select the most suitable application it is therefore more appropriate to make the decision based on the process which will benefit most from BPR.

2. Defining the scope of the application (section 9.4).

Each process is different, and so the best people to define a Notes application are those who are involved in the process. However, Notes is a new technology, and one that is very different to any other software tool in use. Many people have had access to database systems, often having developed their own little applications to store the useful information which would otherwise clutter up the desk on hundreds of post-it notes. Trying to come into Notes development and system specification from this background is very dangerous, and it is often the case that these users tend to assume that Notes will be able to accomplish the same thing.

It is therefore imperative that a dedicated Notes developer be involved in the design process, but again not solely involved. A good, successful application will only result if the Notes developer is acting as the interface between those involved in the process and the Notes development architecture. But in order to achieve an application which performs as intended to the satisfaction of all concerned, the developer must be in possession of all the relevant information from those involved in the process, preferably in the form of an implicit specification of the process and what they are trying to achieve. If this is not decided at the beginning, a lot of work will be carried out which will have to change once the users of the system actually see what they are getting. Ideally, the development process should continue to be a strong collaboration between the Notes developer and the group involved in the process throughout the course of the development.

3. Designing the application (section 9.5 and 9.6).

The overriding message which can be taken from the authors experience in developing the case study applications is that the theory quoted in the manuals, the on-line help, the technical journals and so on, is a long way removed from the actual practical issues involved in the design of Notes applications. Every finalised design detailed in the case studies above is actually a compromise between what is wanted, what is reportedly achievable and what is actually possible. Of course this statement is only based on the authors experience, and many of the functions which were dismissed as impossible to achieve, may well be within the knowledge of another designer, but that designer will probably only have attained that knowledge through trial and error, not through the published reference manuals.

9.3 Relating the Design Considerations to the Reference Model

During the assessment of the suitability of a potential application to Notes, the characteristics of the application have been classified against a series of defined measures contained in a reference model (chapter 5). The reference model has been developed in such a way as to provide an identification of the areas of an application that will cause the most problems in its design and implementation. Therefore as well as providing a means of selecting only applications that are suited to Notes, the model also gives the developer a guide to where the main focus of effort should be, if the developer can successfully counteract the effects of the less ideal aspects of the application then there should be an increased chance of success.

Table 9.1 represents a matrix which relates the defined characteristics of an application (from the developed reference model) to the design considerations derived from the case study experience. The reasoning behind these relationships is then presented in sections 9.4 - 9.6.

9.4 Structured Design of the Application

The common approach to designing any system is to first of all map the current process, then try and improve on that process before eventually beginning to flesh out the findings by writing the code into the selected development tool. The procedure is much the same with Notes, but the flexibility of the system requires that certain additional considerations be made during the analysis and redefining stages of the development process.

Key :

X = General Relationship

+ = Positive effect

- = Negative effect

	Planning the Application											Starting the Design				Specific Routines		
	Type of Application					Number of People involved	Match the Existing Structure	Use Existing data Sources	Communication within Process	Make information readily available	What do the users want	Design Templates	What is Notes designed to do	Re-engineer the process	Developer shouldn't 'Design' the application	Varying Document Display	Limited Realational Capability	Simulated Response Hierarchy
	Discussion	Reference	Broadcast	Tracking	Workflow													
Rate of Change of core data			X	X				X					X					
Number of Relationships between data	X			X									X				+	+
Rate of Change of related data				X									X				+	
Response time required				X				X		X			X			+	-	
Number of Frequently used views		X			X					X			X					+
Number of Ad Hoc queries		X								X			X					-
Corruption Sensitivity of the data		X		X	X								X			-	-	
Structure of the data				X				X					X					
Number of Locations sharing data				X									X					
Data Sharing within the process			X		X				X				X			+		
Process Definition						X	X				X	X		X	X			
Number of Existing Applications																		

Table 9.1 - Relationship between Design Issues and Reference Model

9.4.1 Focus of Design Determined by the Type of Application

Relating to the discussion presented in chapter 4, the developer should be attempting to design one of a limited number of application types suitable to Notes implementation. The importance of each of the defined criteria of the reference model will be different for each type of application, by determining this classification beforehand a more meaningful audit against the reference model should result. i.e. If one of the criteria is more critical for the type of application being audited then results nearer the end of the relevant scale will have a bigger impact on the decision to implement or not.

9.4.1.1 Discussion Applications

Discussion applications are intended to capture the underlying thread of the issues which are raised on the system and it is therefore the relationships of documents to each other that becomes the focus of the design. The response hierarchy which is established must keep together all the related documents whilst at the same time leave the forum open for the raising of any new issues that users of the system feel merit group discussion.

This is probably the least complicated type of application to develop and Lotus provide a simple template which allows a discussion group to be set up very easily, containing three basic forms, Main Topic, Response and Response to Response which are sufficient to set up an extensive discussion thread on an existing or new topic, and three standard views, All, By Category and By Author which allow anyone accessing the discussion to find interesting pieces of information easily provided that categorisation, and therefore the relationships between documents, are initially set up to allow this.

9.4.1.2 Reference Applications

With a reference application, the focus is on the revision control of the information, the user must be assured that the document he is looking at is of the latest revision. Therefore, the design focus is in providing a means of maintaining a sufficient level of integrity in the data. A lot of control is required over the access rights to documents, and there will undoubtedly be a wide and varied range of views used to display the data to suit the requirements of each of the users.

Both the Mandatory Information and the Code of Practice applications were required to maintain the integrity of data by ensuring that all users are looking at the correct revision of a document. This was achieved in these applications by including a revision history within each document that clearly stated when the document was last changed (section 6.7.1.3.4). Any discrepancies, perhaps caused by printed documents being used, could be easily resolved using this revision history to determine which version is the correct one.

This principle is taken further in a commercially available application to control quality documents, by physically preventing users from seeing any document that has not been approved and issued as the current document. This is achieved using the standard security routines which are available within Notes.

9.4.1.3 Broadcast Applications

The information contained within, and disseminated by, a broadcast application is often time-critical, although it will remain fairly static once it is in the database, and the focus is with the transfer of the information both from its original source and then onwards to the intended audience. Often such applications will pull the information from external sources (such as newsfeeds) to allow for company personnel to be kept up-to-date with industry related events, and it is the Agents which are built into the application that provide this 'pull' as a background process. Although missing information is probably not critical to the continued existence of the company, it may well affect both the profitably (through missed opportunities) and the users confidence in the application.

9.4.1.4 Tracking Applications

Tracking applications are designed to capture all the information related to a particular aspect of the companies operation, be it customers, suppliers, employees or a whole host of other 'objects'. The information will be generated by a variety of sources and will probably be in a variety of formats. The design of such an application must provide a consistent view of the data contained, no matter who has entered it or who is accessing it, but it must also not constrict the users to a defined set of variables, if this were the case a traditional database would probably provide a better alternative.

An application to track the quotes produced by the commercial department of an oilfield service company used a standard form containing a great many predefined keyword lists to facilitate the rapid and uniform entry of the basic detail of the enquiry, whilst also allowing the particular idiosyncrasies of the project to be entered and reviewed, using workflow routines, as the quote progressed. By ensuring that the basic information, such as quantities and item specifications, were always entered in the same way, more meaningful analysis could be performed on the contents of the application, e.g. what item is most requested, etc.

9.4.1.5 Workflow Applications

Workflow applications, by definition involve the movement of documents around the database. This may be within the same database, or more commonly, as the complexity of the process increases, constrained only to the Notes environment of the particular organisation. The worst case scenario with this type of application is in the information becoming lost or corrupt in its travels around the system, so the design is focused on the movement of information. The design must also provide a clear and unambiguous display of the status of each document as it moves around the system, otherwise users will not even be aware that they are supposed to perform an action on it.

The Bill of Material application detailed in chapter 7 is a very good example of workflow, the process defining both the views that are included in the application to track the status of each document and the points at which the integrated e:mail functionality needs to route the document to another user to inform them of the requirement to further progress one of the requests. The author has used exactly the same principles (section 7.6) to design further applications to control the approval of travel requests and the approval and analysis of employee training courses, with a high degree of success.

9.4.2 More People Involved means more Complexity in Design Specification

By definition most Notes developments will involve at least two people, and these two people will have their own individual ideas and requirements for the Notes application. As the number of people involved increases, the list of requirements of the application grows almost exponentially to match it.

It is therefore vitally important that all the users of the system are brought together at the earliest opportunity, to agree and sign-off on the requirements, otherwise bad feeling will arise as a partially adequate system is pushed onto the users. This represents one of the conclusions taken from the design of the Mandatory Information application (section 6.8.5.2), a great deal of time could have been saved in the development of this application had a full specification been detailed before cutting the code. Articles on the subject of Lotus Notes continually stress the requirement that a Notes application fits the existing process instead of trying to define it, and only through this 'Group design' policy can this be achieved. No-one knows the particular business process like those involved in it, and by the same token, no one user can fully appreciate all of the issues involved in the process, there will always be one or two combinations of variables that are only experienced by other members of the group, but yet may affect the requirements of the design substantially.

9.4.3 Match the Existing Information Structure of the Process

As the author has just stated, Notes applications have a greater probability of success if they are designed to match the current process rather than attempt to define it. Even if the process requires changing to remove a lot of effort and potential for error, this should be performed as a completely separate exercise prior to commencing the design of the Notes application, with no consideration being given to how Notes is to cope with the changes. If Notes cannot be made to fit a redefined application then Notes should not be used.

If the Notes application is to support an existing process then the information which is created and stored by that process will represent the biggest single influence on the design of the application. The structure of the paper based forms, and the relationships they have to each other will define the response hierarchy which is defined. The contents of each paper-based form will provide the model on which the electronic forms will be built, a Notes application will have a greater chance of success if the users are familiar with the layout and structure of the information they are asked to contribute, than if they are presented with an entirely new set of forms.

In the Bill of Material application, the existing paper based forms were copied line for line into the design of the forms used within the database (section 7.4), modifying them only where Notes provided a more acceptable solution. For instance the paper form included a list of options which required the relevant selection to be highlighted in some way. In the Notes form this was replaced with a keyword field that firstly allowed a selection to be made and then only displayed the selected item. By closely matching the existing format for the information, the users were more inclined to accept the system as it still represented their initial ideas and it did not require any further training other than in the use of Notes in general.

Much of the effort involved in data entry can be removed using Notes defaulting, calculation and inheritance capabilities, but in order to implement these features correctly, the precise nature of every piece of information on the existing forms must be full appreciated. The same must be said of any validation which is included in the database design. Validation is intended to prevent documents being saved which are incomplete or contain unexpected values and which may then introduce confusion into the system, however if a certain field is made compulsory when it is only on rare occasions that the information is available then that aspect of the system will become unworkable.

9.4.4 Take Advantage of Existing Sources of Information

Every effort should be made to make the data entry into the forms as easy as possible, limiting the volume of information required at each stage. This can be accomplished in a variety of ways, but the first consideration should always be in trying to transfer existing electronic data into the application.

Electronic mail messages, word processed documents and spreadsheets should all be able to be included into the database without having to retype the information. In the current state of development of information technology, it should also be possible to treat faxes as e:mail, with the system able to both send directly from the workstation without the need to print the details, and receive directly into the relevant application. One application to control the Approved Suppliers List of a company (European Quality [1995]), allowed for supplier incidents to be recorded and tracked in the Notes database. This not only included details of the incident itself but, but the use of fax software enabled communication to originate directly from the Notes database. E:mails which formed part of the incident history were simply cut and pasted into the relevant section, letters out were attached as word processed files and letters received were scanned and imported into the documents of the database. Very soon after the introduction of this system, the company involved rewrote their quality procedures to remove the need to store any paper related to supplier incidents.

A lot of information is held in the existing corporate databases which are still used to process the daily transactions of a business, again if this information is to be used in the Notes application, there should be absolutely no reason to print a report and retype the information into Notes, it should be possible to transfer the information directly. When trying to record information pertaining to the full usage of each label within the Mandatory Information database, to allow the impact of design changes to be easily assessed, manual input would have meant a great deal of duplication of effort. The solution arrived at (section 6.7.5.2) took a weekly download of Bill of Material information from the company's production control system, automatically processed this outside of the Notes system to determine the additions to the list from the previous week, and then imported the information into the Notes database. This saved a considerable amount of time and ensured that the information contained in the two systems was identical.

With the increasing popularity of the Internet as a way to obtain important information, Notes is continually being set up to monitor web pages of interest and automatically download anything that may be of relevance. This process imports the information directly into Notes with no need to retype any of the information.

With all the avenues available to electronically transfer information, Notes applications must be designed to allow for this information to be collected and organised without the need for any further intervention by the users of the system. Virtually the only 'manual' input required of the users should be to record the details of telephone calls (but again if desired this could be addressed by systems, recording all telephone conversations of interest and attaching them as voice files to the Notes documents), and the details of personal meetings that result in feelings and impressions being recorded as well as absolute facts.

9.4.5 Make Communication a Natural Part of the Process

Notes has been described by some of its critics as sophisticated e:mail, and indeed one of its many selling points is that fact that it adds to the basic e:mail facilities by being able to automatically send documents and then receive reply's and other messages into a predefined database structure, making it much easier to locate messages that are of concern.

In carrying out most business processes, users will undoubtedly arrive at a point where they need to communicate with someone else, either electronically, by fax or directly. As already discussed two of these are capable of being included in a Notes application, and the development specification must take into account these communication requirements to leverage the full benefit from the 'sophisticated e:mail' of Notes.

The Bill of Material application used a series of 'triggers' to route the documents to the relevant person when the information they needed to further progress the requests had been added (section 7.6). Basically this involves checking the contents of relevant fields each time the document is saved, sending an e:mail if the defined conditions for that field are satisfied. This is very easy to accomplish using simple Notes code and has been used by the author in several other workflow applications.

The ideal design which incorporates these communication facilities will either make the sending of information an automatic background process which the user will not notice, or make the manual sending of communication a natural progression within the workings of the process. The author was involved in the design of an application to control the contract review process within an organisation which, rather than automatically distributing documents, required the user to push a button contained within the form. This meant that no communication was performed until the user was certain that all relevant information had been included in the document. Once mailed, the button was hidden and could not be used again, preventing accidental resends and providing an indication of the contract review status of each document, i.e. which point in the cycle it had reached.

9.4.6 The Necessary Information must be Readily Available in any Situation

A Notes application will often be implemented to provide the manager of the process with a convenient window onto the daily performance of their section of the business, but this will only be possible if the design has incorporated the necessary routines and views to allow the manager to see the status at a glance. By knowing the status of all the information in the process, the manager should be better able to direct the efforts of the team in the direction that requires the most attention, or will benefit most from that attention.

The author was involved in the design of an application which made use of the approval template supplied with the Notes software. This template included a view which listed all outstanding approvals, a view which was very useful to the manager concerned in identifying, and hopefully eliminating, the bottlenecks in the process.

But in addition to the daily processing of information, the manager should also be looking at the possibilities to develop and extend a successful application, increasing its functionality and producing more significant benefits to the company. It is very rare that the design of applications will not be scaleable, but it is possible to make this easier through an intelligent design in the first place. As the number of databases involved in an application increases, the problems involved in expanding the system rely more heavily on the intelligence inherent in the initial design.

The system to control Quality Documentation (European Quality [1995]) was enhanced by one company to provide a view which allowed each user to quickly identify the documents which affected them. This was achieved by simply including a view which categorised documents based on the contents of the existing 'Document Distribution' field.

9.4.7 A Notes Application must be what the Users want it to be

An IT department working in isolation will find it impossible to push through the implementation of a Notes application in any area other than IT. Every business process has both owners and users, and unless the intended application has the commitment and support of all of these, the design is doomed to failure. An application has more chance of achieving this if it can be shown to meet all the requirements of the process in a way which suits the way in which the group works.

Each group operates within a defined set of dynamics, related to the members of the group, the process itself and many external pressures acting on both of these factors. The initial design of the Mandatory Information database suffered from this in the early stages (section 6.6.2), before the successful finished design accommodated the requirements of the users instead of trying to tell them what these requirements were. In order to promote the level of commitment and support needed the application must reflect these dynamics in its design. This is the main reason why it is impossible to prescribe a general design methodology for every application, and why a perfect design will only result from the users themselves designing and developing the application. The ease and speed with which applications can be developed with Notes is then not only a good selling point but is increasingly a compulsory facility for a successful Groupware system.

9.5 Potential Pitfalls in Design : Case Study Experience

Having explicitly defined what the application is intended to do, the information it is intended to hold and the uses to which the information is to be put, taking into account all of the above considerations, then the development effort turns to detailing the design. During the development of the case study applications the author made several mistakes, which involved a lot of design effort and which were eventually rejected as unworkable. These are presented below, along with some other potential pitfalls involved in the design process, and the author cannot stress the importance of them too strongly.

9.5.1 Design Templates Impose Inflexible Restrictions on Development

Notes is shipped with a variety of standard templates, giving the basic design for a variety of common applications for the system. Developers are advised to use these templates as the basis for their own design provided of course that they are developing that type of application, and that the template is a close approximation of the finalised design specification. One of the reasons that Notes applications can be developed so quickly is that it provides these standard foundations on which to build, thereby taking out much of the drudgery in coding in the basics, leaving the individual the exciting tasks of making the forms and views more intelligent in what they do.

Notes also provides users with a set of example databases, which unlike templates contain sample data to show how the various functions work. They come with help documents included and even suggestions on the ways in which the application could be customised by the individual users. The books by Falkner [1996] and Rayl [1994] both ship with disks containing sample applications that could be used by the purchaser of the book to develop their own applications.

The author has already made, and reiterated, on the point that each Groupware application is different, being as it is, affected primarily by the group dynamics of a particular set of users within a particular company. There are therefore, no 'standard' applications and attempting to use any of the templates or examples as a foundation actually adds to the design effort involved in arriving at a workable solution (section 6.6.1).

Every designer (of anything, not just software applications) will have their own particular ways of working and the resultant design in each case will be peculiar to them. Another designer trying to appreciate all the capabilities that have been built into a template or example database will therefore be faced with a very daunting task, and any modifications made will undoubtedly lead to certain 'background' links between data being missed.

Therefore, unless a template or example exactly matches the requirements of the system being developed it should not be used. Notes makes it so easy to develop applications from scratch that this is not a significant reduction in the functionality of the system that is being utilised. Lotus seemed to have accepted this to a certain extent, and release 4.1 ships with a reduced set of templates that only deal with the very basic types of applications.

The author developed a system to control the approval of many of the forms within an organisation (holidays, travel, etc.). For many of these forms the standard approval template provided a suitable framework which needed only a few minor alterations to suit the requirements of the process. However, when it came to the travel requests, an exact match to the template did not exist and the author was forced to include this process without reference to any part of the predefined template.

Where the templates and example databases could provide an advantage is in suggesting applications for processes that do not currently exist within the organisation, for instance group discussion is not usually a formalised process, but just occurs anyway in the daily activity of the business.

9.5.2 Never Forget what Notes is Designed to do

Notes provides the user with a combination of the capabilities of many office software tools, but it cannot be stressed strongly enough that it is not (and was never intended to be) a relational database. Notes is also intended to capture the unstructured information within a business, with a result that structured information is not supported to a great extent. Notes can perform basic calculations, but asking it to simultaneously act upon a range of values, performing complex numerical calculations is probably slightly over ambitious. These facilities are best left to the tools that have been specifically designed for the task.

During the design of the 'Mandatory Labelling' application (section 6.7.5), the author made the mistake of trying to emulate a relational database to provide the users with a list of data based upon their specific request, and all this within a form not a view. The database was first required to look up a list of all the products listed in the database (a collection of nearly two hundred documents), before then cross-referencing that with a list of products that were supplied to a particular customer and a selection of the brands required by the user. The number of lookups involved in the procedure and the amount of data in the system meant that delays of up to five minutes could occur on slower machines.

The author tried to address the solution in two ways, by making the data permanent in the documents, so that once it had been looked up initially, it then only required to be saved in the document for future use. Unfortunately the data was constantly changing and this could not be relied upon to provide the integrity in the data presented. The author then introduced a system whereby information was only looked up on request, a user could not peruse the documents at leisure, they physically had to request the information from the system. But this meant that the views only contained details of requests that had been made, leading new users to question whether that was the only information available.

After much development effort in trying to arrive at a compromise solution, the problem was eventually solved by taking the data manipulation out of the system, performing the relational matching of records using a tool designed for the job, before importing the information into Notes as one document per record contained in the external database. The format of the information in the external database was arranged to provide a whole series of categorised views of the information, once it was contained in Notes. If the author had remembered that Notes is not a relational database, a lot of effort could have been avoided.

In the above example the information was loaded into the system as Notes documents, but it is equally as viable to load the information into a Notes document, within its original application. Spreadsheets are designed to perform multiple calculations on a large range of data, and any such procedures within a business process should be performed by a spreadsheet. In order to include the results of the calculations in the Notes application, the spreadsheet can be included within a document (as with the Code of Practice case study application).

In summary, the developer should never lose site of what Notes is and what it isn't. There is no harm in using one of the traditional tools to perform a specific function, as the information can easily be included in the Notes application to promote the level of sharing which is trying to be achieved.

9.5.3 Re-engineer the Process, then Design the Notes Application

Every action which is performed within the daily operation of a business has an underlying process controlling it, from the complex order processing and expediting of a manufacturing order to the simple process of pushing the correct sequence of numbers on the telephone to make the call to the desired person. Many of the processes will have been established in an informal manner through the habits and routines of the people involved, some will be dictated by the requirements of the quality, or similar, system to ensure that the output is to a certain standard, and some will represent the only way to accomplish the desired task.

However the process has been derived, a Notes application installed to support it must follow the same rules and constraints that exist. If a user is presented with a system that takes them away from their normal routine then they will probably reject it and revert back to the manual process. If the process is clearly impractical and contains steps that actually add confusion and time to the overall system, then the first stage should be to redefine the manual process, fitting Notes to that, and not trying to redefine the process using the system.

The success of the Bill of Material application (chapter 7) can be largely attributed to the fact that it was almost a direct translation of the existing manual system into a Notes environment.

It is Notes openness and flexibility that require it to have a system which can benefit from its introduction, and this is the main barrier to Notes success. If the organisation does not promote and support change, the application will be fitting around bad practice, more than likely exaggerating errors as there is no longer the opportunity for the people to 'fudge' the process when things go slightly wrong. By hard-coding the problems into the system, things that go slightly wrong are immediately evident in the system, a system which does not have the capability to modify the outcome.

9.5.4 The Notes Developer shouldn't 'Design' the Application

Notes is designed to support group processes, and group processes cannot be defined and developed by individuals working in isolation. In section 9.5.3, it was highlighted that the system must match the workings of the process and the only people who know all the aspects of the process are those directly involved in it.

However, no matter how rigorous the definition of the application is, there will inevitably be certain aspects that are omitted, either they are not considered important enough and are not mentioned or they have simply become so habitual that the users forget about them all together.

These issues will probably come to light during the design process, as a certain routine requires information that is actually available somewhere or is input in a certain manner as the result of some other process. If the design were performed in isolation by a developer with only the knowledge gained at the definition stage to guide him, then the first draft of the application will not fulfil all the requirements of the process and so lose some of its impact at implementation, as was partly the case with the Mandatory Information database (section 6.6.3). It may be that inclusion of the 'missed' routine is not difficult to accomplish, but it could equally mean a redesign of an entire section of the database, as the structure of main and response documents does not facilitate this aspect of the process.

The ideal solution is to have regular review meetings during the design, to ensure that everything has been taken into account. The more the group members are forced to analyse the process, the greater the chance that everything will become evident. An improvement on this is to have the members of the group actually develop the application themselves, Notes is easy to use as a development tool, and the maximum benefit will only be achieved if the power users of the system have the capability to transfer the majority of processes into a Notes environment.

9.6 Adding Functionality to the Design

Having discussed some general issues relating to Notes database design, with a view to starting off a new design in the correct way and ensuring that it then stays on course to provide the best solution for the process being supported, the discussion now turns to some of the issues surrounding the actual functionality of a database. During the design of the case study applications the author had to derive some fairly powerful procedures to deal with issues which were not covered in the basic design literature, and these are discussed below.

9.6.1 Varying the Document Display depending on the Situation

With a paper based system, the contents of a document are set up at the outset in the shape of a proforma containing blank spaces for information to be added based on the responses of the person concerned. This format then becomes fixed, anyone looking at the completed form at a later stage is forced to view the information exactly as it is laid out to facilitate ease of entry. The usual methods of making forms easy to fill in are with "delete where appropriate", checkboxes and so on, none of which make it easy for anyone unfamiliar with the particular form to gain any useful information from it.

Notes allows the developer to copy this form into the system, reducing his design effort and increasing the chance that the application will be accepted due to the fact that it has a familiar look and feel for the users of the system. However, where the computer system wins is in the ability to display that information to a reader in a different format, bulky checkboxes are removed, replaced by a single value relating to the selection made, the order of information is changed to match the requirements of the later processes and so on.

With release 3 of Notes the 'hiding' of information was limited to distinguishing between whether the user was editing or reading the information, with the result that a reader deciding to edit a document was suddenly presented with a completely different form and layout from that which they had been looking at immediately before. All of the editable information was then available for edit, whether they wanted to or not, and an unfamiliar layout could easily lead to the wrong fields being mistakenly altered. This situation could be addressed by having a different form altogether for initial entry of the information and then subsequent editing of that information, as was performed in the case study relating to the Bill of Material process (section 7.7.1). However, this also required complex formulas to be written in the views to ensure that each user saw the document they were expecting and were only allowed to edit information which was of relevance to the particular stage in the process.

In release 4, the situation is addressed somewhat, by adding the facility to hide a paragraph based upon the results of a formula. This means that a field value can be set the first time that a document is saved, to change the display of the form when edited at any later stage. Obviously this is a very basic use of the system, and there are many more.

In many of the forms filled in by the author for financial institutions there was always a section relating to marital status and spouse's details. If the applicant was single this section is completely redundant, and is left as a big blank space on the form. With the Notes capability of hiding information in certain circumstances, the user would be faced with a single field for marital status. Only if the field contained "married" would the section relating to spouse's details be displayed, saving on space and time in editing, reading and printing the documents.

In most circumstances this facility is only of visual benefit, making the forms more intuitive to the needs of the user. The feature can be used as a very minor security measure, disallowing selected users from ever seeing certain fields, but this is not a comprehensive security measure, the main use is always going to be the display modification for users, to present them with an interface that will make the application as easy to use as possible.

9.6.2 Adding Limited 'Relational' Capability to the Application

In chapter 4, the author made repeated statements to the effect that Notes is not, and was never intended to be, a relational database. However, the system does contain some useful functions that provide a measure of relational capability.

As the proliferation of Notes grows through a company, the number of applications and the amount of information contained will rapidly increase. So much so that those inputting data will often find themselves re-entering information in one application that has already been input into several other applications. A good example of this would be in contact management through Notes, where the customer details will be of relevance to the marketing, sales, accounts and service departments (as well as many others) and to have the same information contained in individual applications related to each area would result in a large amount of duplication and therefore redundancy.

It is quite simple to store all the contact information in one application, but it is often the case that some of the details need to be stored in documents in other applications, otherwise the reader would have to continually skip through several open applications to pull together all the information required.

This is where the two functions @DbColumn and @DbLookup are most useful, with the latter being the one most often used. Both of the functions access existing documents in either the same database or a completely different one, through the use of views. With @DbColumn the returned data is the entire contents of a specified column in the view, and this is of most use for specifying dynamic keyword fields that pull the allowable values from existing input. With @DbLookup the returned data is that related to a "key" specified in the formula, and can either be the values taken from a column or extracted from a field in the identified document. This function provides the capability to populate a series of fields based on the user input into one key field, and the allowable values in this field can be controlled using @DbColumn, making a 'relational' application as foolproof as possible.

However, there are certain drawbacks with using these two functions. Each time the formula is processed the entire index is loaded into the memory of the workstation where the values to be returned are calculated. With a large application, having a large index to reference, the performance of the application is adversely affected. Where a form contains a lot of 'relational' processing, the performance suffers virtually exponentially, and it would be much easier to physically type the information. This can be overcome using a cache, which after the first processing of the formula, permanently stores the lookup index at the workstation and thus speeds up the process. However, this is only really suitable where the information being accessed is fairly static, otherwise the integrity of the returned data could not be guaranteed. For most Notes applications this will be satisfactory as they are not intended to process large amounts of real-time information, a contact database, once established, won't change all that often.

Whilst building the case study applications the user continually came upon the situation where @DbLookup seemed to have failed to find the relevant information, or had only found some of it. After further investigation it was found that any blank references in a returned list of values, caused the function to escape out and return values only up to the blank. If this blank occurred at the beginning of the list, obviously no values were returned. One method of avoiding this is to make the fields being referenced compulsory, i.e. if there is no value entered into them when the document is saved, the author is physically prevented from saving and exiting the document. This is not ideal, as the value may sometimes not be known, and a message continuously asking for an unknown value will soon become very frustrating. What proved a better, if not ideal, solution was to translate the field into a 'space' if there was no entered value at the time of saving the document. The field was not blank and so would not cause the @DbLookup function to escape, but nor would it display a misleading value in any returned list.

This problem only affected the function when looking up a list of values, an occurrence which was eventually removed from the application in question following a revelation that Notes was trying to perform functions for which it is not intended. If the application has been identified correctly as being suitable for Notes implementation, then it is very rarely that these functions will cause a problem, and the benefits which they have in reducing information input make them a very useful part of Notes development.

9.6.3 Simulating a Response Hierarchy

Notes applications can be built using three types of document, the 'main document' which provides the top level in a hierarchy, the 'response document' which applies to all documents directly below a main document, and 'response to response documents' which can extend the hierarchy many levels below the second level response document. This concept is shown in figure 9.1.

Main Document

Response Document

Response to Response

Response to Response

....

Figure 9.1 - Notes document hierarchy

This hierarchy is very useful in keeping related documents together. using the contact database as an example, the main document could be the company, the response documents would be the contact details within that company, and further levels of responses could detail correspondence or sales visits made to that particular contact.

However, by using a response hierarchy, the flexibility of the views is limited, as it is only really the bottom levels that can be 'turned off', i.e. in order for a response to be displayed, the document to which it is 'responding' must also be included in the view. In the above example, if for some reason a view was required of contacts and correspondence without reference to the specific customer, then the response hierarchy cannot be used, which then results in the documents probably not being listed in the desired order.

Categorisation of documents provides a useful means of grouping related documents together, but this relies on the premise that every field which will be used to categorise documents has been inherited by all the lower level documents. However, as the complexity of the response relationships increases, the number of categories needed to ensure that documents sort correctly also increases, which results in users having to search through and expand many levels before finding the document they want.

Every document in a Notes database contains reference to the Form which was used to create it, and this could be used in a hidden sort column to arrange the documents into the correct order, i.e. @If(Form = "X":1:......). Using a formula in the view column to provide the correct sorting of documents can affect the application performance as the result is calculated for every document, each time that the view is opened. This can be avoided by performing the calculation in the document itself, so that the view is only referencing a computed value from the document. However, this only groups the documents by the form used, and does not reflect the response hierarchy in many cases, figure 9.2 highlights this problem.

View Display	Required Display
Contact Document	**Contact Document**
Sales Call	Sales Call
Sales Call	Order Placed
Fax message	Sales Call
Telephone call	Fax Message
Telephone call	Reply to Fax
Telephone call	Telephone call
Order placed	Telephone call
Reply to Fax	Telephone call

Figure 9.2 - The affects of sorting only by the form used.

An alternative method used by the author for the Mandatory Information case study (section 6.7.3.1), was to combine the two solutions above, using the key fields that would normally be used to categorise the documents, to instead provide the hidden sort criteria. To simulate the hierarchy, a concatenation of these key fields was inherited by all response documents and appended with a letter code, dependent upon the existing code at the end of the inherited value. Figure 9.3 shows the concept behind this.

Contact document	Key
Sales Call	Key + A + SalesKey
Order Placed	Key + A + SalesKey + A
After Sales	Key + A + SalesKey + A + A
Sales Call	Key + A + SalesKey
Fax Message	Key + B + FaxKey
Reply to Fax	Key + B + FaxKey + A

Figure 9.3 - Simulated response hierarchy concept

It can be seen from the above detail that this method of hierarchy simulation increases in complexity as the number of levels increases. However, it did provide the author with a good means of correctly organising documents in the legal database application, but if the complexity of the system were to become restrictive then perhaps the entire structure of the application needs reassessment.

9.7 Validating the Design Guidelines

The above design guidelines are derived from a combination of a review of existing literature on this subject and the development experience of the case study applications. The case studies served to provide a level of validation to the guidelines, each resulting in a successful application which took into account the issues raised here in the planning and development stage.

Further design work performed by the author also provides a certain amount of validation as the same philosophies and principals were used in each new case to ensure that the application had the greatest chance of success. To date the author has developed, either as part of a design team or as a solo project, around 20 different applications, all of which have been successful, albeit to varying degrees.

However, this only relates to the experience of one developer. In order to increase the level of confidence in the validity of the derived design guidelines it is necessary to include the views of other developers. To achieve this a questionnaire (appendix A) was distributed to a group of experienced Notes developers, asking them to express their level of agreement or disagreement with the guidelines presented above. An analysis of the responses is given in table 9.2.

Design Guidelines	Level of Agreement
The focus of the design is determined by the type of application.	1.7
Discussion - maintaining the discussion thread.	1.7
Reference - document revision control.	1.3
Broadcast - timely transfer of collated information.	1
Tracking - consistent view of information for all users.	1
Workflow - movement of information & status tracking.	1.7
The more people involved the more complex the system specification.	1.3
Match the existing information structure of the business process.	0.3
Take advantage of existing sources of information.	1.7
Make communication a natural part of the process.	1.3
Information must be readily available to suit any situation.	1.7
Application must be what the users want, not what the developer wants them to use.	2
Design templates can impose inflexible restrictions.	1
Don't try to force Notes to do what it is not designed for.	1.7
Re-engineer the process first, then design the application.	1.7
The developer shouldn't design the application in isolation.	-0.3
Key :- 2 = Strongly Agree, 0 = Neutral, -2 = Strongly Disagree	

Table 9.2 - Results of Survey of Notes Developers on attitudes to Design Guidelines.

As can be seen from the responses received, the design guidelines presented in the text do reflect the general approach of Notes developers to the planning and initial development of a new application. Where the feedback indicated a lower level of agreement, some of the respondees offered an explanation of their decision.

9.7.1 Match the existing information structure of the business process.

"The existing information structure often has redundant processes which have traditionally been maintained by the organisation but no-one actually knows why it exists. Only by talking to the users do you find this out. So although you use what currently exists as the organisations information structure Notes can often improve the information flow."

(Alison Hood - Principal CLP in Application Development, CRS Computers)

This closely matches the statement by the author that the implementation of a Notes solution should follow a Business Process Re-Engineering exercise to ensure that these redundant processes are eliminated before starting the development of the application, a point which is not emphasised in the limited wording of the questionnaire.

9.7.2 The Developer shouldn't design the application in isolation.

"Agree that only the people involved in the process can appreciate many of the issues affecting the eventual design, but they can only specify what they require, not the application design."

(Julie Waddell - Lotus Notes Developer, CRS Computers)

The authors experience is primarily in developing applications from within an organisation, having almost constant access to those involved in the process. Many of the respondents to the questionnaire are Development consultants who have to exercise a certain amount of autonomy in the design of applications.

9.8 Conclusion

The issues involved in Notes application design are many and complex, and the author does not claim to have addressed them all or to have provided details of many of the problems that can occur outwith the published design literature for Notes. Indeed everything discussed in the above text is a distillation of the author's experience in designing the case study applications, there is no question that the design of different applications would raise further issues.

To provide a level of validation to the defined design guidelines several conclusions are presented.

- Where possible the guidelines are cross-referenced to the case study applications (chapters 6 - 8), highlighting the origin of the discussion and demonstrating how it affects the planning and design phase of an application.
- Where the author has been involved in the design of applications beyond the scope of the case study applications, the relevance of the defined guidelines is highlighted, demonstrating their generic applicability.
- The experience of other Notes developers has been surveyed to demonstrate that the guidelines are suitable in the majority of situations and can be applied by any developer to improve the planning and design phase of a project.

Outside of the presented issues, the best approach to the design of a Notes application is to try it, if it doesn't work then the rapid development possible means that a lot of time and effort has not been wasted, and the developer will have gained valuable experience in what not to try in any further applications.

By adding this experience to the matrix presented in table 9.1, the developer can continue to build a tool which will smooth the development of future applications. This is by no means a new idea, those involved in all areas of design undoubtedly use their previous experience of what worked and what didn't in the production of future designs. The added benefit in this case is the existence of a model which can be added to by any developer, providing a future reference which is easily interpreted and utilised by all.

As the body of this knowledge grows for a particular design team it will be increasingly likely that there are no potential problem areas that cannot be overcome by focusing the design effort on the relevant issues highlighted by the design model, despite the diversity which can exist in the applications which arise.

CHAPTER 10

DISCUSSION : REVIEW OF WORK DONE

10.0 DISCUSSION : REVIEW OF WORK DONE

10.1 Introduction

In this research, the author has attempted to develop a Reference Model for an ideal Groupware application and supplement this with Design Guidelines to ensure that the selected application has the best chance of producing the desired return.

In order to gain the maximum benefit from the use of the developed models and produce a level of confidence in the results obtained, this chapter first defines a methodology, taken from the case study experience, which should be used when assessing the suitability of a process to Groupware implementation via the Reference Model and Design Guidelines presented.

Groupware is a vast topic and the limited experience of one developer will never raise some of the more involved issues of implementation or design. However, by utilising a suitable research plan the author has identified many of the generic issues which need to be considered in every attempt to implement Groupware, and used these in the development of the Reference Model and Design Guidelines which should ensure that an application is both suited to Groupware and that the finalised design will provide the maximum benefit in the given situation.

10.2 Methodology for Utilising the Developed Models

Having developed and validated both a Reference Model and Design Guidelines which will aid in the selection and implementation of a Groupware application, consideration must be given at this stage to a suitable methodology which should be followed when using the two models to achieve the desired result, i.e. How can they be used in conjunction with each other to arrive at a decision of 'Good / Bad' candidate for implementation.

The presented case study applications utilise such a methodology without exactly stating what it is, and also lead to the conclusion that the analysis of the audited reference model for a given application needs to be taken in the context of the type of application being considered. i.e. the significant factors for a discussion application (those which lead to a clearer definition of feasibility to Groupware implementation) are different from those for a Workflow application, due to the nature of the process being automated.

i.e. A discussion application is concerned with maintaining the discussion thread (the relationships between the individual documents) in every separate topic within the database, if this is not achieved the database becomes a meaningless jumble of ideas that would be useful if only they were linked together with others on the same topic.

A workflow application on the other hand is concerned with the movement of the appropriate information in a timely manner and to the intended recipients. therefore everyone involved needs to know the status of the documents and what is required of them to progress to the next stage in the process. If this is not done the process halts and deadlines are missed.

These principles are drawn from a review of the success or failure criteria in a variety of applications, through both the literature review (chapter 4) and the author's direct experience of a variety of different Lotus Notes applications, during (chapters 6, 7 & 8) and subsequent to the research presented here.

This point is brought out in the developed Design Matrix (Table 9.1) by cross-referencing the five basic types of applications which are suitable to Groupware, against the defined characteristics of a business process included in the Reference Model, highlighting in each case those factors which have a greater impact on the feasibility of the application. The second section of the Design Matrix then relates to the planning of the application to overcome some of the characteristics of the process which the Reference Model audit has revealed as having the potential to cause problems during implementation (but problems which do not make the application unfeasible). The Design Matrix could therefore be split into two sections which are used at different stages within the defined methodology.

Figure 10.1 represents the methodology in the form of a flow-chart, and each stage is then discussed below.

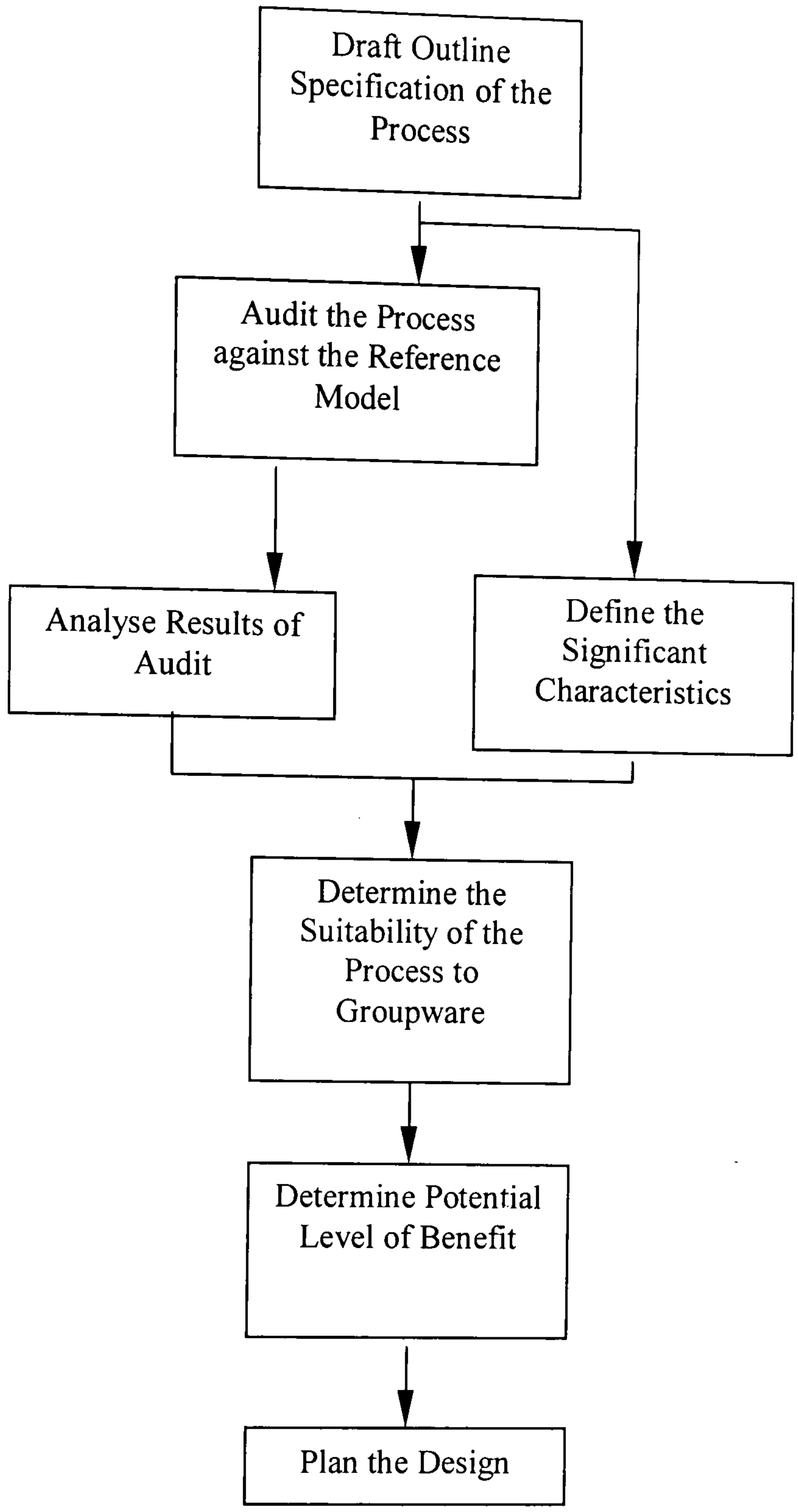


Figure 10.1 – Methodology for auditing a proposed application against the developed Reference Model

1. Draft outline specification of the process.

Having identified a business process which it is thought may benefit from the implementation of a Groupware solution, and wanting to audit this against the Reference Model, it is necessary to draft an outline specification of the process (be it as it currently exists or preferably after a certain amount of re-engineering). This will firstly clarify the problem that exists, it may be at this stage that a clearer understanding of the issues involved allows a much simpler solution to be found, and secondly, aid in the classification of the process against the Reference Model by breaking it down into the basic characteristics required, be it explicitly or through a better mental understanding of the process.

The proposal to use Groupware to find a solution should originate from the process falling into one of the five basic types of process suited to such a system. By drafting a basic specification of the process this classification is developed so that the Design Matrix can be better utilised at a later stage in the methodology.

2. Audit the process against the Reference Model

The Reference Model, where possible, includes numerical scales to allow for the more accurate positioning of each characteristic during the audit process. However at this stage the positioning of each measure is based only on the outline specification of the process, and it will probably be the case that an exact figure is not known, in which case an approximation must be made using the auditor's skill in systems analysis and their familiarity with the requirements of the business process (e.g. in case study 2 it is thought that one view will be required for each status that the documents can have), or that one single value will not apply in every instance within the application (e.g. In case study 1, the core data relating to legislation may change once a week or once a year depending on the country involved), and the auditor must then derive an average value using their acquired knowledge of the business process and the nature of the data it will contain.

Because much of the auditing process relies on assumptions made by the auditor in relation to the business process, the author found it helpful to include a short narrative for each scale, detailing the reasoning behind each classification. When the results of the audit are analysed at a later stage, this explanation should make the decision of a 'Good / Bad' candidate simpler as each result can be taken in context.

3a. Analyse results of Audit

The Reference Model has been split into two sections and it is scales (a) – (g) which form the basis of the 'Good / Bad' candidate decision. A result towards the left hand end of a scale indicates a 'Bad' candidate and towards the right indicates a 'Good' candidate. It should be easy at this stage to make a determination of which results represent a negative effect and which a positive effect where they fall towards the end of a scale, but where they are positioned towards the centre this decision in much more difficult and can only be fully assessed by taking them in the context of the type of application and by considering the big picture rather than each scale in isolation.

3b. Define the significant characteristics

The first five columns of the defined Design Matrix, relating the basic types of application to the Reference Model are used to determine the scales of the model which are of most significance in making the 'Good / Bad' candidate decision in any one case. The draft specification of the process should have allowed for the type of application to be specified before arriving at this point in the methodology. It is not necessary to define each process as only one type of application, the mandatory labelling application in case study 1 was both a reference and a broadcast application, it simply means that more scales will have a significant impact on the analysis of the Reference Model audit.

4. Determine the suitability of the process to Groupware.

Having determined the significant characteristics of the process in the context of the type of application being considered, the 'Good / Bad' candidate decision should be made. Table 10.1 attempts to illustrate this :

	Majority towards left	More towards left	Even	More towards right	Majority towards right
Significant Scales	Bad Candidate	Worse Prospect	Consider Minor Scales	Better Prospect	Good Candidate
Minor Scales	More Problems	Some Problems	Consider scales (h) – (l)	Few Problems	No Problems

Table 10.1 – Context sensitive analysis of Reference Model Audit Results.

Even though the Design Matrix has been used to identify those scales with more significance for each type of application, the analysis of the Reference Model should still take into account every scale (a) – (g), and where problems may occur the question should be asked as to whether it can be overcome with the tools available in the system and even if not, is it still an improvement over the existing process.

5. Determine potential level of benefit

If the proposed application has been identified as a 'Bad' candidate, it should have been rejected before arriving at this stage in the methodology. Scales (h) – (l) are used not to make a determination of suitability to Groupware, but rather to indicate the level of benefit that is likely or the number of alternatives that may exist to using Groupware. For instance a process in which the information is totally structured is not unsuitable for Groupware implementation but there are probably other software applications which will also handle the data, however as the information to be captured becomes less and less structured the number of viable alternatives decreases and the benefit of using Groupware therefore increases.

The analysis of these scales also plays a role in the next stage of the methodology, the planning of the design, by highlighting those areas where more effort will be required to justify the use of Groupware to provide a solution to the business problem.

6. Plan the Design

The analysis of the Reference Model audit should have revealed those aspects of the process which will cause greater problems for the designer. By comparing this analysis against the Design Matrix, the designer is hopefully given a better understanding of how these problems can be overcome.

Due to the nature of the business processes and the idiosyncrasies of individual organisations each audit against the Reference Model will be different, however by following the methodology given above the decision maker should be in a strong position to make a confident determination of a 'Good / Bad' candidate in any given case.

10.3 Suitability of the Defined Research Method

The primary research objective was to develop a reference model for a Notes application, based on available experience, in such a way that any application could be quickly audited to provide an indication of the level of success that can be expected.

The reference model had to be as general as possible and yet achieve a certain level of validity, therefore the research plan specified a review of the available literature and an assessment of the performance of existing Notes applications, giving 'wide but shallow' research. The validity of the resultant reference model could be called into question, as there was not enough detail in the application studies (section 4.6) used in the development. However, this was addressed later in the research (chapters 6-8), by using the in-depth research of the three case studies to provide a more detailed analysis of the issues affecting the valid use of the reference model. The ideal method of developing the reference model would have been to use the experience of numerous detailed case studies, but this would have required a considerable length of time, developing the applications and allowing them to run for a sufficient period to allow for an assessment of success, with the result being that the reference model still only related to this defined group of cases, albeit that the model would be more valid, in a generic environment, than the one developed in this research.

By validating the developed reference model using three detailed case studies, the research also produced an analysis of a variety of design issues which could affect the success of an application. By examining these issues in conjunction with the developed reference model, a series of guidelines were developed which could be used to overcome the more negative aspects of a potential application, as highlighted by the reference model.

However, there is really no way to fully appreciate all of the issues involved in design unless the researcher has experienced them first hand. Because of restrictions on time available, this design analysis had to be limited to a few case studies (three in this case), which again could limit the generic nature of the developed guidelines. However, further experience of the author in this area has revealed that the same issues appear each time an application is developed, and so as limited as this aspect of the research first appears, it does allow many of the relevant issues to be highlighted.

The conclusion therefore is that the defined research method allowed for the results to be as valid as possible in the time available for the study. With the inherent level of flexibility that Notes incorporates, more time to continue to develop applications and study the results in detail, would only result in the outcome of the research being valid in as many more cases as were examined.

Figure 10.2 represents a graphical map of the defined research method, highlighting how each of the identified research hypotheses was initially validated and then addressed through the main body of the research, to eventually arrive at valid contributions to the existing knowledge on the subject.

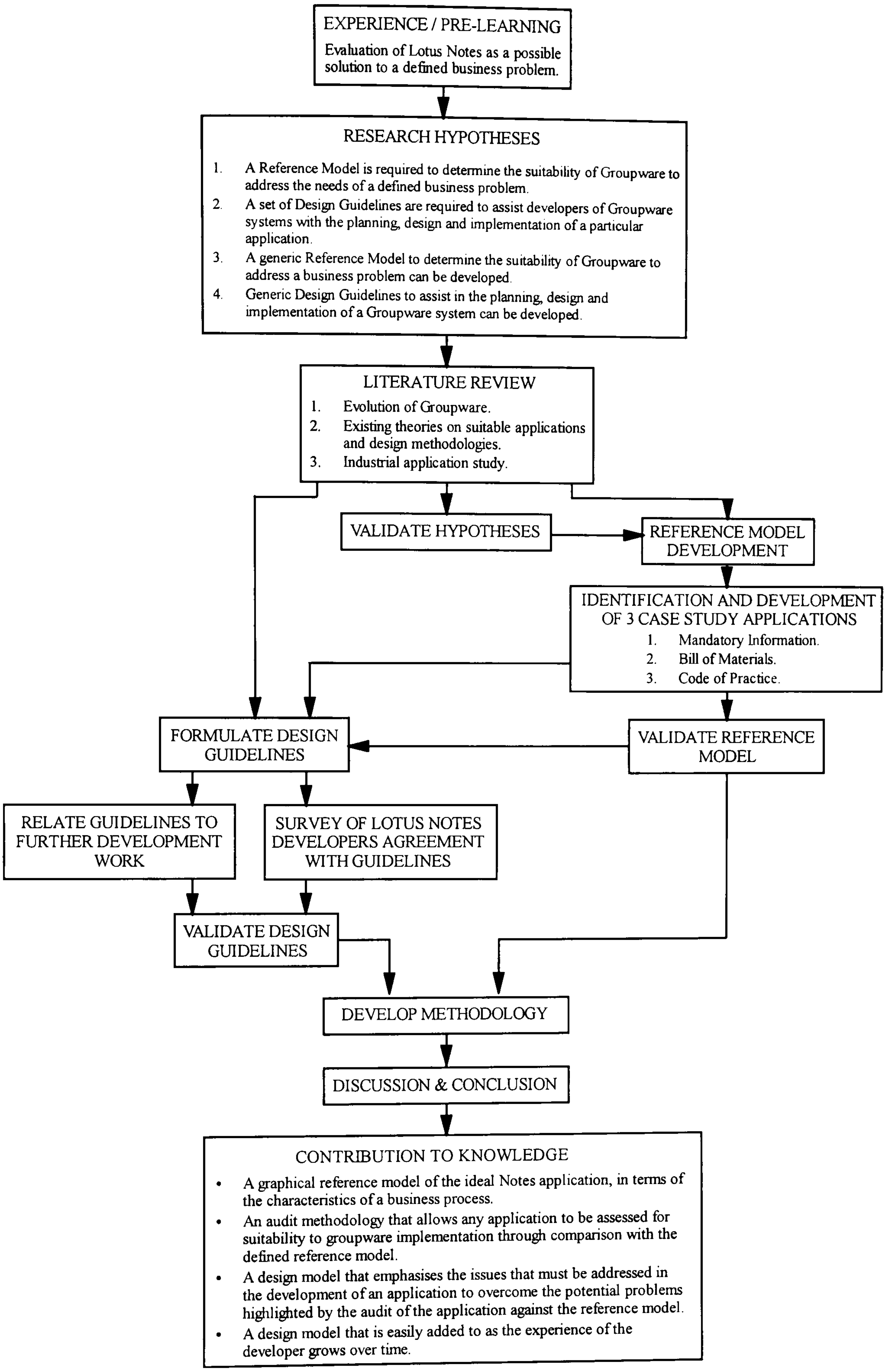


Figure 10.2 - Research Map

10.4 Contribution to Knowledge

During the development of the reference model, a review of the available literature highlighted the fact that although many authors had commented on the suggested uses for Notes and the areas where this software was clearly not suitable, the author has not found any that had actually consolidated this information into a graphical reference model which could be quickly and easily utilised by a wide audience to assess the feasibility of their proposed developments.

Through the characterisation of a suitable Notes application against the developed reference model, the affect of certain design issues could be seen more clearly, in terms of the aspects of an application which could be better supported by concentrating the focus of the design in these areas. Without the development of the more detailed reference model, the impact of these design issues would not have been so easily appreciated and represented in a way that not only shows where the main thrust of the design should be for the identified application, but also allows any developer or user to add to, through their future experience of development.

10.5 Validity of the Reference Model

Chapter 5 defined a reference model for Notes applications, presenting a list of features of business processes that would give good or bad implementations of Notes for the process concerned. The idea behind the reference model is to allow a developer to assess the features of the process under review, and if there are more potential problems than there are features which suit Notes then don't waste the time and resources in trying to develop the application.

However, the model was developed using only the available literature and a limited assessment of the performance of Notes applications currently implemented in industry. The conclusion therefore is that the reference model cannot be used as a prescriptive statement which will lead to either full development or no development at all, as there is not enough justification in the arguments presented to allow this to be the case.

The three more detailed case studies were used to try and validate the reference model , using the more in-depth examination of the issues to provide definite arguments for or against the findings of the reference model. From this analysis, the biggest flaw of the developed reference model, is in requiring the classification of the defined features in such a way as to accurately rate the suitability of the application to Notes development. The experience of the three case studies highlighted that even an application which appears to contain too many drawbacks to allow for successful implementation, should be developed if the main impetus of the application development results from one of the major positive characteristics.

What is lacking in the research is a case study where an audit against the reference model led to the identification of a bad candidate, that could then be followed through to a stage in the development where this conclusion could be proven through an unsuccessful implementation. Without this, the validity of the reference model as a tool for fully testing the feasibility of a potential application could be called into question, every application may be identified as a potentially successful candidate to a greater or lesser extent. However, the assumption is made that this is not the case, no tool can be used for something it was never intended to ever do, and the negative extremes of the reference model represent those characteristics of a process that Notes cannot support. Even if it were the case, the model still represents a useful tool to concentrate the design effort on the characteristics of an application that are likely to create the most problems for the development team.

In most cases, the features that would present a problem to the development, could be easily overcome using the design features inherent in Notes. For instance, the Code of Practice application had to maintain the revision level of the documents it contained, i.e. the application was sensitive to data corruption. However, Notes is very good at maintaining revision control, and so the potential problem was not at all restrictive to the design.

Although this argument can only really be said to apply to the three case studies, the fact that the same issues appear in each case, and a measure of common sense, points to the possibility that this is a general issue, affecting any application to which the reference model is applied. Therefore the classification of any application against the reference model must be performed with the maximum practical amount of collaboration with those directly involved in the process to ensure that each argument is taken in the correct context.

10.6 Case Studies

The three detailed case studies presented in chapters 6, 7 and 8 provided the opportunity to assess the validity of the reference model, as they all seemed to be successful implementations of Groupware. However, it has been continually stressed that the benefits which they provide are very difficult to quantify, although in some cases an attempt has been made, and without a definite figure, a true assessment of success cannot be made.

The author is confident that any marketing department will argue that the financial benefits of introducing a product into a market some weeks ahead of schedule, are significant, but they will never be able to put a number to just what the increased revenue will be. Similarly, the financial benefits of good customer relations are undoubtedly significant, as a satisfied customer will probably be more inclined to provide future business, but again, an actual number for the increase in revenue is impossible to determine.

For this reason, Groupware applications must change the definition of success, moving the bias away from financial gain (although this is undoubtedly part of the equation) and towards the improvement of the process. If a business process can be performed in less time and require less resource with the introduction of Groupware, then the application has been a success. Therefore, it could be said that in each of the case studies, the applications have been a success.

However, this is only a partial success in getting the Groupware application into use in a minor way, as even within the pilot group there are reservations as to the benefits that the change in working practice will produce. This is not a failing in the application or the technology, but is rather a barrier imposed by the people who are using the application. Just one person dragging their heels, reduces the benefits which accrue from the introduction of the application.

In summary, the reference model has successfully identified three applications which are suitable for Groupware implementation, what is lacking (and what will cause the downfall of any one, or all, of these applications) is a defined method of introducing Groupware into an organisation, to ensure that all of the people accept, and use, the new technology.

10.7 Design Guidelines

The author attempted to define guidelines for design based upon his limited experience of the issues which affected the development of three applications using release 3 of Lotus Notes. Subsequent exposure to release 4 and the designs of external consulting agencies has highlighted just how limited this experience was.

But from speaking to other developers, the impression is that this is also the case for them, the conclusion being that there will never be a complete understanding of all the issues involved in the design of a Notes application. No-one, not even the designers of the software, will ever have cause to utilise all the functionality which is included in Lotus Notes, and many of the issues are only highlighted through experience. The best that a developer can hope to achieve is to record the procedures that have been employed to overcome problems and cross-reference these with the characteristics of the process that the routine has most benefit for, whilst at the same time keeping an open mind for the discovery of new ways to achieve the desired outcome. The underlying principle being that the design will be a continuous learning experience.

Probably the only principle which applies to all Notes applications, irrespective of who is designing them, what process they are involved with or any other differences in their defining factors is that the design should be simple. There is absolutely no benefit in designing an application that is so complex that it can only be changed by one person, and will take three weeks to implement all the changes, with the processes involved, these changes may well be obsolete by the time they are made to the design. The ideal design will allow for changes to be made, by anyone with appropriate access, in a few hours.

But does this need to keep the design simple, limit the level of integration that can be realised within the organisation and hence limit the benefits that can be achieved. To a certain extent, if many applications require complex integration, perhaps Groupware is not the best platform for them anyway, it is not a relational database by any stretch of the imagination, although simple integration is possible.

10.8 Prerequisites for Groupware Success

The developed reference model deals mainly with the characteristics of the business process which is being supported by the application. However, many of the barriers to the successful implementation of Groupware are more closely linked to the people involved in developing and using the application.

10.8.1 Notes Attempts to Change the Organisational Culture

Based on the authors experience to date, the introduction of enterprise-wide Groupware systems can cause major problems if the sharing of knowledge between individuals and departments is not part of the existing company culture. The unfortunate situations have been encountered where employees keep information to themselves (either through fear of job insecurity or perceived 'expert' status), and any Groupware system introduced into such an environment is doomed to failure.

10.8.2 The Implementation must be in Response to an Identified Need

Any Groupware implementation must have a definite goal towards solving a perceived problem within the organisation. In Chapter 4, application study 1 - GM Europe, there was a defined need to solve the problem of overspending on desktop computer equipment, and the Groupware solution implemented proved to be very successful in this case. In application study 3 - Cleer University, the system failed as some aspects were ignored because they contained no useful information. The failure of these aspects led to the failure of the entire implementation as user perception was irrevocably set against the new technology.

10.8.3 The Users hold the Key to Success or Failure

New computer systems invariably mean more work for someone. If those people who will be required to do this extra work cannot perceive a direct benefit from it then they will obviously be reluctant to do it. As in any information systems implementation, it is essential to gain the users ownership through early involvement and their commitment through their experience of the immediate benefits which can be gained. Longer term benefits will serve to reinforce this commitment.

The underlying idea behind any Groupware system is that anyone who has a worthwhile contribution to the database can add their information onto the system, this of course assumes that those with information know how to do this, without going through a third party.

Therefore, in order to successfully implement a Groupware system, the preparation must be lengthy and involve training, job specification and procedures, and most importantly, a clear definition of the expected benefits.

10.8.4 The 20 Rules for Success

In section 4.7, the author presented a list of 20 rules for Groupware implementation success. The experience gained by the author during the case studies has led to a slightly different perception of these statements. The statements made in the section 4.7 are presented again below, with the authors comments added into each separate point.

1	Find a Groupware champion - the higher up the hierarchy, the better. By getting top management involved, they will see the benefits and give a lot more support. During the development of the Legislation and Labelling database (Chapter 6), the initial sponsor of the project moved into a different role within the organisation. Despite the fact that another 'champion' quickly stepped into the role, he did not possess the contacts within the other sites of the organisation to guarantee the same level of commitment from these 'distance' users who had 'a million projects to do'.
2	Groupware changes the corporate culture - plan for it. No matter how much planning is carried out, the necessity to be open about all aspects of business imposed by Groupware systems, will produce an adverse reaction from some employees. However with the increasing prevalence of computer technology, job security resides not on what you know but how readily you accept the changes that are imposed on the existing methods of working.
3	Pick a pilot project rather than trying to roll Groupware out to the whole organisation. A small pilot project is undoubtedly easier to handle, control and monitor than a large business wide application involving everyone, but it does mean that some people may feel left out, and hence lead them to reject any future development involving this new technology. The electronic mail system which is included in release 4 of Notes is very good, and does provide an enterprise wide application which could be used as the pilot project in itself, to get everyone in the organisation familiar with Notes and thereby increase the chance of future success.
4	Pick a project with boundaries and a group that is supportive of both technology and innovation. The problem of users being unfamiliar with computer technology is becoming less critical as desktop computers become increasingly prevalent within most industries. However, there will still be those who are resistant to a change in the way they work, for whatever reason, and it is very difficult to select a group of people that does not include at least one such individual. The group is defined by the process being converted to Groupware, not the other way around, and the 'champion' must find a way around the personnel problem.

5	Pick a project with both visibility and financial impact if possible. Many of the benefits of Groupware are qualitative in nature and even though an application may have a major financial impact, it will undoubtedly be very difficult to put a value to this or indeed assess the full implication of the benefits gained. Visibility is not a problem if the chosen application affects everyone in an organisation, but smaller projects will always suffer to some extent with underexposure.
6	Realise that training, maintenance and support will be the majority of the cost, rather than the initial cost of the software alone. If the applications are carefully selected, then the essential training and support will pay for itself in a very short time span, although it may be more difficult to convince the directors of this, as there are often no figures which can be put to the benefits achieved.
7	Measure productivity factors before and after the project has started. This is a good way to cost justify Groupware. As already mentioned, it is very difficult to quantify the benefits that a Groupware application provides. The need for Groupware to more closely match existing practice requires that applications be developed in conjunction with a full examination of that process, an examination which will reveal certain inefficiencies in current procedures. The Hawthorne effect mentioned in chapter 2 is largely unavoidable with Groupware implementation, and any cost benefits cannot be wholly attributed to the software solution.
8	Pick Groupware based on a specific business problem that needs to be solved and has not been solved successfully using traditional methods. Do not try to pick the Groupware and then try to find a problem to fit it. Undoubtedly, the first applications to be implemented in an organisation must relate to a defined need for a Groupware solution. However, the implementation of Groupware into the organisation cannot be justified on the basis of a few applications, in order for it to achieve its full potential, development must be an ongoing process and for this reason there will always be an element of 'looking for a process to improve'.
9	Make sure that there is adequate planning, support, training and maintenance for the project. IDV introduced a support programme for Notes that involved effectively 1 1/2 people to cover the whole of the British Isles, which then led to the application developers having to shout very loud to get support. Clearly this was an inadequate level of support and many useful applications would never see the light of day in this environment.

10	No single Groupware project can do it all. Do not expect it to do so. Lotus Notes is the currently accepted standard for Groupware, and includes many features that the other major systems (Microsoft Exchange and Novell Groupwise) do not as yet support. However, it still has some shortfalls in its functionality, and of course it will never replace a traditional database in the real time processing of large amounts of transactional data.
11	Don't expect software vendors to offer all the services needed for Groupware. May need to use internal people or consultants to ensure the project's success. The best people to design Groupware applications are those closest to the process involved, in other words the users themselves. In the initial stages, outside agencies will provide the additional functionality for the databases which are developed, but they will still require a lot of input from users. Over time the functionality will be achievable in-house and better applications will result.
12	Groupware is not a quick fix. As part of a re-engineering effort; it may take two or four years to see the results. Groupware isn't a quick fix, but even so many of the companies involved in the IDC report [1994] reported pay back periods of less than one year, in many cases considerably less. But this is no excuse to rest upon the laurels of initial success, Groupware should be a continuing commitment and development to obtain the greatest benefit to the organisation.
13	Listen to people involved in the pilot project. They are the experts on what needs to be done and can often suggest ways to better the process. More than any other software, Groupware applications cannot be developed by one (or a team) of designers working in isolation from the users of the process. Groupware success or failure is most heavily influenced by the dynamics of the group involved, and only the users can successfully anticipate how this will affect the application on a daily basis.
14	Don't be afraid to make changes. A pilot project is an experiment. Learn as it goes on. Lotus Notes allows for rapid application development and in most cases, where design changes are needed, it is easier to simply start again, learning from the mistakes made previously. Templates are a good (or bad) way to ensure a certain level of design consistency between the subsequent incarnations of a database.

15	Make sure the software selected fits with existing systems. Try to offset the LAN investment by connecting to the mainframe or similar systems. The ability of Lotus Notes to allow for the inclusion of virtually any computer based information is a big advantage when integrating data from an existing mainframe system, as most of them allow for the export of data to a file format which can be read and manipulated by at least one of the supported platforms.
16	People cannot be changed overnight - be prepared for resistance. Most Groupware applications will have numerous major features, and often a minor feature will provide more of an impetus for acceptance of the system as it is more visually obvious in its improvement of the existing process. This will often produce a greater positive reaction from users than something which is less obvious. For instance, the addition of label graphics to the legislation database, along with a method of easily finding the required information, led to a greater acceptance of the application than any of the work involved in formatting the legislation itself.
17	People take time to change. Organisations can take even longer. Any company willing to invest in Groupware technology when faced with the vagueness of the sales literature (What is Groupware ?) is already half way to changing the organisation to allow it to succeed. But not until all potential users have accepted the change will the organisation be fully able to realise the benefits which can be achieved.
18	It takes courage to change a corporate culture. Applaud those who are willing to change. However, by the same token, don't criticise those who are a little slower in accepting the new developments, they will only be alienated even further.
19	Be careful about what is automated. There is no point in automating a very inefficient process as there will be no big productivity wins in it. Groupware applications cannot and should not define the process they are supporting, they should be completely at the command of the process, therefore the process should be the first thing to be changed. In this way, anything which is automated with Notes is efficient to the degree allowed by manual processes.
20	Groupware can be very political - make sure the win is a big win. Unfortunately there is no way to predict this at the outset of a project, and once set upon the path a change of direction will also be seen as a failure of Groupware to deliver.

10.9 Evolution in the Research

The research presented in this thesis attempted to develop a reference model which could be used to identify potential candidates for Groupware application development and derive guidelines for design which could be utilised to ensure that the application is as robust as possible. This has been achieved to a certain extent, with the reference model being used to identify several other possible applications within J&B.

- Packaging development - the design and development of new packaging is a continual process and involves personnel from the marketing department in London and the operations site in Scotland. At present all projects are tracked using a paper based form and regular lengthy meetings to analyse the progress. If the process were transferred into a Tracking application, everyone would be aware of progress, and able to contribute to the development, without having to leave their own local office on a weekly basis. Time spent travelling is time when more useful work could be performed from the desk (and flights from London to Glasgow aren't cheap).

- "Star Trek" - a lot of the sales effort in the drinks industry involves visiting the 'on-trade' establishments, the pubs, restaurants, etc. Very often different salesmen will visit the same establishment, and under the current system be armed only with out of date information. Prior visits were either not written up in full, or the salesmen has not had chance to visit the office and pick up the latest details. With a Groupware application, the salesmen has access to the latest information about any client from his laptop PC, and can write up reports for the visit 'on the road', allowing the next caller to reference any developments in circumstances almost immediately. The good impression that this will give to customers is enormous.

- Vatting - the production of whisky is not a quick process, and J&B in particular leave their malts to mature for a minimum of 8 years before even attempting to bottle it. For the blended whisky there is also a considerable time spent maturing, and this is done in large holding vats, once the liquid is transported to the bottling plant from the distilleries in the North-East of Scotland. The existing method of tracking all this bulk liquid is via a paper based system, which often results in many corrections as liquid is added and removed from the vats. By implementing a Groupware system to track the movement of the liquid, the system efficiency could be vastly improved. The storage vats were located a short distance from the bottling plant, and the Groupware application could also improve the communication between the two sites, effectively creating a 'Just-In-Time' supply chain for this most essential material.

Even though the reference model is capable of identifying suitable applications for Groupware, there are undoubtedly modifications and refinements which could be made which will provide a greater degree of certainty that the identified application will succeed. However, it is not possible for any one developer to identify all the criteria that must be considered, or provide a means of classifying a company into one category or another. Every company is different and every business process is different, it is the people involved who define the specific dynamics. Perhaps a reference model would be better developed for the people, if they don't fit then Groupware shouldn't be used. However, this is painting a gloomy picture, and it must be remembered that people can change, if they are given sufficient incentive.

In terms of the design guidelines, they will never be complete and comprehensive enough for every situation, many of the issues in those presented here will not be relevant in the majority of cases, and there will undoubtedly be problems in future applications that have not yet been encountered. The other problem with trying to identify all the issues with design is that every designer will approach a new application in a different way, and will apply their own knowledge to the design. Therefore once again, it is the people involved who are the biggest single factor in the success or failure of a Groupware application.

10.10 Conclusion

The reference model and design guidelines have been developed with enough rigour to achieve the aims of this research, i.e. a simple analysis of the suitability of a process for Groupware implementation, and a means to ensure that the development effort is maximised in its effect. However the limited scope of the research means that the findings can only really be said to be relevant to those case studies presented and there remains a great deal of further research which could be undertaken to improve both the detail of the findings and the validity of the results.

As with all computer applications, Groupware only represents the mechanisms with which to accomplish the desired goals, it is not an automatic 'turn-key' solution that will monitor all the occurrences within a business and act upon them for the improvement of processes. Indeed, to a large extent, Groupware provides even less of a system than conventional technology, in order to allow the level of flexibility which is possible. For this reason, further research would never fully define an appropriate reference model, there would always be new issues affecting a new implementation.

The same is true of any design guidelines, there will always be fresh issues in a new implementation, and it is the responsibility of the company to design and develop a system which meets the users requirements and is fit for its intended purpose. It also requires each individual to give the system full commitment, so that the full benefits are realised.

CHAPTER 11

CONCLUSION

11.0 CONCLUSION

11.1 Objectives of the Research

As a result of the author being involved in the evaluation of Lotus Notes as a suitable solution to a defined business problem, five basic hypotheses were formulated for the research :

1. A Reference Model is required to determine the suitability of Groupware to address the needs of a defined business problem.
2. A set of Design Guidelines are required to assist developers of Groupware systems with the planning, design and implementation of a particular application.
3. A generic Reference Model to determine the suitability of Groupware to address a business problem can be developed.
4. Generic Design Guidelines to assist in the planning, design and implementation of a Groupware system can be developed.
5. A methodology can be written for the application of any developed Reference Model and Design Guidelines to ensure accuracy and confidence in the results obtained.

11.2 The Research Plan

Examining the current theories on management research methods, a research plan was designed to validate and address the identified research hypotheses.

1. A Reference Model is required to determine the suitability of Groupware to address the needs of a defined business problem.
   - Undertake a literature review of the current theories regarding the areas of application for Groupware, determining whether this gives a suitable

Reference Model for the ideal Groupware application by comparing this with the reported performance of existing applications.

2. A set of Design Guidelines are required to assist developers of Groupware systems with the planning, design and implementation of a particular application.

   - Undertake a literature review of the methods used by Groupware systems to support business processes to which they are reportedly better suited, using a review of existing industry applications to determine where the current design methodology may be deficient.

3. A generic Reference Model to determine the suitability of Groupware to address a business problem can be developed.

   - Expand on the theories identified during the literature review to develop a more robust Reference Model, providing guidelines on the characteristics of a business process which affect the suitability for conversion into a Groupware application, and identifying those which are likely to promote greater benefit.

   - Utilise the developed Reference Model to identify three potential case study applications and develop a solution using Lotus Notes.

   - Assess the success of each case study application to review the validity of the developed Reference Model.

4. Generic Design Guidelines to assist in the planning, design and implementation of a Groupware system can be developed.

   - From the experience gained in the design of the three case study applications, develop generic Design Guidelines that can be applied in future developments to overcome the aspects of the application which do not fit neatly into the 'ideal' presented by the Reference Model.

- The validity of the Design Guidelines is inherited from the fact that they are developed from the implementation of potentially successful applications. Further support for this hypothesis can be supplied by surveying the views of other developers regarding the Guidelines and the experience of the author in utilising them in any future development work.

5. A methodology can be written for the application of any developed Reference Model and Design Guidelines to ensure accuracy and confidence in the results obtained.

    - By combining the methodology inherent in the developed Reference Model and Design Guidelines with the experience of their application to the case study examples, define a sequence of steps to be followed to arrive at an appropriate and reproducable decision as to the potential for using Groupware in the situation under review.

11.3 Validating the Research Hypotheses

A review of the evolution of Groupware demonstrated both the importance of such a system and the necessity to have useful tools which will enable the greatest level of benefit to be realised from a flexible system which is open to virtually any interpretation that the user can imagine, viable or not. This review also led to the conclusion that in the field of Groupware, the recognised leader is Lotus Notes and the research then concentrated solely on this software.

- The main advantage of Lotus Notes over its competitors is the ease with which new applications can be developed. For this reason Notes comes as a blank sheet with virtually no guidance given on what route any development should take.

- A successful Groupware solution must be more than one or two standard applications, it must evolve into a set of useful applications which suit the individualities of the particular organisation.

- The biggest barrier to success is the people involved, if a new system requires twice the effort for half the productive output then not only will the application fail but the future of the entire Groupware system will be questionable.

- Early success can lead to different problems where users quickly see every business process as benefiting from the development of a Groupware application, leaving the development team with an overload on their available resources.

All of these points could be addressed if the developer were given a set of criteria (Reference Model) against which each potential application could be measured for suitability, and some direction (Design Guidelines) on how to begin the development. The limited resources of the development team could be focused on the areas that were likely to yield the greatest benefit with the least amount of pain, and the applications could be planned in such a way as to best accommodate the requirements of everyone involved.

11.3.1 Existing Reference Models for Groupware Applications

The initial aim of the literature review was to determine if a reference model already existed, containing the level of detail required to satisfy the objectives of the research.

The available literature states that Groupware should be used to support business processes and leave the operational activities to the software better suited to that function, the relational databases and so on. However this cannot be used as a reference model as there are many business processes which will not be suited to Groupware.

But this basic premise does represent the main principle that a model should follow. Many authors presented a list of five business process categories that are best suited to the implementation of Notes.

- Discussion
- Reference
- Broadcast
- Tracking
- Workflow

Subsequent examination of some of these application types in the 'real-world' reveals that it is again not sufficiently detailed to fulfil the objectives of the research.

11.4 Addressing the Identified Need

Having identified that the initial hypotheses were valid, a specification was formulated to address the need for a Reference Model and Design Guidelines to facilitate the identification and development of business processes which could benefit from conversion to a Notes platform.

3. *A generic Reference Model to determine the suitability of Groupware to address a business problem can be developed.*

- Develop a model of the 'ideal' Groupware application which could be used to indicate the suitability of a particular business process to implementation via Groupware.
- Define the model in such a way as to allow applications to be quickly and easily classified against the characteristics of a process which affect its suitability to Groupware, and provide a rapid identification of the level of fit to the defined ideal.
- Validate the developed model by identifying three suitable business processes and following the implementation of those applications to a point where the level of success can be determined in each case.

4. *Generic Design Guidelines to assist in the planning, design and implementation of a Groupware system can be developed.*

This specification also includes provision to develop some generic Design Guidelines.

- Utilise the design experience gained during the implementation of the case studies to determine basic Design Guidelines which could be used to overcome some of the aspects of a process which do not fit the concept of the 'ideal' application.

5. *A methodology can be written for the application of any developed Reference Model and Design Guidelines to ensure accuracy and confidence in the results obtained.*

As with any set of tools, the results obtained from their use will only be meaningful if the tools are used correctly to get to that point. The development and validation of the Reference Model and Design Guidelines provides the basics of a methodology which will ensure they are used correctly, by deriving the necessary sequential steps from the application of the two models in the case studies presented.

11.5 The Developed Reference Model

The research utilised the existing models and expanded on the ideas presented to look at the specific functionality of the software in order to determine the types of application that Notes is best suited to, whilst trying to present this analysis in such a way as to allow for the rapid and simple auditing of any process to make the determination of implementation feasibility.

The reference model presented in figure 5.17 defines a set of characteristics of a process against which any potential application can be classified. These characteristics are presented in a graphical manner that places the bias of a successful Notes application on the right hand end of a scale, the aim being to provide a rapid visual assessment of any process audited by the developed reference model.

The difficulty in using the model arises in trying to classify the characteristics of the process at the correct point on the scales to give a true representation of the level of fit of the application to the ideal Notes solution.

11.5.1 Validity of the Reference Model

In all three case studies the reference model proved to have succeeded in identifying what resulted in being a successful Groupware application. However, by classifying each application against the defined scales of the model, areas were highlighted where more design effort would be needed to produce a suitable application.

The question which then arises is whether the reference model did actually provide an indication as to the potential success of the application, or whether the analysis needed to classify the application against the reference model, focused the designer on the issues which needed to be addressed to make a success out of what would have actually been a bad candidate for implementation. But if the desired outcome of auditing an application against the developed reference model is to concentrate the design effort where there is more chance of success, then the actual mechanics of how this is achieved are irrelevant, if the application was completely unsuitable to Groupware then no amount of clever design will cause it to succeed.

One theory that was confirmed by the case studies was that the closer that each characteristic is placed to the right hand end of the scale, the more benefit will be gained from the use of Notes to facilitate the business process (case study 3).

The conclusion is therefore that the developed reference model provides a valid tool for determining the suitability of an application for Lotus Notes implementation. Although it could be stated that this is at most within one organisation, the emphasis placed on the characteristics of the process, and not the organisation or group dynamics involved, in the model should ensure that it is still valid in all other situations, albeit to a greater or lesser extent.

11.6 Design Issues

The best approach to the design of a Notes application is to try it. if it doesn't work then the rapid application development which is possible means that a lot of time and effort is not wasted, and the developer will have gained valuable experience in what not to try in any further applications.

By adding this experience to the matrix presented in table 9.1. the developer can continue to build a tool which will smooth the development of future applications. This is by no means a new idea, those involved in all areas of design undoubtedly use their previous experience of what worked and what didn't in the production of future designs. The added benefit in this case is the existence of a model which can be added to by any developer, providing a future reference which is easily interpreted and utilised by all.

As the body of this knowledge grows for a particular design team it will be increasingly likely that there are no potential problem areas that cannot be overcome by focusing the design effort on the relevant issues highlighted by the reference model, despite the diversity that can exist in the applications which arise.

11.7 Audit Methodology

Having developed and validated both a Reference Model and Design Guidelines which will aid in the selection and implementation of a Groupware application, the sequential steps required to utilise these tools are prescribed into a suitable methodology which should allow anyone to achieve the desired result in each case.

Due to the nature of the business processes and the idiosyncrasies of individual organisations each audit against the Reference Model will be different, however by following the developed methodology the decision maker should be in a strong position to make a confident determination of a 'Good / Bad' candidate in any given case.

11.8 Contribution to Knowledge

- A graphical reference model of the ideal Notes application, in terms of the characteristics of a business process.
- An audit methodology that allows any application to be assessed for suitability to Groupware implementation through comparison with the defined reference model.
- A design model that emphasises the issues that must be addressed in the development of an application to overcome the potential problems highlighted by the audit of the application against the reference model.
- A design model that is easily added to as the experience of the developer grows over time.

11.9 Further Research in this Area

Neither the reference model nor the design model are complete, there will undoubtedly be other characteristics or issues that can be added, or further research will reveal some aspect of the models which can be modified to increase their validity. However, this is probably best performed as the result of practical experience rather than through dedicated research effort.

The defined reference model contains graphical scales on which the characteristics of an application can be positioned to indicate the level of fit that exists in relation to Groupware. However the defined scales are derived from the limited experience of the author combined with interpretations of the available literature, and it is impossible to say that this is 100% accurate. With more experience in the design and development of Groupware applications, it may be possible to define these scales to a greater extent, modifying the values on the scale to increase the confidence in the evaluation of an application.

In looking at Groupware as a category of software tools, the research concentrated on the industry leader Lotus Notes, assuming that any conclusions drawn would relate to all other Groupware products, as they take many of their basic concepts from Notes. However, this cannot be proven in this research as the author has only experience with Lotus Notes to draw conclusions from. One potential area of development for the research is therefore to determine whether or not the developed models can be applied to Groupware as a collection of software, or whether they only apply to Lotus Notes.

11.10 Outcome of the Research : Benefits to the Researcher

Undoubtedly the undertaking of this research has given the author experience in the conduction of research, planning activities to ensure that the results presented are sufficiently valid, carrying out the research to ensure that everything is completed on time, and presenting the results in the form of a report, ensuring that the text follows a logical path through the research to the conclusions at the end.

Two publications resulted from the research, a paper was presented at the 12th annual Irish Manufacturing Committee conference (appendix B), dealing with the use of Groupware to improve manufacturing integration, and a second paper was presented at a Teaching Company Directorate seminar (appendix C), looking at Notes suitability to the improvement of quality systems within a company.

The research has also allowed the author to gain employment, in a position heavily involved in the development of Notes applications. The level of design experience gained during the research is such that the author is not only able to create applications from the basic idea stage, but has also significantly improved the design of existing applications developed by external bodies. Again this validates the statement that the principles of Notes design are common to all applications.

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APPENDIX A

QUESTIONNAIRE USED TO SURVEY LOTUS NOTES DEVELOPERS ON THEIR LEVEL OF AGREEMENT WITH THE DEFINED DESIGN GUIDELINES.

Lotus Notes Design Questionnaire

Please indicate your level of agreement / disagreement with the following statements related to the initial planning and development of a Lotus Notes application.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The focus of the design is determined by the type of application.					
Discussion - maintaining the discussion thread					
Reference - document revision control					
Broadcast - timely transfer of collated information					
Tracking - consistent view of information for the user.					
Workflow - movement of information & status tracking.					
The more people involved the more complex the system specification.					
Match the existing information structure of the business process.					
Take advantage of existing sources of information.					
Make communication a natural part of the process.					
Information must be readily available to suit any situation.					
Application must be what the users want, not what the developer wants them to use.					
Design templates can impose inflexible restrictions.					
Don't try to force Notes to do what it is not designed for.					
Re-engineer the process first, then design the application.					
The developer shouldn't design the application in isolation.					

APPENDIX B

THE APPLICATION OF GROUPWARE AND MULTIMEDIA TECHNOLOGY FOR IMPROVED MANUFACTURING INTEGRATION

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Competitive Manufacturing

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The Application of Groupware and Multimedia Technology For Improved Manufacturing Integration

Umit S Bititci* and Sean Kemp**
University of Strathclyde, Glasgow. UK

Abstract

In today's competitive environment, increasing pressure is being put on manufacturing businesses to continually develop and improve their products and services. In order to maintain this impetus, it is necessary for teams to effectively communicate, not just between themselves but to an increasingly wider audience. Traditional communication systems are no longer able to meet these demands, but a viable alternative does exist. Lately "Groupware" systems have emerged as a powerful tool. With the incorporation of Multi-media capability, their ability to control, share and disseminate information and data, makes them an essential consideration within a manufacturing company's information systems strategy.

The objective of this paper is to provide a detailed insight in to the potential uses of "Groupware" in a manufacturing environment and demonstrate, through a case study, its potential capabilities. The paper will first examine the need for flexible but structured communication, sharing and dissemination of data in real-time. It will then go on to develop the case study to demonstrate the potential for improved organisation wide-integration through the following capabilities:-

- "Groupware" provides a group with the flexibility to admit many different members whilst still providing the facilities for meaningful communication within the group. This flexibility is achieved by the system being able to organise and present the data in the best format to suit each individual user. Similarly, data which is input from varying sources can be combined into more meaningful shared information.

- By combining Groupware technology with advances in "Multimedia" systems, the benefits to group working can be increased tenfold. As communication is no longer limited to simple text files, scanned images, video footage and sound all play a role.

The paper also recognises the problems associated with the introduction of groupware systems, which can be numerous especially where the sharing of knowledge is not part of the company culture to begin with. Again, the potential problems and possible solutions. The paper concludes with a summary of potential benefits a manufacturing organisation could harvest through the use of "groupware" and the potential issues which need to be considered and addressed.

Introduction

In order to maintain a competitive advantage in the marketplace, industry is having to shift its emphasis away from economy and concentrate more on the level of service which it provides to customers. This involves both the introduction of new products and designs, and the speed with which enquiries and complaints are answered. To provide this improved service requires a more effective information strategy, allowing for rapid communication and increased sharing of data. This is true for all industries, but especially so for manufacturing, where the sheer diversity of data types presents a significant barrier to effective information flow.

Existing electronic communication technology allows widely dispersed users to share their information and knowledge and so reach decisions without the need for a physical meeting between the two parties. The information can be shared between several members, simply by addressing the messages to the appropriate people or by making it generally available on a bulletin board. However, these systems impose limitations on the level of information availability within the organisation as the communication is uni-directional, i.e. data is sent to a specified group of people, no-one can pull the data from the system, not even the intended recipients. This leads to the situation where work is done on projects which has been carried out before in another part of the organisation, but the use of this type of communication has meant that only those directly involved in the project are aware of the issues which arose from it, and then only if they have been specifically informed about it.

The communication system itself is concerned with the transfer of the information and is not interested in the data contained, therefore there is no structure to the data, other than that imposed by the personnel at either end of the communication link. The recipients of information must then read all of their e:mail to find any relevant information and then store it in their own personnel filing system, if this information is contained in bulletin boards for general release then their system is clogged with much unnecessary information and they waste time in going through all of it.

The retention of knowledge and the increased availability of it, can be achieved by using a conventional database, storing the data in a structured format and allowing anyone with access to search for the information they want. The introduction of a large general database, containing the data generated by all the functions of a manufacturing organisation can cause its own problems, due to the diverse nature of the information itself, so much so that functions often develop their own databases which stores their information in the way they want to see it. This obviously limits its availability, as even if others could access it they may be unable to do anything with it, because of the way in which it is presented. The performance of a centrally stored database would be affected by the number of users accessing it at any one time, and the rigidity of a database prevents two users accessing the same record simultaneously, which may actually slow down the process of gaining information.

The structured design of a database is used to ensure that records can be accessed and linked as smoothly as possible, unfortunately this often means that flexibility is sacrificed, and the information within each record must be stored in a rigidly defined way. Any information entered into the database must then be manually translated by those having editing rights, unnecessarily lengthening the storage process, and probably resulting in the abandonment or under-utilisation of the system.

In order to promote the level of information availability and communication necessary for the integration of manufacturing functions, a system is needed which combines the best functions of e:mail and database systems, having enough flexibility to allow everyone to place their data on the system, in whatever format they like, whilst storing it in a structured way, so that any user reading the information can find it and any related information very easily. The level of communication within this hybrid system must allow for the rapid and widespread dissemination of information, so that advances in knowledge are propagated throughout the organisation almost immediately. Although this type of system seems to be one of those 'theoretical ideals' that academics talk about, an emerging class of software may well be able to provide all these facilities and more.

Case Study - J&B Scotland Ltd.

J&B Scotland Ltd is the main UK production site for the International Distillers and Vintners (IDV) group, and produces and bottles several of the leading brands of brown and white spirits, which are sold throughout the world. The range of different brands which are produced by J&B only numbers just over twenty, and yet the production control system in operation lists close to 3,000 individual product codes. This proliferation can be partly accounted for by the different bottle and case sizes which are used, i.e. 70cl x 6, 70cl x 12, 75cl x 6, etc., but the largest factor which leads to this situation is the differences in the strict legislation governing the labelling of alcoholic beverages which each country specifies and that must be complied with before products can be exported.

At present there is no central store of this information which can be quickly accessed, and this has lead to the inclusion of non-mandatory information on labels which has been specified by the customer, and J&B have no basis on which to argue that it is not really required. Therefore the proliferation of labels is made even greater as they are not only country specific, but customer specific as well. When taking into account the 160+ export markets, the legislation itself is volatile enough, but add to this the changing requirements of the individual customers, and the task of maintaining the label inventory becomes a full time job.

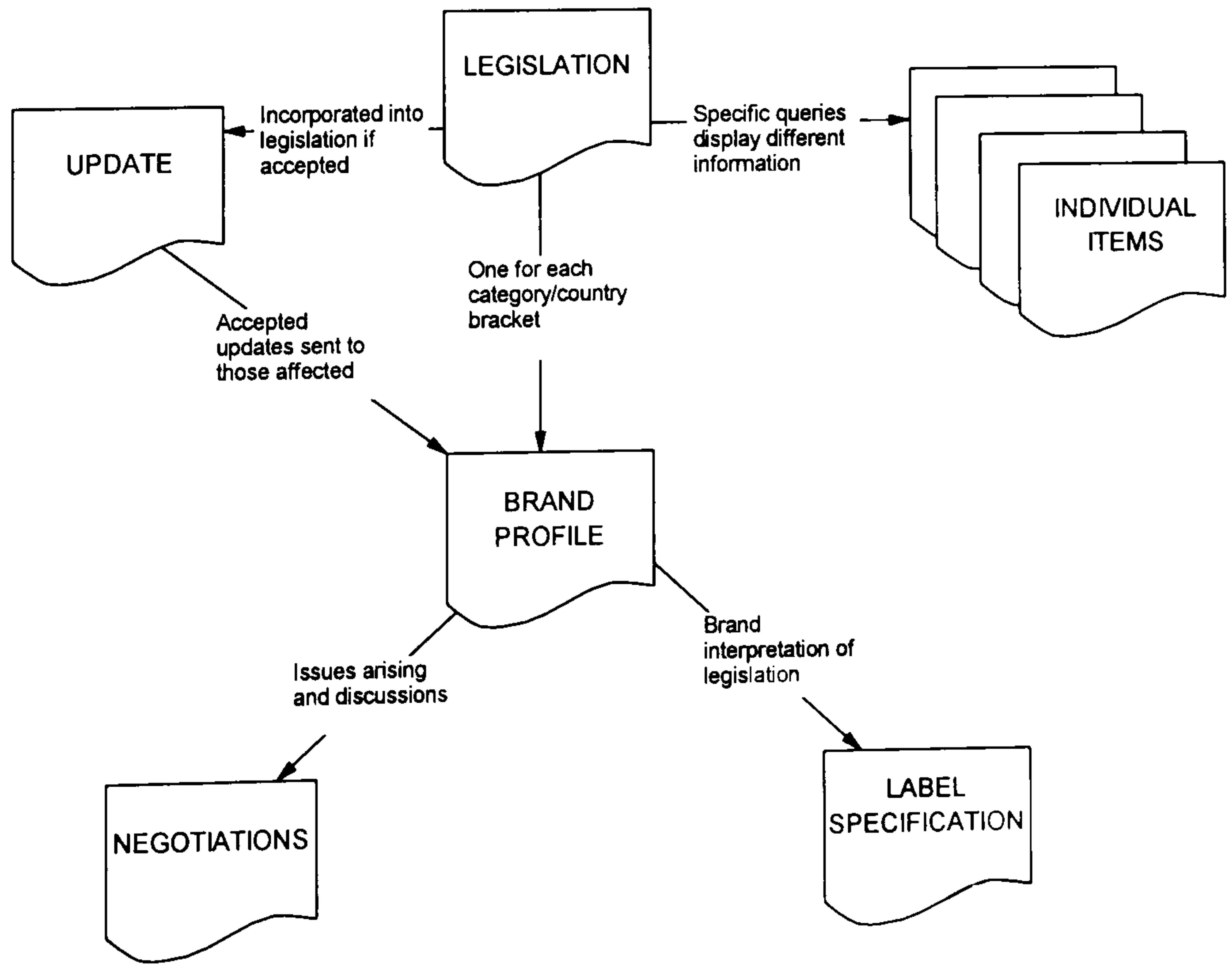
Within IDV, each brand operates as a separate entity, controlling its own products and markets, and hence specifying its own labels. Because of the lack of a central store of accurate legal information, each brand must actively seek out the labelling requirements of the country which they are dealing with, define the actual label and then gain approval for it from the market concerned. As the brands operate in isolation from one another, this process is repeated by each brand for each market, and very often the same problems are encountered each time.

It has been indicated in the above text that a central database of legal information would solve the problems of unnecessary proliferation and duplication of effort, and indeed any database package could easily cope with the amount of information which could be stored. However there are several aspects of the situation which make it an ideal application for Groupware.

IDV, as the name implies, is an international company with marketing, distribution and production companies around the world. An ideal database would allow for the communication of information between all of these sites, for instance a distribution company is closer to the customer and so is more aware of the issues involved in the requirements specified by them and the government itself, but control must be exercised over each of these by a central function to maintain the integrity of the database. Using a conventional database, the communication between the various sites would have to be by conventional means, which would then require the information to be manually incorporated into the database. Using the facility of groupware, to maintain synchronisation of geographically distributed databases, the direct updating of the database would be achieved automatically as a background function of any communication network.

Groupware products place more importance on the information a person has than their position in a company, and having a database which is kept synchronised over a widely distributed area makes maximum use of this concept, as any issues which arise related to the information in the system can be entered by whoever receives them. Another issue which may restrict the flow of information into the database is the necessity to physically type it in, but groupware uses a very flexible document structure, which allows for the scanning of images into the database, so information which would take several hours to type into the system, and may very well then not be included, will only take a matter of minutes to enter, and be immediately usable by everyone concerned. By utilising the E:mail function of a groupware system, information can be both directly sent to those whom it is known to concern, and included as a general entry on the database for anyone with access to read.

In this case study, the information is likely to affect only certain brands, i.e. those which export to the particular country, and so the system must have some way of determining which of these to send the information to. Utilising the hierarchy which is set up in a groupware system, a sub-level can be used to define brand specific information under each country, from which is pulled the relevant Author to which any update documents should be sent. Using this structure also allows for everyone to see immediately which brands go to which country, a facility that is useful for making brand comparisons for particular countries, i.e. how the legislation has been interpreted and why. Thus when other brands are going into that market, they can see what the existing brands actually do to meet the requirements. Textual descriptions of the labels themselves would only reveal so much of this information, and it would be more useful to have an actual graphic of the label in question. Individual items within this graphical representation could be linked to the legal documents and issues which define them, allowing for the required textual information to be stored only once.



Problems

The introduction of organisation-wide groupware systems can cause major problems if the sharing of knowledge between individuals and departments is not part of the existing company culture. The unfortunate situation exists where many employees keep information to themselves, in order to gain an advantage over their colleagues or to ensure that they retain their jobs, as they are then an essential commodity, and any groupware system introduced into such an environment is doomed to failure. The relative anonymity of a computer system used for the communication and sharing of information, means that higher level managers and directors effectively lose their rank, as a secretary may have just as much, if not more, useful information to contribute. Therefore, the very people who are required to drive the introduction of a system may suppress it, as they perceive it diminishing their position within the organisation hierarchy.

New computer systems invariably mean more work for someone, be it in the inputting of extra data that they would not ordinarily record, for instance the contents of a telephone message may contain just as much valuable information as an engineering drawing, or in the searching for data that would ordinarily be obtained by bothering someone else with a phone call. If those people who will be required to do this extra work cannot perceive a direct benefit from it then they will obviously be reluctant to do it.

The idea behind groupware is that anyone who has a worthwhile contribution can add their information onto the system, this of course assumes that those with information know how to add it to the system. If they do not know and have to ask someone else to input the information then both parties are going to be reluctant to continue with that situation, and the system will be unused.

Therefore in order to successfully implement a groupware system, the preparation must be lengthy and involve training, job specification and procedures, and most importantly a clear definition of the benefits which will be obtained. Even so, if these benefits do not materialise soon after the introduction of the system, then no amount of preparation and planning will make a difference.

Because of the costs involved in installing groupware systems, and the applications for which it is most useful (i.e. synchronisation of information across dispersed sites), it is of most interest to larger multi-national organisations, who need to talk to their sister companies in other countries, or need to get their departments talking from one side of the site to the other. Smaller one site companies are able to gain less useful benefit from their investment.

The incorporation of multimedia applications into the groupware system also presents a restricting factor for the smaller companies as the hard and software to support the full range of capabilities can run into large sums of money, especially where many computers are required to have access to these multimedia files (i.e. complete manufacturing integration requires all employees to be able to see and use all information). Multimedia is a nice add-on to groupware, expanding its potential considerably, but it is not essential to the operation of the system. What is essential for Lotus Notes is one of the major operating systems, either Windows or OS/2 on a PC or the use of an Apple Macintosh, i.e. no Windows, no Notes.

In order to share information between dispersed sites using a groupware system, the databases contained on the separate servers are kept in synchronisation through the process of replication, where all the documents and design elements which have changed since the previous replication are copied to all the other databases. This means that groupware systems do not provide the facility for the real-time exchange of data, and so they cannot be used to provide a conferencing system or other such application, unless the participants are prepared to accept a delay in the responses they receive. To provide such a facility would require the replication process to be continuous, an option which is unfeasible as this would take up far too much of the computing resource. The frequency of replication must therefore be a trade-off between the requirements of the information and the restrictions of the hardware platform used. This limitation could restrict the applicability of groupware to certain applications.

One of the advantages groupware has over traditional databases is that the same document can be accessed and edited simultaneously by two different people, as the documents are contained on two different servers, in effect meaning that each person is accessing a different database. It is the process of replication which synchronises all the various copies into one general database, but this may cause problems if the various changes to the same document conflict with each other. In this case, multiple documents are created, the one with the most changes becomes the main document and all the other copies are then stored as responses to this document. This conflict then requires a manual clean-up of the database to reconcile all the various documents into one, necessary to ensure that problems do not arise through people using the wrong documents.

Conclusion

The total integration of functions within organisations can only be brought about by improved communication and data sharing, and current software allows this only to a limited extent. Groupware represents a new powerful tool, and with the incorporation of multimedia technology a very flexible one, which will help companies overcome these limits in their information systems, so achieving more complete integration.

However, as with all computer applications, groupware only represents the mechanisms with which to accomplish the desired goals, it is not an automatic 'turn-key' system that will monitor all the occurences within a business and act upon them for the improvement of processes. Indeed, to a large extent, groupware provides even less of a system than conventional technology, in order to allow the level of flexibility which is possible. Therefore it is the responsibility of the company and each individual to give the system full cooperation so that the full benefits are realised.

Groupware, and Lotus Notes in particular, is being accepted as the software of the future, but the cost sassociated with its implementation mean that is only really a viable system for larger organisations. However, as the large companies who have already introduced such a system reveal the scale of the savings which have been made (many companies quote a figure close to 200% as the return on investment after only three years) and the benefits to the business process which can be achieved, that the cost of implementation will become less and less of an issue, even for smaller organisations.

Umit S Bititci and Sean Kemp

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APPENDIX C

THE APPLICATION OF GROUPWARE TECHNOLOGY FOR IMPROVED QUALITY PERFORMANCE

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Cost Effective Quality

(chr. Dr. J Brain)

27th September 1995, Glasgow, Scotland

THE APPLICATION OF GROUPWARE TECHNOLOGY FOR IMPROVED QUALITY PERFORMANCE

Sean Kemp and Umit S Bititci
J&B Scotland Ltd., Dumbarton and University of Strathclyde, Glasgow.

ABSTRACT

This paper provides an detailed insight into the potential of "Groupware" to improve quality in a manufacturing environment and demonstrates, through the use of case study, its increased capabilities when used in conjunction with multi-media technology. The paper first examines the need for flexible but structured communication, sharing and dissemination of data in the operation of an efficient quality system, before going on to describe the capabilities and benefits offered by groupware technology and its combined approach with multimedia technology. A case study is described to demonstrate the exploitation of these capabilities within a manufacturing environment to achieve improved integration. The paper concludes with a discussion on potential problems associated with the implementation of this technology and its potential benefits.

1. INTRODUCTION

In order to maintain a competitive advantage in the marketplace, industry is having to shift its emphasis to concentrate more on the quality of service which its provides for its customers and re-engineer its processes to efficiently and effectively satisfy the customers requirements. This involves both the introduction of new products and designs, and the speed and accuracy with which orders are fulfilled. To provide this improved level of service requires a more effective and efficient information strategy, making use of recent developments in information systems and thereby ensuring that everyone is aware of the standards which they are attempting to meet. These trends are true for all industries but especially so for manufacturing, where the sheer diversity of data types presents a significant barrier to effective information flow and integration. Faced with the ever increasing demands for relevant, up-to- date information and virtually real-time information exchange, the traditional information systems technologies are no longer adequate, but in recent years, developments in information technology are addressing this vital issue.

2. COMMUNICATIONS: ISSUES AND REQUIREMENTS

Existing electronic communication technology allows widely dispersed users to share their information and knowledge and so reach decisions without the need for a physical meeting between the two parties. The information can be shared between several members, simply by addressing the messages to the appropriate people or by making it generally available to all on a bulletin board. However, these systems impose limitations on the level of information availability within the organisation as the communication is uni-directional, i.e. data is sent to a specified group of people, no-one can pull the data from the system, not even the intended recipients. This leads to the situation where work is performed on projects which has possibly been carried out before in another part of the organisation, but the use of this type of communication has meant that only those directly involved in the project are aware of the issues which arose from it, and then only if they have been specifically informed about it.

The communication system itself is concerned with the transfer of the information and is not interested in the data contained, therefore there is no structure to the data, other than that imposed by the personnel at either end of the communication link. The recipients of information must then read everything to extract the data relevant to their needs, and then reconfigure it before storing it in their own personal filing system. If this information is contained in bulletin boards for general release then their system is clogged with much unnecessary information resulting in wastage of valuable time.

The retention of knowledge and the increased availability of it, can be achieved by using a conventional database, storing the data in a structured format and allowing anyone with access to search for the information they want. The introduction of a large general database, containing the data generated by all the functions of a manufacturing organisation can cause its own problems, due to the diverse nature of the information itself, so much so that functions often develop their own databases which store information in the way they want to see it. This obviously limits its availability, as even if others could access it, they may be unable to do anything with it because of the way in which it is presented. The performance of a centrally stored database would be affected by the number of users accessing it at any one time, and the rigidity of a database prevents two users accessing the same record simultaneously, which may actually slow down the process of gaining information.

The structured design of a database is used to ensure that records can be accessed and linked as smoothly as possible, unfortunately this often means that flexibility is sacrificed, and the information within each record must be stored in a rigidly defined way. Any information entered into the database must then be manually translated by those having editing rights, unnecessarily lengthening the storage process, and probably resulting in the abandonment or under-utilisation of the system.

In order to promote the level of information availability and communication necessary to achieve the desired level of quality performance, a system is needed which combines the best functions of the flexible but unstructured electronic mail type systems with the structure and formality of database systems. This type of integrated system would provide enough flexibility to allow everyone to place their data on the system, in whatever format they like, whilst storing it in a structured way, so that any user reading the information can find it, and any related information, very easily. The level of communication within this hybrid system must allow for the rapid and widespread dissemination of data, so that information is propagated throughout the organisation almost immediately. Although this type of system seems to be one of those 'theoretical ideals', an emerging class of software, called "GROUPWARE" is able to provide all these facilities, and more.

3. GROUPWARE AND MULTIMEDIA: THE FUTURE

Essentially a Groupware system consists of three critical elements, these are:-

- The database which forms the nucleus of the system.

- The communications / messaging facility which provides the flexible free-format communications network between the users.

- The viewing / masking facility which allows each user to define data which is important to the user consequently masking all other information which is considered to be irrelevant.

In database terms the function that distinguishes a groupware system from conventional databases is that of replication. A copy of the entire database can be stored in several locations, on a Notes server, and the users at each location can access their particular server, creating and editing documents as necessary. What replication does is, at regular intervals, reconcile all these unique databases into identical copies of each other, transferring all the files created or updated since the previous replication, from each separate database into every other copy. This feature means that geographically dispersed sites can be kept in synchronisation with each other, and the fact that each server is only accessed by local users means that the performance of the database will not be adversely affected even though every user is effectively accessing the same database.

The free format messaging facility, for all intents and purposes is similar to the electronic mail systems commonly used today, the key difference being that this messaging system is integrated within the groupware system. This means that communications may take place through the electronic medium and the person, authorised to make changes to the relevant fields, is then required to review the information and make an amendment where necessary. Similarly, as soon as a certain entry in the database is changed the interested parties are automatically informed of the change through the messaging facility, as soon as the document is saved, thus improving the efficiency and effectiveness of corporate communications.

The widespread sharing of information using bulletin boards, whilst a very attractive function, can lead to wasted time, searching and looking for relevant information, and cause problems in maintaining the security of the data. Groupware systems can overcome this problem by giving the users access to information that directly affects them. This is achieved because groupware systems store information as documents, using appropriate blank forms created by the application developer. Access to the information contained in these documents is obtained by opening them from a view. The views, which can be easily configured by the user, are typically used to display various documents in the format that the user wishes to see them. The documents to be included in a particular view can be specified so that unwanted data is not included, useful where many documents exist in one database as the view is recreated and indexed, each time that it is opened.

Because the views are comprised of data fields from the documents, one document can be used to store a lot of information which is then subdivided into meaningful portions for the view, so that users accessing the same document can gain information relevant to their needs. Furthermore to enhance the security of such systems, this masking feature can be extended into the document itself by separating the information into sections which can then be selectively made available based on who has accessed the document, and whether they are reading or editing.

The most versatile field type is a 'Rich text' field, which allows for the incorporation of many different data types into documents. Indeed, the blank form is simply a large rich text file, to which the necessary static text and fields are added. The fact that the form is a rich text field means that other objects can be embedded into it, to provide such facilities as the running of macros of the use of hyper-text features, creating linkages between documents.

The versatility of the embedding and linking features within the system allows for the use of some of the more sophisticated multimedia technologies, allowing an almost limitless array of applications to be developed containing conventional database information as well as audio and visual (still photos, video clips, drawings, sketches, etc.) information, within an integrated framework.

The reader would appreciate that, the combined use of groupware and multimedia technology opens enormous possibilities for improving quality performance in manufacturing organisations. The following section describes a case study where such an application is currently being developed with the objective of improving customer service and profitability by ensuring that products are "Right first time" through more effective communication.

4. A CASE STUDY

The case study focuses on the main UK production site of one of the worlds leading producers of wines and spirits, where just over twenty brands of brown and white spirits are produced. Despite this small catalogue of products, at any one time the production control system, which is specific to that site, lists close to 3,000 stock-keeping-units (SKU's), i.e. finished goods ready for sale. This large degree of proliferation can be partly accounted for by the different bottle and pack sizes used, but by far the largest factor is the strict legislation, specified by each country, which governs the packaging (i.e. labelling and capping) of alcoholic beverages and that must be complied with before the products can be exported.

The result of failing to comply with a markets/customers specific packaging requirements is that the product fails to reach the market in time and the market runs out of stock. To explain the gravity of the situation in more practical terms, imagine not being able to buy Coca-Cola at any shop in your country because the manufacturers failed to deliver on time. The consequences, in terms of loss of revenue and customer good-will could be catastrophic. In addition to this, recent years have seen increasing pressure from the customer base for more reliable and frequent deliveries, as this improves the capital employed and cash flow situation of the customers organisation, so the necessity to get the details of the product right first time has become increasingly important.

In the face of ever increasing variety in S.K.U.'s and having recognised the gravity of the situation the company decided to create a central data store where all relevant information on a markets and customers packaging, shipping and delivery requirements are stored and rigorously maintained. The objectives associated with this central data store were as follows:-

- to provide up-to-date information on the packaging, shipping and delivery requirements of each market, and each customer operating in that market, thus allowing the production units to respond to the customer orders effectively and efficiently.

- to identify and exploit rationalisation opportunities to minimise, as far as possible, the number of S.K.U.'s handled by the business, which in turn will ease planning and stock control problems.

- to facilitate rapid identification and communication of any changes to the requirements of markets and customers.

- to minimise the pack development lead times for new markets and/or customers.

At the outset of the project, it was thought that a simple central database system with centralised management would suffice. However, as the project progressed it became apparent that, considering the structure and organisation of the company a centrally located and managed database would not be a practical proposition. Within the company each brand operates as a separate entity, controlling its own products and markets and hence specifying its own packaging. In addition, being a truly international operation, the company has several marketing, distribution and production operations throughout the world. In this respect the issues facing a conventional database systems were that:-

- Expertise on market and customer requirements are distributed across the world and that no one central organisation could provide all the necessary information to maintain the data. That is, the maintenance responsibility had to be distributed whilst maintaining integrity of data for use world-wide.

- The data had to be accessed and used by various organisations, including third party distributors, located in various locations across the world.

An ideal database would allow for the communication of information between all these sites, but control must be exercised over much of these by a central function, in order to maintain the integrity of the database. Using a conventional database the communication between the individuals concerned would have to be by conventional means, which would then require the information to be manually incorporated into the database. However, the company recognised that using the facilities of groupware systems as explained earlier in this paper, the distributed updating of the database could be achieved, as any information which arises can be entered by whoever receives it, in the first instance being communicated to an authorised person before final acceptance into the database.

The multimedia capability of groupware systems is seen as an essential requirement for this type of application. In many cases textual descriptions of the packaging and other related information would reveal only limited information, and the inclusion of actual images of labels (as well as shipping and legal documentation) is seen as an essential component of this particular system.

At present, the system described in this case study is at an advanced state of development. The structure of the forms contained in the database is illustrated in figure 1.

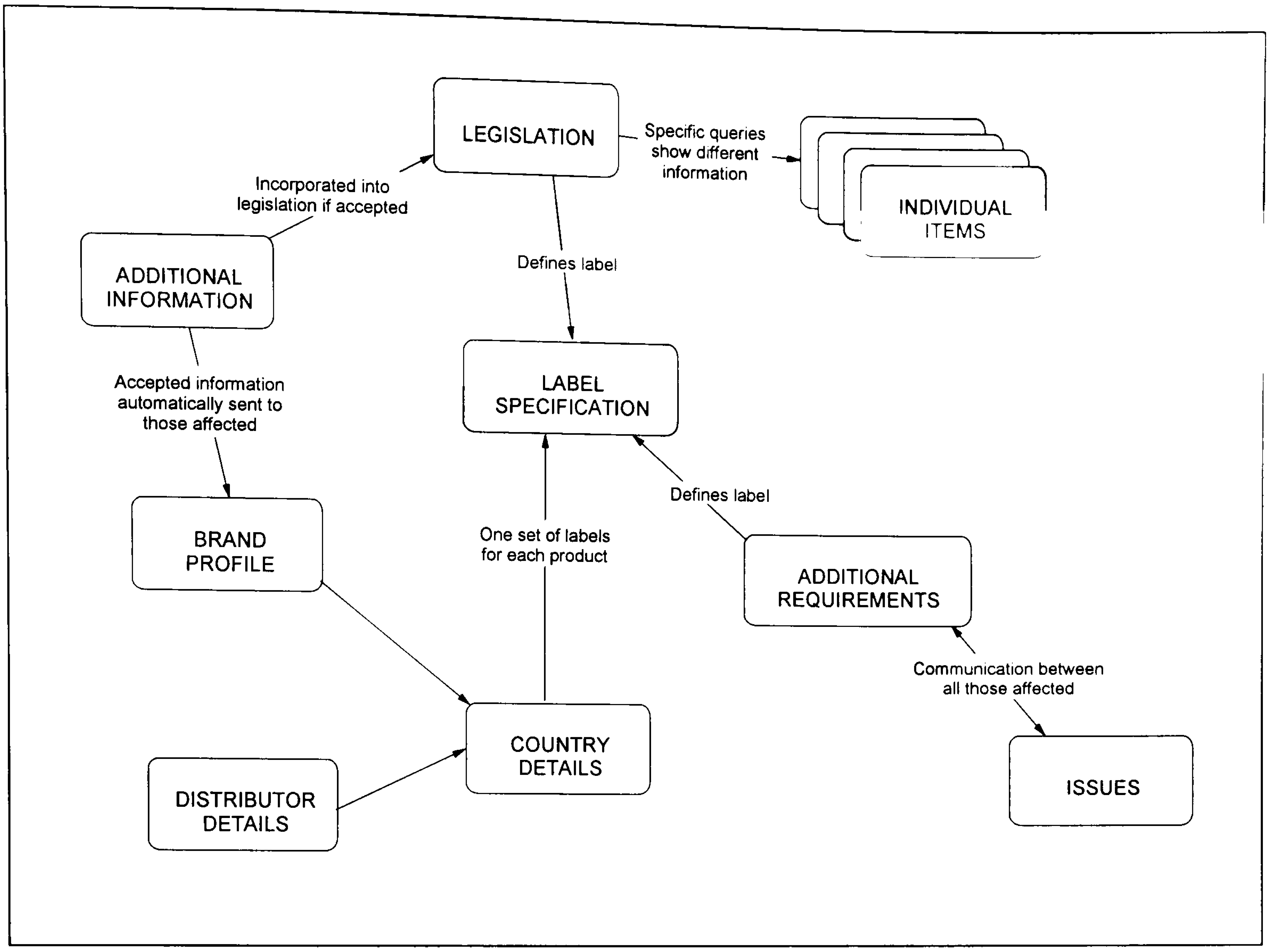

Figure 1. The structure of the forms contained in the database.

On completion, the company expects the following benefits:-

- Reduce costs due to:-
  - less rework
  - reduced export problems
  - improved communications
  - reduced complexity in SKU's, improving turnover and planning capability.
- Improved customer service due to:-
  - better understanding of markets and customer requirements
  - faster response to new packaging development projects

- readily available and up-to-date information

5. POTENTIAL PROBLEMS

5.1 Organisational Culture

Based on our experience to date, the introduction of organisation-wide groupware systems can cause major problems if the sharing of knowledge between individuals and departments is not part of the existing company culture. The unfortunate situations have been encountered where employees keep information to themselves. Any groupware system introduced into such an environment is doomed to failure.

5.2 Commitment and Ownership

New computer systems invariably mean more work for someone. If those people who will be required to do this extra work cannot perceive a direct benefit from it then they will obviously be reluctant to do it. As in any information systems implementation it is essential to gain the users ownership through early involvement and their commitment through their experience of the immediate benefits which can be gained. Longer term benefits will serve to reinforce this commitment.

5.3 Training

The underlying idea behind any groupware system is that anyone who has a worthwhile contribution to the database can add their information onto the system, this of course assumes that those with information know how to do this, without going through a third party.

Therefore, in order to successfully implement a groupware system, the preparation must be lengthy and involve training, job specification and procedures, and most importantly, a clear definition of the expected benefits.

5.4 Company Size

Because of the costs involved in installing groupware systems, and the applications for which it is most useful (i.e. synchronisation of information across dispersed sites), it is of most interest to larger multi-national organisations, who need to talk to their sister companies in other countries, or need to get their departments talking from one side of a large site to another. Smaller, one site, companies are able to gain less benefit from their investment.

5.5 Multimedia

The incorporation of multimedia applications into the groupware system also presents a restricting factor for the smaller companies as the hardware and software to support the full range of capabilities can run into large sums of money. Multimedia is a nice add-on to groupware, expanding its potential considerably, but it is not essential to the operation of the system.

5.6 Replication Frequency

In order to share information between dispersed sites using a groupware system, the databases contained on the separate servers are kept in synchronisation through the process of replication, where all the documents and design elements which have changed since the previous replication are copied to all the other instances of the database. This means that groupware systems do not provide the facility for the real-time exchange of data, and so they cannot be used to provide a conferencing system or other such application, unless the participants are prepared to accept a delay in the responses they receive. To provide such a facility would require the replication process to be continuous, an option which is unfeasible as it would take up far too much of the computing resource. The frequency of replication must therefore be a trade-off between the requirements of the information and the restrictions imposed by the hardware platform. This limitation could restrict the applicability of groupware to certain applications.

6. CONCLUSION

The essential improvements in the quality performance of a company can only be brought about through improved communication and data sharing, and current software allows this only to a limited extent. Groupware represents a powerful new tool, and with the incorporation of multi-media technology, a very flexible one, which will help companies overcome existing limitations in their information systems, so achieving the necessary integration to promote the improvement of quality.

However, as with all computer applications, groupware only represents the mechanisms with which to accomplish the desired goals, it is not an automatic 'turn-key' system that will monitor all the occurrences within a business and act upon them for the improvement of processes. Indeed, to a large extent, groupware provides even less of a system than conventional technology, in order to allow the level of flexibility which is possible. Therefore it is the responsibility of the company to design and develop a system which meets the users requirements and is fit for its intended purpose. It also requires each individual to give the system full commitment, so that the full benefits are realised.

Groupware technology certainly paves the way to the future in terms of corporate communication and information systems, but at this stage the cost benefits associated with its implementation mean that it is only really a viable system for larger organisations. However, as the large companies who introduce such a system reveal the scale of the savings which have been made (figures close to 200% as the ROI after only three years have been quoted) the cost of implementation may become an attractive investment, even for smaller organisations.

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