Defining an information architecture to support a knowledge based organisation

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ABSTRACT

This paper describes a methodology for the definition of an information architecture of an organisation. The term information architecture is used here to mean a high level description of the information that people need and use across the organisation, where it comes from, how they use it and what happens to it as well as its availability and perceived value. The information architecture is therefore a ‘map’ of the organisation’s information environment on the basis of which information policy including data acquisition, data storage and information and communication technology (I&CT) can be planned to support the knowledge worker.

The rationale behind the method is explained including the theoretical model of the user of information upon which it is based. A detailed account of the application of the approach is given drawing on a case study involving the Singapore Productivity and Standards Board (PSB). The PSB is an aspiring knowledge-based statutory organisation in Singapore tasked with the mission of increasing Singapore’s overall total factor productivity (TFP) growth, and through it, helping to enhance its economic competitiveness. The study involved the survey of 600 people in the organisation using a combination of qualitative and quantitative techniques. The techniques were developed specifically for the purpose of understanding the requirements of individuals for information and stemmed from the model of the user of information which provided a guide to the data that should be gathered.
1.0 INTRODUCTION

This paper describes a systematic approach to the definition of the underlying information architecture of an organisation. The term information architecture (IA) is used here to mean a description of the information that people need and use across the organisation, where it comes from, how they use it and what happens to it as well as its availability and perceived value.

The approach taken to derive the IA is based on a theoretical model of the user of information. The purpose of the model was to 'identify a useful subset of the features or variables' (Spink, Wilson, Ellis & Ford 1998) on which data would be gathered. The model resulted from undertaking previous studies of information communities and the consolidation of approaches to user modeling found in Information Science (in particular those associated with information behaviour such as information seeking and use), Human Computer Interface design and Software Engineering. Stemming from this theoretical orientation techniques were developed to understand the information behaviour of individuals the results of which were aggregated to help determine the Information Architecture of the organisation as a whole.

The driving force for this research was twofold. In the first place there is an increased need for effective I&CT systems that will support the knowledge worker. ‘Knowledge is what we acquire from our interaction with the world; it is the result of experience organised and stored inside each individual’s own mind’ and ‘information [and data] is what human beings transform knowledge into when they want to communicate it to other people’ (Orna, 1999, p8). Knowledge workers update and refresh their knowledge through experience and via access to a range of formal and informal sources of information and data. Increasingly tools are being developed to support the knowledge worker. Emphasis has been placed on the development of tools to solve specific problems such as the recording and sharing of knowledge within the organisation or the visualization of relationships within data sets. These tools are useful however their application and development is not generally based on an understanding of the information architecture of the organisation as a whole which it is argued is the logical starting point for the planning of I&CT systems to support knowledge workers.

Secondly there is surprisingly little consensus as to how to go about understanding the requirements of potential end users of I&CT. In software engineering emphasis has traditionally been placed on the specification stage of system design rather than user requirements analysis. Quite naturally software engineers i.e. builders of systems, focus on the content of the ‘system’ and the processing of this content. In recent years there has been an appreciation of the weaknesses of system driven solutions. Hill (1995) states that 60% of major errors in systems development has been in the requirements analysis stage. Current Structured Systems Analysis and Design Methodology (SSADM) guidelines for involving users have been described as inadequate, (Middleton 1999). Recent discussion has emphasised the use of sociological techniques for understanding users (Heath & Luff 1991), such as the use of ethnographic methods (Simonsen & Kensing 1997) indicating a realization that a deeper understanding of the user is required. In the area of expert system development greater emphasis has been placed on methodology due to the complexity of
understanding the cognitive processes of the ‘expert’ (Cook 1994). Human Computer Interface design has perhaps led the field in terms of having a holistic view of the user due to the historical influence of ergonomics. However neither software engineering nor expert system design nor human interface design have an underlying theoretical model of the user of information which would help to define exactly what it is we need to understand about the user when developing I&CT systems. Nor have methodologies been developed with the intention of understanding both the information behaviour and needs of the individual as well as those of the organisation as a whole. Less time has therefore been spent on understanding the user and their interaction with information partly because the associated skills are not emphasised during the training of these professionals and also because the primary task is perceived as building and testing of the system. Information Science in contrast has concentrated on the user and their interaction with information. Hert (1997) provides a good overview of related research in this discipline. The following model therefore owes more to previous research in Information Science. Nevertheless the disciplines mentioned above have been particularly useful in identifying specific techniques for studying the user due to the diverse range of techniques that have been applied in practice.

2.0 MODELLING THE USER

Modelling the user has been a concern of designers of information retrieval (IR) systems for a number of years. The objective being to be able to identify either generic characteristics of potential users or the specific characteristics of an individual user so that information retrieval can be facilitated. One of the problems of defining such a model is the distinction between macro and micro or generic and specific. For example some models describe the moment of interaction with an electronic information retrieval system whereas others model information seeking episodes associated with specific task related contexts. Both types of model have been presented as generic models of the user of information. Ingwersen (1996) and Saracevic (1996) for example focus on modelling the user’s interaction with IR systems. Ellis (1989, 1997) identifies generic behavioural processes associated with information seeking in the academic and industrial research context. There is therefore still a need to identify generic characteristics of the individual and their situation that may influence their information behaviour as well as to identify criteria that help to explain specific interactions. Wilson (1999) provides one of the most comprehensive models of the user distinguishing between macro and micro in his ‘nested model of information seeking’ (p263) and in his 1996 model he identifies many of the key variables influencing information processing and use. The models proposed here owe much to these previous researchers but hope to make more explicit the individual components of the user model and their interaction. They also help to distinguish between micro events when the individual is actually looking for information and macro processes associated with the broader information intensive task. Furthermore the models proposed here emphasise the dynamic constructivist nature of the user’s interaction with information i.e. although the ‘domains’ remain the same their content is constantly changing. In addition a distinctive feature of this research is that the theoretical model is used to help identify appropriate methodology and specific techniques for understanding the information behavior of individuals. Previous research has focused on the development of models and placed little emphasis on the implications of these models for the understanding of user
requirements for information. In this case the theoretical model helped in the choice of methods which enabled an understanding of user requirements and hence enabled the definition of an IA. This in turn led to definition of information strategies that would support individuals in their knowledge-based work.

2.1 Underlying theoretical framework for the proposed model

It is proposed that three significant domains are integral to understanding information behaviour. These are environmental, psychological and behavioural. Each one is made up of various elements as shown below.

Environmental
- Norms, goals, roles, tasks
- Subject content (the knowledge domain)
- Artifacts (books, journals, pictures, graphs, online systems, the Web etc.)

Psychological
- Cognitive knowledge (about the tasks, subject domain and artifacts)
- Cognitive processes (associated with the tasks, use of information and artifacts)
- Cognitive ability & style (which influences behaviour and interaction with information)
- Affective states (associated with the completion of tasks and interaction with artifacts)

Behavioural
- Actions (associated with information seeking and use)
- Speech (verbal statements associated with information seeking and use)

These three domains interact and are constantly changing. However depending on the individual and their environment they may be more or less consistent. In addition these variables will change while the individual progresses through the information tasks ‘making sense’ of problematic situations. The domains and their elements therefore define what we need to understand about the user’s information behaviour. The following scenario should help to appreciate the interactive nature of the various domains shown in Figure 1.

Scenario: An individual is involved in a particular task, such as deciding on a commercial strategy (as a part of their role in the organisation). Depending on the organisational norms, for example, the emphasis placed on collaboration or research, the artifacts available (databases etc.), the cognitive knowledge of the individual (of the subject domain) and their particular cognitive style certain actions would be taken. These actions would be associated with the use of specific artifacts such as people, reports, Web based sources etc. that in turn influence the nature of interaction. The use of these artifacts would be associated with specific cognitive processes (comparing, ranking etc.) and would be influenced by the individual’s cognitive knowledge of the subject domain and the particular artifacts. The cognitive style of the individual would affect how they interact with artifacts. For example the holistic or serialistic nature of the individual may influence information
seeking and use behaviour (Ford, 1995). Interaction with artifacts and progression through the task would be associated with affective states such as confidence and frustration.

In Figure 2 the relationship between the different domains while the individual undertakes an information intensive task is shown. Three incidents are highlighted.

Figure 1. Modelling the variables associated with the individual and their interaction with information
3.0 APPLICATION OF THEORETICAL FRAMEWORK

This theoretical framework was used to help formulate a methodology for defining the information behaviour of individuals in a large statutory organisation in Singapore, the Singapore Productivity and Standards Board (PSB), and to derive an understanding of the information architecture of the organisation. This organisation was formed in 1996 through the merger of the National Productivity Board and the Singapore Institute of Standards and Industrial Research. This merger was designed to enable an integrated approach to the management of Total Factor Productivity to sustain Singapore’s future growth (PSB, 1997).

The overall approach taken is shown in Figure 3. A brief explanation of each stage and the techniques applied follows.

3.1 Project orientation

The objective of the project orientation phase of the research was to familiarise the researchers with the organisational structure and the norms, roles and goals of the organisation. Generally these were gleaned from internal PSB documentation. It was decided that the information needs and task analysis survey would focus on the goals of the organisation since these were perceived as critical to the success of the organisation. Goals included ‘building up a world class skilled workforce’, ‘cultivating commitment to productivity’, ‘building up world class companies’, ‘developing highly productive industries’ and ‘facilitating market access for Singapore’s exports’. Each goal was
Figure 3. Methodology for defining information architecture
associated with specific programmes, output indicators and deliverables. These provided the context within which people undertook information intensive tasks.

In addition the orientation stage helped to identify the ‘subject content’ people dealt with and to some extent the ‘artifacts’ (information systems and sources) that they used. Figure 4 provides an indication of the broad categories of information identified and an indication of the questions staff needed to answer.

During the orientation stage a presentation was given to senior management to ensure understanding and support for the project. This was important to help ensure commitment to the project by managers and staff. This was particularly necessary due to the hierarchial nature of the organisation.

Lastly the orientation stage enabled the researchers to identify parts of the organisation that were particularly information intensive and the identification of departments and roles for subsequent qualitative in-depth research.

### 3.2 Task analysis and information needs analysis – a qualitative approach

All PSB Divisions took part in the qualitative study. Within these Divisions 32 departments/centres participated out of 45. The qualitative study involved Task/Analysis Information Needs Analysis, Focus Group/Flowcharting sessions and Observation/Talk-through.
Task Analysis/Information Needs Analysis of Directors and Task Analysis/Information Needs Analysis of Staff took place to a great extent in tandem. However the Task Analysis/Information Needs Analysis of Directors started first. The phrase Task Analysis/Information Needs Analysis (TA/IN Analysis) was coined to reflect the process undertaken. Task analysis, often used in Human Computer Interface design, was adapted and used to elicit information needs. The reasons for this were threefold. Firstly, asking people about their information needs is relatively unproductive producing ‘thin’ data. This is the likely consequence of the unconscious nature of information use. In addition the need for information is specific to contexts and situations and hence generalisations of need tend to be abstract and lack detail about how information is used. However people can describe in detail the tasks they undertake and can break these down into sub-tasks. A full description of the information/data associated with these tasks can then be elicited. Secondly, as can be seen in Figure 2 tasks are a fundamental part of the user model and, it is argued, play an integral role in determining information needs and use. Thirdly, the task analysis technique had been applied on two previous occasions and was shown to be relatively easy to apply. This was an important consideration since the technique would have to be applied by people with little training, that is, the PSB’s Information Architecture team who played an active role in gathering data.

### 3.2.1 Task analysis and information needs analysis of directors

Eight out of twelve Divisional Directors took part in the TA/IN Analysis interview sessions. It was decided to conduct an extensive interview with Directors partly to understand their needs but also to get them involved in the process. This helped to get their support for the subsequent research which would involve their staff. It was recognised that without the backing of senior management little co-operation would be afforded by subordinate staff. In addition due to the precious nature of their time and their seniority it was unlikely that subsequent analysis of their information behaviour would be possible. Ideally focus group/flowcharting sessions as well as observation/talk-through would have taken place with this group.

The interview with Directors was divided into the following questions:

1. What is your role in the organisation?
2. a) What are the main tasks you have to perform, major activities that take up your time, things that you do?
   b) How do you do these?
   c) What decisions have to be made during these tasks? What questions are you trying to answer?
   d) What information do you need to do these tasks? [Subject, form, coverage, media, frequency, quantity, difficulty, the ideal, reports generated – were discussed at this point.]

Hence questions 1, 2a and 2b focus on tasks and roles. 2b the ‘How’ question enabled main task to be broken down into sub-tasks leading to more detailed data on tasks. Question 2c focused on the cognitive knowledge and cognitive processes associated with
these tasks and question 2d the information artifacts and their associated characteristics. The following examples provide an indication of the type of response.

One respondent’s primary task was to ‘tackle the international certification issues’ which involved ‘international meetings’ and raised questions such as ‘what certification is being accepted in Japan, U.K. etc’ and ‘what effect will it have on Singapore’ which drew on information from ‘international bodies’ and the need for research reports.

Question 3 asked the respondents to focus on specific tasks that contributed to the goals of the organisation. Again question b was designed to break down the main tasks into sub-tasks. Question c identified questions that related to cognitive knowledge of the subject such as ‘who is doing failure analysis?’. Cognitive processes such as ‘identify’, ‘justify’, ‘conceptualise’, ‘evaluate’, ‘match’ were also identified. The need for specific subject content, for example, information on technology areas, such as, animatronics (cost of production, who produces it, trends etc.) were elicited.

For example ‘facilitating market access’ by ‘providing accuracy of measurement which leads to… credibility and market access’ which raises questions of ‘what standards should we anticipate? Who will use the standard? Who manufactures the standard? Which requires information about the ‘costs of implementing a standard’ the ‘need to study the impact of standards … effect it has on the bottom line’ etc.

Question 4 concerned the flow of information and asked ‘Who do you exchange information with? Who do you provide reports to and who do you receive reports from?’ This helped to identify the flow of information and also helped to identify sources of information within and outside the organisation.

Question 5 used the ‘critical incident method’ where respondents were asked to focus on a specific situation where information was needed to answer a question or resolve a problem. The objective here was to build a rich picture of information need and use situations. To achieve this the context of the situation, the actions to resolve the situation, barriers and outcome as well as how the information was applied was explored. Driven by a constructivist perception of the individual this approach was expected to help build up a picture of the respondent navigating through tasks and role driven contexts and highlight the interplay between cognitive knowledge and processes within a specific subject domain using associated artifacts. An example of such a situation included ‘how to provide low-cost automation solutions for small and medium sized enterprises in food and precision engineering industries’.

Finally an opportunity was given at the end of the interview for the respondent to identify areas of information or data that would help them in their work. This helped to identify gaps in existing systems and possible solutions.

The interview with Directors therefore provided the opportunity to explore information needs and use from different angles gradually building up a rich picture of their needs and eliciting data defined as significant by the model shown in Figure 1.
Data derived form the interviews were input into a database for future analysis. A full description of the design and implementation of this database will be published in International Journal of Information Management (Foo & Hepworth 2000).

3.2.3 Task analysis and information needs analysis of staff

TA/IN analysis of staff involved the survey of a larger population of respondents. To achieve this in the limited time available forms were designed that could be distributed to respondents and filled in by them. Members of the IA team were assigned different groups and they facilitated form completion. Again respondents were asked to concentrate on tasks that contributed to key organisational goals and to identify main tasks and sub-tasks and the associated information needs, subject content and related useful information artifacts. Furthermore they were asked to identify information input, output and the destination of information output both internal and external to the PSB. The forms were designed to facilitate data input into the TA/IN database mentioned above.

An initial analysis of Directors and Staff showed that they had both shared and different information needs. For example Directors and Staff shared a need for similar types of company information such as financial data about clients who had taken part in schemes or about competitors. Directors however stated a greater need for management and process information such as on best practice, internal procedures and staff competencies. Staff showed a greater need for technical knowledge associated with tasks such as conducting testing of products or implementing a marketing scheme.

3.2.4 Focus group/flowcharting sessions

Although self-completion of the TA/IN forms was completed successfully it was felt necessary to widen the population of respondents and to help ensure that adequate detail was elicited. There is a danger that self-administered survey tools result in a simplified view of what actually happens in practice. Probing is required to unearth further detail and also to help understand why certain tasks, sub-tasks, and information gathering strategies were followed. In addition the researchers wanted to corroborate that the information tasks and needs elicited were representative of those of others undertaking similar roles. As a result an adapted form of the focus group session was instigated. These focus groups were made up of respondents who had completed the TA/IN forms and also colleagues who had similar roles but had not completed forms.

These focus group sessions were distinct from normal focus group sessions in that respondents were asked to concentrate on the data derived from the TA/IN analysis and as a group to develop flow charts showing main tasks and sub-tasks. The use of flow charts helped respondents to visualise the tasks they were involved with and helped to instigate discussion about those tasks and their associated information needs, use and output. This process enabled the data derived from the initial TA/IN analysis to be enriched and also to ensure that the final ‘picture’ represented adequately the subject content, cognitive knowledge and processes of the respondents involved in the various roles and tasks.
An example of one task that was explored during a focus group session was ‘the application of technology in the area of waste management’ which related to the organisational goal of ‘promoting green productivity to industry using a demonstration project’. This was broken down into tasks and sub-tasks such as ‘identifying potential organisations’ interested in such activities. This involved drawing on case studies where such activities had taken place and identifying specific strategies and their benefits and then matching these case studies to local SMEs who may be willing to participate.

Again additional data gathered as a result of the focus groups was appended to the TA/IN database.

3.2.5 Observation/talk-through

Having identified information intensive roles the intention was to conduct observation and talk-through sessions while respondents undertook information intensive tasks. ‘Talk-through’ is a method whereby individuals verbalise their thoughts while undertaking a task. The aim was to concentrate on the behaviour of individuals during information seeking and to capture detailed data on associated cognitive processes. This involves capturing data on specific information seeking situations as shown in Figure 2. This micro level analysis helps to elicit data on how people use specific artifacts and their reasons for doing so. That this would help to provide a more detailed understanding of information needs and contribute to the design of specific systems to support the user of information. In addition studying people in context tends to provide a greater degree of data granularity than can be achieved through techniques such as interviews that take place away from the task and are by default simplifications and abstractions of practice. Furthermore studying people in context helps to ensure that the data derived reflects what actually happens in practice rather than what should happen. Furthermore it helps to orientate the researcher to the physical context within which the respondent works.

Two examples provide an indication of the type of data that is derived when applying this technique. One respondent was involved in producing a report on productivity measurements in different countries. The challenge here was to identify relevant measurements and data, understand how different measurements were calculated and turn these into useful comparative data. The other respondent was involved in writing a report for the Board of Directors. This involved access to current and past reports from the Divisions. The challenge here was drawing together of information often provided in dissimilar formats and checking for completion of agreed actions as well as the consistency of data between reports.

The data derived from the observation/talk-through therefore helped to elicit information needs and had implications for the way in which information was processed and generated by Divisions and Departments. The findings of these sessions therefore elicited information needs and had implications for internal information generation as well as systems to support these processes. In this particular case time did not permit extensive observation/talk-through and where it was used it was primarily to revisit areas where it was felt that a further understanding of needs was required. Despite this a rich picture of the organisation’s IA was achieved. It could be argued therefore that this level of analysis
would be more appropriate in a second phase of research when specific solutions were being designed. However ideally these stages would be combined.

3.2.6 Analysis of data

As stated earlier all the data gathered was input into a database to aid data storage and analysis. To help analyse the data in the database it was necessary to code the information needs that had been identified. This was done by inductively analysing the TA/IN data derived from the Director interviews and the TA/IN data from Staff. Broad categories were identified and these were then applied to each occurrence of a need for different subject content in the TA/IN database (a total of 2764 data elements). This resulted in eight broad categories of subject content and 262 sub-categories of information required by respondents. The broad information categories included:

- Country
- Industry
- Company
- Organisation
- Specialist
- Subject Knowledge
- Workforce
- PSB

Examples of the sub-categories are given below however due to reasons of confidentiality only a selection are given. Nevertheless these should serve to give the reader an indication of their content.

The ‘Country’ category, made up of 20 sub-categories, included sub-categories such as ‘trends in technology’ and ‘trends in standards and regulations’.

The ‘Industry’ category, made up of 57 subcategories, included sub-categories concerning ‘market segmentation’; ‘trends in areas such as technology’, ‘standards’, ‘management practice’; information about key industries such ‘healthcare’ including ‘materials used’, ‘training needs’ and ‘best practice’.

The ‘Company’ category, made up of 54 sub-categories, included ‘contact details’, ‘participation in PSB schemes’, ‘performance’, ‘the opportunity to list by process’, ‘product’, ‘case studies’.

The ‘Organisation’ category, made up of 15 sub-categories, was concerned with the external organisations, other than companies, that were important to the PSB including ‘regulatory bodies’, ‘government bodies’ such as finance, labour and trade; ‘research institutes’ plus details of ‘collaboration and agreements’.

The ‘Specialist’ category, made up of 12 sub-categories, included sub-categories concerning individuals with particular expertise of use to the PSB plus the output from previous involvement.
The ‘Subject Knowledge’ category, made up of 31 sub-categories, included sub-categories such as 'economic methodology' and 'marketing methods'. However the majority of the sub-categories related to the tasks of people involved in standards and testing who required access to scientific and technical information relating to specific industries in Singapore.

The ‘Workforce’ category, made up of 12 sub-categories, concerned the labour market such as the 'national labour profile', 'trends' and 'critical workforce skills'.

The ‘PSB’ category, made up of 61 sub-categories, demonstrated a significant demand for access to internal information. This included access to the 'corporate plan'; the 'calendar of events', information about 'staff' (function, skills etc.), 'divisional and centre activities' and 'resources', 'procedures' and 'performance indicators'.

A rich picture of the subject content making up the information infrastructure of the organisation was therefore developed through an iterative process of selective sampling of key information intensive tasks that were representative of activities throughout the organisation. The qualitative techniques that were applied enabled the generation of detailed data on the tasks undertaken, their subject content, the artifacts used and the cognitive knowledge and processes associated with these activities. However due to the qualitative nature of the techniques used, which by default are time consuming, it was not feasible to apply these techniques to all people in the organisation.

As a result an electronic survey of 600 professional staff in the organisation was undertaken to determine whether the categories of information derived from the qualitative study reflected the needs of the organisation as a whole. This led to the Information Audit which was planned to derive quantitative data on the demand, availability, use and value of the information categories outlined above.

3.3 Information audit – a quantitative approach

The phrase ‘information audit’ in Information Science has been associated primarily with two authors Horton (1994) and Orna (1999). Initially the term implied the survey of information sources in the organisation, their use and value and was not concerned to a great extent with identifying the fundamental needs of the individuals in the organisation although this was implied by their use of sources. Orna has subsequently expanded the remit of the concept to include a more general understanding of the needs of the organisation and provides practical guidance as to how to go about this task. In this research the concept was used to describe the quantitative survey of the organisation as a whole to determine the need for the categories of information derived above using qualitative techniques.

The information audit was administered through an electronic survey that was circulated to 600 professional staff in the organisation, 34% of respondents returned the completed survey in the time specified. The objective was to determine and quantify across the organisation the expressed need for the information categories, the current availability of information, the frequency of use, the perceived value of information categories and
whether additional categories of information were required. Two sets of electronic survey forms in MS Access 97 and MS Excel 97 format were designed to carry out the survey. This was necessary to cater to different computing environments that were available to staff. The use of an electronic survey tool meant that the survey data could be automatically appended to the Information Audit database for data analysis. A full description of the database design and its implementation can be found in the Journal of Information Management and Computer Security (Foo & Hepworth 1999).

A thorough pilot test was carried out with a small number of users in the database design and implementation stage. This was to ensure that the data input interface was intuitive and easy to complete, the process of data returns and direct appending to the database occurred without problems, and the formulated queries yielded the correct data for subsequent analysis.

The Information Audit enabled the identification of common and distinct needs for information categories across the organisation as well as the level of demand. The electronic survey form also enabled respondents to enter additional categories of information that they felt were absent from the list of information categories included in the survey.

The greatest demand across the organisation as a whole was for internal PSB information (38%) followed by industry (28%), company (26%), country (2%), organisation (1%) and lastly subject knowledge (less than 1%). However within particular Divisions these percentages were dramatically different. As indicated from the qualitative study Divisions involved in standards and testing had a far higher demand for subject knowledge. In addition different roles within Divisions required access to specific types of information.

Figure 5 and 6 provide typical displays used to illustrate the information needs of the organisation. In this case only the need for company information sub-categories are charted. Similar charts were generated by Division and also by information category.

Within the PSB category the most valued sub-category concerned events involving staff and PSB stakeholders. This implied a shared need to know what is going on whether or not it was directly relevant to individual staff. However it should be noted that over 59% of respondents indicated that this was available. Areas that were highlighted by 20-30% of respondents as unavailable concerned information about the skills required by staff within the organisation and also areas of staff competency. Within the industry category sub-categories that were recognised as valuable but largely unavailable were industry trends concerning the major players, the supply chain, manpower needs and also best practice.

The ability to identify important categories of information that were highly valued and their availability was important because it helped to prioritise the necessary building blocks of the IA needed to support knowledge workers in the organisation. It also had direct bearing on future organisational information policy and specific strategies concerning information/data acquisition and also the development of systems to support these needs.
Figure 5. The demand for different sub-categories of company information across the organisation

Figure 6. The demand for different sub-categories of company information by Division
4.0 CONCLUSIONS

The model of the user of information was effective in helping to identify those aspects of the individual and their interaction with the information environment that are important to understand. Based on this model qualitative and quantitative research methodologies were designed and applied. The findings about individuals, groups and a broad cross section of the organisation were synthesised to develop an understanding of the IA of the PSB organisation. Specific techniques were developed including Task Analysis/Information Needs Analysis and Focus Group/Flowcharting which were effective for collecting relevant data. Data was used to identify sources of information (online databases, Web sites, organisations etc.) that would sustain the IA and the specific needs of individuals as well as strategies that would facilitate the acquisition and storage of relevant information. Subject content was linked to roles, tasks and cognitive processes. Key data categories and their data elements were identified and their relationship with other categories were defined. Diagrams were developed to show how these elements and combinations of them would serve to answer questions (gaps in cognitive knowledge and challenging cognitive processes) associated with achieving organisational goals.

However given a longer time frame, that is six months rather than three, the following activities would be included. More time would be spent training internal staff involved in the project. It is likely in most organisations that staff would have little experience with this kind of exercise particularly in the area of qualitative survey techniques or studying information behaviour in general. Generally people are more familiar with quantitative techniques. In addition system design people tend to be more comfortable with dealing with highly structured information rather than ‘soft’ information and dynamic information needs.

As stated before more time would be spent on observation/talk-through. This would enable the generation of more detailed information about how people interact with information indicating the cognitive processes of individuals and the problems associated with undertaking these processes. This would help in the specification of specific systems to resolve these problems. Observation/talk-through would also help identify affective states such as uncertainty associated with specific tasks that in turn would imply the need for solutions that would support the user in these situations. In terms of the models of the user of information discussed at the start of the paper this would help understand the micro moments where people undertook information seeking.

Again at the micro level the model suggests that it would be useful to gather information on the cognitive ability and style of the respondents so that solutions could be designed to support individual differences such as those between the holist and serialist. This could be achieved through the application of psychometric tests. It could be argued that this is beyond the remit of an IA project or even systems design itself. Our feeling however is that in the long term the methodology described above would lead into system specification and design and that information systems will increasingly be responsive to individual differences in terms of how people learn and solve problems.
Despite these comments it was possible, through the integration and application of both qualitative and quantitative methods, to define an organisation wide IA on the basis of which a strategic approach to information management could be taken. To achieve this a number of data gathering techniques and extensive involvement from the people in the organisation was necessary. Critics may consider this expenditure of time on the understanding of the information requirements of individuals and ultimately the organisation as a whole as unrealistic. However we would argue that this 'up-front' investment in understanding information behaviour, use, needs, availability and value throughout the organisation will help lead to integrated user-oriented solutions that support the business objectives of the organisation. Furthermore it is unlikely that this kind of activity would be a one off exercise. In fact once the mechanisms for running the electronic survey has been developed it would seem sensible and relatively easy to repeat the exercise on a regular basis to monitor changes in demand and use. In addition during the development of systems to support groups, functions and tasks further liaison with the user would be required.

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