The Implementation Of An Electronic Survey Tool To Help Determine The Information Needs Of A Knowledge Based Organization

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Abstract

One of the most difficult aspects of deriving an information management plan for a large knowledge based enterprise is to determine what information people require to do their various tasks as well as help them expand and update their existing knowledge. Achieving this goal can be time consuming. To speed up and yet effectively define information needs, an electronic survey tool was designed to survey the employees of a large government organization. The organization, the Singapore Productivity and Standards Board, whose role is to enhance the productivity of business and industry in Singapore, employs approximately 1000 people. A total of 700 were surveyed using an electronic survey tool. The electronic survey proved to be an effective way of substantiating the information needs of the organization as a whole. The content of the survey was based on an understanding of the key categories of information required by staff. These were derived through the application of qualitative techniques, such as task analysis, focus groups and in-depth semi-structured interviews. The electronic survey tool resulted in a database of information needs which can be used to answer questions such as who needs what information, how frequently is it used, is it available, what information is valued most highly, what information needs are shared across the organization, what needs are unique, and so on. This paper concentrates on the development and implementation of the electronic survey including survey preparation, distribution, data collection and processing, and data analysis and evaluation. Practical, tested, guidelines are included. In addition, alternative means, tools and techniques to conduct the electronic survey are discussed.

Keywords: electronic survey tool, information needs, knowledge based organization, practical guidelines
1. Introduction

It is increasingly accepted that systematic access, management, use and exploitation of data, information and knowledge can have significant bearing on an organization’s competitiveness (Davenport and Marchand, 1999; Davenport, 1998). Attempts by companies such as Monsanto and Glaxo to become ‘knowledge-based enterprises’ have been well-documented (Syrme and Amidon, 1997). In order to develop a systematic approach to becoming such an organization, it is necessary to understand what information people need, use and would like, to help them do their work and to ensure their knowledge is up to date. A host of approaches have been taken to achieve this task including user needs studies (Wilson, 1994) and information audits (Buchanan and Gibb, 1998) using a diverse range of techniques such as paper based surveys, interviews with key staff, observations and talking to experts. In each case the information manager is given the opportunity to be proactive, develop interactions with users of information throughout the whole organization, improve the utilization of the information resources, and influence decisions on the strategic use of information. The results of these surveys can then be used to evaluate existing information services and systems, to gauge the match between information requirements and provision, to identify common information needs, classes of important information, and information gaps. All these are used to aid the derivation of an organization’s information architecture or information plan. In this particular case, an initial qualitative survey was carried out on selected information intensive parts of the organization. This enabled an in-depth understanding of those areas surveyed and resulted in the derivation of key categories of information. It was then necessary to see whether these categories of information were relevant, needed, valued, available or unavailable to the organization as a whole. In addition, due to the qualitative nature of the initial survey, it was important to see whether other areas of information needs were also important. As a result an electronic survey was designed to answer these questions and implemented across the whole organization. This paper describes the process of designing the survey, survey preparation, distribution, data collection and processing, and data analysis and evaluation. Practical, tested, guidelines are included. In addition, alternative means, tools and techniques to conduct the electronic survey are discussed.

2. Electronic Information Needs Survey Process

An information needs analysis and information audit is normally carried out via surveys conducted through one or more data collection tools such as questionnaires, interviews, case studies and observations. Specific techniques include questionnaires, in-depth interviews, focus groups, observations, critical incident technique that focuses on the organization’s critical success factors. Generally more qualitative techniques proceed the use of large-scale quantitative surveys. One of the most commonly used techniques for the quantitative survey is the questionnaire. It is a relatively low cost survey technique that can be applied flexibly to both small and large numbers of people in a number of different ways to suit different organizations and situations.

Although the paper-form or telephone-survey type of questionnaire is still been widely used, organizations are moving towards the electronic version of the questionnaire, particularly due to the popularity of the Internet. This is because it
offers a number of distinct advantages over the traditional paper based or telephone surveys. It is cost-effective because it saves on printing, paper, mailing, telephone and human costs. Delivery is fast when compared to hand-delivery. It is secure since encryption and authentication can be applied during distribution and delivery. In addition, it is possible to include multimedia. Importantly, because the completed data is returned electronically, it is already in a suitable form for electronic processing to take place. Nonetheless, electronic surveys do have drawbacks. These include the lack of anonymity, lack of common application platforms, lack of computer literacy skills of participants, incomplete and erroneous returns that require special processing. Nonetheless, almost all of these drawbacks can be overcome by a careful design of the survey process and the questionnaire itself.

The process of developing and implementing an electronic information needs survey includes a number of stages: questionnaire preparation, questionnaire distribution, data collection and processing, data analysis and evaluation. A database facility is the preferred route to store and maintain the data results since it supports powerful query facilities that can be used to address a wide range of questions. If necessary, the database can be designed to accommodate or combine other forms of data input. The data can also be exported or extracted in a desired format to other applications for further processing, analysis or visualization.

2.1 Survey design

The objective of the survey was to determine whether the categories of information that seemed important to the organization (based on the initial qualitative research) were perceived important to the organization as a whole. As a result, for each category of information, respondents were asked whether they needed or used the information, the frequency of use and whether it was available or not and also how highly they valued the information. This led to the design of the electronic survey. In addition, respondents were given the opportunity to suggest other types of information that they felt important but had not been included in the list of categories.

2.2 Survey preparation

Survey questionnaire preparation can be carried out primarily via two methods, namely, electronic form and authoring program.

An electronic form can be composed using a typical office-processing tool such as a word-processor, spreadsheet or database. These tools support the authoring of common questionnaire attributes such as text display (to display the questions), text and numeric entry (to obtain user inputs such as name, comments, number from multiple choice question or a range of selection) and, text and numeric selection (using list boxes). Obviously, the level of authoring sophistication increases as one move from a word processor to a database.

An authoring program can be either be a high level authoring tool, a developed program, or a program script. Examples of high level authoring tools include a host of user-interface tools such as Microsoft’s Frontpage (Microsoft, 1999a), Microsoft’s Visual Basic (Microsoft, 1999b), Inprise’s Delphi (Inprise, 1999), and Sybase’s Powerbuilder (Sybase, 1999). These tools have the common feature of a set of
available user interface components (objects) that can be used to compose the questionnaire. Common components used include the text label, radio button, push button, list box, combo box and text box.

A developed program is written specifically to carry out the questionnaire survey using a programming language such as Sun Microsystem’s Java (Sun, 1999a), Microsoft’s Visual C++ (Microsoft, 1999c) or Visual Basic (Microsoft, 1999b), and so on. Such a program can permit additional features to be incorporated in the questionnaire. For example, certain questions can be tagged as compulsory so that user responses must be provided before proceeding. Additionally, an ‘Exit’ button at the end of the questionnaire can be programmed to validate the participant’s input and to initiate a process to return the completed questionnaire directly back to the sender. These added facilities ensure that all pertinent information of the questionnaire is obtained and that there are few or no erroneous returns. At the same time, this implies that there will be less processing required or problems encountered at the later data collection and processing stage. However, all these advantages come with a cost in terms of additional effort, expertise, time and money.

The other alternative to a developed program is to use a program script. Examples of scripting languages include Unix’s shell scripts (Quigley, 1997), Tcl/Tk (Ousterout, J, 1994; Sun, 1999b), Safe Tcl (Sun, 1999c), JavaScript (Sun, 1999a), and so on. Unlike compiled executable programs, these scripting languages require a corresponding interpreter or browser to be available and loaded on the user’s computer before the script can be executed. However, the advantage of scripting is in its high level of program vocabulary (that is almost equivalent to a 4GL (4th generation language)) so that it becomes easier to learn and use in comparison with programming languages.

Survey preparation must be accompanied by careful questionnaire design. This task is not simple and substantial effort is required to determine the content, organization and layout of the questionnaire. All the associated techniques of good questionnaire design (Leedy, 1993) must be observed. In this work, a usability test was conducted in the form of a pilot run of the questionnaire. This was carried out on a small number of participants who were subsequently asked for their feedback on the content, style, language, tone, ease of completion, areas of confusion, length of time for completion, and so on. This information was fed into questionnaire redesign where questions were added, modified, deleted or re-grouped in better logical order. Additionally, participants were asked to comment on the mode of questionnaire distribution (see following section) to gauge the level of satisfaction in questionnaire delivery and return. This iterative process needs to be carried out until the final questionnaire emerges.

2.3 Survey distribution

Electronic survey distribution can be accomplished using either a centralized or decentralized (i.e. distributed) approach. In this case, a centralized approach was taken. The survey was placed in a central location on the Web server. However, an FTP server or some common networked folder could also have been used. An electronic mail message was then sent to all participants inviting them to participate in the survey and to inform them of the procedure to complete the survey. The
objectives of the information needs survey and the importance of participants’ completion was clearly spelt out in the message. In some cases, different forms of the same survey (that are composed using previous techniques) may be placed in the central location to cater for the different respondents’ preferences or computer constraints. For example, the questionnaire can be made available in the form of a word-processed, spreadsheet, database or Web document. Otherwise, participants who do not have the equivalent application program on their computer would obviously be unable to load and access the survey document. Such scenarios are common in many organizations where not all computers are loaded with identical application programs. Even with the same program, different versions of it may be found scattered across the organization. Ideally these situations are avoided due to the presence of and adherence to information management policies.

In a decentralized approach, an electronic mail or a computational electronic mail (Foo, 1996; Foo, Leong and Sng, 1997) may be used to distribute the questionnaire directly to the participants.

If the survey is distributed as an email message, the questionnaire forms part of the message or mail attachment. The questionnaire is then completed and returned to the sender. This decentralized mode is only suitable when one same form of questionnaire (i.e. one document type) is sent out to all participants. However, even in this situation, a heavy load will be placed on the mail servers. Catering for more than one form of questionnaire is clearly unfeasible and impractical due to reasons of redundancy, space requirements and load on the mail server. Doing an information needs survey in this manner for a large survey population is likely to require gigabytes of resources on the mail server. This can potentially choke the network and adversely affect other business functions.

Computational electronic mail (Cemail), an extension of electronic mail, is essentially the embedding of programs within traditional electronic mail messages (Foo, 1996). This transform the mailing system into an ‘active’ system since the mail reading software at the recipient’s machine will recognize that the message is intended to be executed rather than to be read. Upon confirmation by the recipient, the program will be executed accordingly. The program may take the form of a compiled executable program or written in a scripting language. In this instance, only one questionnaire is required. This assumes that all the computers can support program execution or are loaded with the appropriate interpreter or browser. This can create interoperability problems if an organization uses a host of different computer platforms and different operating systems. Thus, a program written on a PC-DOS computer cannot execute on a Macintosh-Mac OS computer, or a Unix workstation, and so on. This lack of compatibility, coupled with security concerns (e.g. virus infected program), has made the computational electronic mail route less attractive than previously thought.

2.4 Data collection and processing

The amount of work and processing involved in this stage of the information needs survey will depend on the form of questionnaire used in the survey. Using a program questionnaire can enable automatically routing returns. Alternatively, the participant returns the completed questionnaire.
Survey returns in the rawest form (from a completed word-processed questionnaire) can go through a process of automatic information parsing and extraction through a program written specifically for it. The extracted information can also be directly appended to the information needs database for analysis. Program returns usually take the final form of participants’ responses without the accompanying survey questions. Likewise, a simple extraction and insertion program can be written and used to append the responses into the database. In the case of spreadsheet returns, a macro or module facility may be written to semi-automate or automate the same appending process. Finally, for database returns, an append query function can be written and used to append the data directly into the database. In this particular case, the questionnaire was authored in both spreadsheet and database form to cater to the needs of the respondents whose computers support at least one of these forms.

2.5 Data analysis and evaluation

A carefully designed information needs database when used as a repository of all returns will lead to an effective and efficient means for carrying out data analysis and evaluation. All the data stored in the database can be queried. Thus, pertinent questions arising from the survey are answered through a set of appropriate queries. The number of questions that can be answered are directly related to the exhaustiveness of data collection. In this case, the results of the survey helped answer the following questions:

- What are the information needs of individuals, departments, or divisions?
- What is perceived the most valuable information by staff in the organization?
- What information is used most frequently by X% of the employees?
- Where are the areas of information overlap or common information needs?
- What are the information gaps of the organization?
- What information is required from outside the organization?
- What information is generated internally within the organization and is required by staff?
- What information sources and services are lacking?

It should be noted that in the final report of this work, outlining the information architecture of the organization, a combination data from the initial qualitative research as well as from the quantitative electronic survey was used to help answer these questions as well as additional questions. The latter included questions regarding the flow of information within the organization.

Once data is held in the information needs database, it can be extracted or exported to other applications for further processing, analysis, or presentation. For example, exporting the data to a spreadsheet enables more complex computations, what-if analysis (e.g. How many top 10 needs of all departments will be satisfied with the availability of information X and Y?), or display charts. Useful display chart types for displaying information needs analysis results include bar charts (e.g. top information needs by categories), column bars (e.g. 3D information landscape), pie charts (e.g. top five information sources by percentage usage), scatter plot (e.g. to identify and group categories of information by frequency), area plot (e.g. 2D information landscape), doughnut plot (e.g. information need by percentage by department or division), bubble plot (similar to scatter plot to support a third variable;
e.g. information need by department, category and value of information), cone and pyramid plots (as in column bars but using cone and pyramid displays). In addition, tables can be used to display common information needs or gaps across the organization. Figures 1 to 5 shows a number of typical examples of these display charts.

Figure 1. Pie chart showing top five information sources

Figure 2. Area plot showing demand for categories of company information across the whole organisation
Figure 3. Column bars showing the demand for company information by division

**Top 5 Information Needs**

- P01. PSB (corporate plan) - 27%
- P05. PSB (calendar of PSB events) - 24%
- P11. PSB (staff - training) - 24%
- C01. Company (company name - list) - 13%
- C05. Company (profile) - 12%

Figure 4. Doughnut plot showing top five information needs
The analysis of the electronic information needs survey when coupled with data gleaned from the qualitative research as well as a review of corporate documents (corporate plans, business process descriptions, etc.), and a review of current information services and systems can therefore lead to an in depth understanding of the use, need, and value of information required to support the knowledge based enterprise. At the same time, it lays the foundation for defining an information strategy for the organization. Analysis of the data generated will provide answers to many questions as well as raising new questions for further investigation. For example:

- How well does the existing information systems fulfill the information needs of the organization?
- To what extent does current information systems provide duplicate coverage of information and how much of the current information is not used at all by the organization?
- In view of data duplication, data redundancy, and the identification of information gaps, how can existing information systems be modified to improve information handling and management? What are the new solutions needed to manage and maintain the information? (e.g. data warehousing)
- How can one make better use of information that the organization already collects? (e.g. data mining)
What other information and reports are necessary to improve the decision making process, marketing process, operational process, and other processes?

What information could be invaluable to management and at the same time, help other areas of the organization?

What is the best way to quantify the “information” contribution to the organization’s overall result?

What are the best methods or products to obtain the missing information needed by the overall organization? (e.g. subscription to online databases, intelligent search agents)

How much of information produced by the organization is required or consumed by the external environment? This in turn raises the question of whether there are commercial opportunities for the organization as an information supplier. For example in Singapore where there is no comprehensive and systematic collection of business information in electronic format, there is therefore the possibility of the Singapore Productivity and Standards Board to make this information available to the country as a whole as well as to their own staff. This would be made available outside the organization either at a cost, subsidising their own information management costs or for free as a part of the government’s role in helping to develop the increasingly knowledge-based information economy of Singapore.

3.0 Practical Guidelines for Carrying Out an Electronic Information Survey

By drawing upon the experience of this work, a number of practical guidelines to carry out an electronic information needs survey is outlined as follows:

1. Carry out a requirement analysis to identify key categories of information that seem to be required by the end user. In other words, what answers are we trying to answer in the proposed electronic information needs survey? This involves the use of specific techniques to enable an in-depth understanding of people’s norms, tasks, roles and their related information context.

2. Select the appropriate set of data collection tools taking into account the information to be captured and also the technical environment within which one is working. Review the usefulness of the selected tools in view of past experiences in performing similar functions. If necessary, re-select the tool set.

3. Design the data collection process taking into account the practical considerations and constraints of the current situation. This process will involve taking appropriate steps to ensure users ‘buy-in’ to the information survey exercise. Getting support from top management through a formal letter or email, conducting briefings at management or staff meetings, and participating in forums are possible avenues to garner support on the impending information needs survey.

4. Design the information needs database ensuring that data elements are linked properly for subsequent queries. Information that is known beforehand can be directly defined in the database and available for selection using list boxes. Examples include employee’s designations, department and division names or abbreviations, information resources, information products, and information suppliers. These minimize the amount of typing that is required by the respondents. Database preparation coincides with the design of presentation and visualization techniques used for the subsequent data analysis.
5. Design the questionnaire for ease of completion and data collection. Due attention should be given to ensure the inclusion of clear instructions for questionnaire completion, appropriate use of language and tone in the questionnaire, minimizing user input by using list boxes for user selection, providing help features, and logical organization of questions. The information needs questionnaire is normally a closed structured questionnaire with an optional provision to allow respondents to volunteer new information (e.g. to identify information gaps not covered by the questionnaire). All unnecessary features of the chosen electronic form (e.g. spreadsheet or database menus, macros, shortcuts, etc.) are disabled to ensure that the respondent is only presented with the bare minimum (but sufficient) functionality to complete the questionnaire. This is important since respondents who fancy themselves as intermittent or knowledgeable users of the spreadsheet or database application are often tempted to explore the electronic form and create potential problems for themselves and the information needs analysis team. In the case where multiple forms of questionnaires are used, an attempt should be made to create similar ‘look and feel’ questionnaires to achieve consistency.

6. Select the appropriate distribution channel and prepare a series of email messages for subsequent distribution. This includes the call for participation, questionnaire completion and return instructions, reminders, and last call for questionnaire completion. Senior staff should be informed and asked to lend their support to help ensure completion.

7. Related usability techniques (Nielsen and Mack, 1994) used for user interface design can be applied to evaluate the electronic survey form. This may include the use of inspection methods (e.g. heuristics evaluation, cognitive walkthrough), testing method (e.g. thinking-aloud-protocol) and inquiry methods (e.g. field observation, focus group). The average time taken to complete the questionnaire should be gauged. Participants can generally be expected to complete a questionnaire that takes no longer than one hour. This is arguable and some may reduce this to half an hour or less. Therefore, if the questionnaire is long, a decision has to be taken whether to reduce its length. Alternatively the information needs survey could be broken up into two or more smaller surveys. Practical constraints, such as time for the survey to be completed and finalized, normally play a part in dictating this decision. These aforementioned activities constitute part of the pilot test process to redesign and finalize the survey tool used for the information needs analysis.

8. The pilot test should be extended to include the use of the information needs database to ensure a subsequent smooth process of data collection, processing, and analysis. The database is thus first populated by some predefined dummy data. All queries are written and tested to ensure that it yields the results as intended. Likewise, a process to simulate the questionnaire returns and appending to the database should be carried out. With the completion of the pilot tests the actual information survey can take place. Figures 6 to 7 shows a sample of an the information needs questionnaire composed using the MS Access database application (Microsoft, 1999d), and Figures 8 to 10 shows the same questionnaire using the MS Excel spreadsheet application (Microsoft, 1999e). These two survey tools resided on centralised servers thus allowing respondents to choose the appropriate one for completion based on their preference or availability of the application programs (i.e. MS Access or MS Excel) on their computer.
Figure 6. Welcome screen of information needs questionnaire in MS Access

Figure 7. Partially completed information needs questionnaire in MS Access
Figure 8. Welcome screen of information needs questionnaire in MS Excel

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Figure 9. Information needs questionnaire in MS Access
9. During the survey period, inquiries from participants are to be expected. A thorough pilot test should help minimize such inquiries. Still, participants will have new and unexpected questions for the information needs analysis team. Quick and correct responses are necessary to eliminate participants’ problems or queries. These inquiries should be archived or noted down for consideration in future information surveys. Regular timely email reminders are useful as follow ups to the initial call for participation via email. An email to the participants’ higher authority may sometimes be necessary to coax participants in responding. It is also useful for the respondent to know that the time they are taking to fill in the survey is sanctioned by senior authority. A final email before the last day of questionnaire completion is a necessity since it is common for people to leave certain tasks (such as questionnaire completion) to the last minute. The importance of the respondent’s input to the information needs analysis should be stressed in the final email so that they are made aware of the objectives of the information survey, the activities, outcomes and benefits that will result from it.

10. Information processing and appending to the information needs database can start once the first returns are received. Early processing is encouraged since this provides more time to resolve any outstanding problems at this stage of the survey. As before, a thorough pilot test carried out earlier is expected to minimize the occurrence of such problems. A method to organize and archive individual returns is necessary so that raw source data can be reused or reprocessed subsequently if necessary.

11. Sufficient time should be set aside for data analysis and evaluation. This manually intensive task can be carried out with the assistance of existing database capabilities, or the use of external data evaluation tools such as spreadsheets and statistical tools. Additional ways to review, analyze or present the information may be necessary in the evaluation stage in order to obtain the desired results. Figure 11 shows an example of an application written in MS Visual Basic to present the information needs of the organization in a different visual manner. In this example, the data used for the display is directly linked and obtained from the information needs database. This enables the data in the database to be sorted by
category of information need or category code, by division, demand/use, value and frequency of use.

![Image](90x383 to 505x714)

**Figure 11.** Sample customized application to interface with information needs

### 4.0 Conclusion

This paper has presented the process of an electronic information needs survey, drawing on experience of applying such a survey in a large organization, the Singapore Productivity and Standards Board, and shown the various alternative means to carry out the survey. The information needs database is an important strand to understanding the information needs of an organization. This is because it can be applied to a large number of respondents and therefore helps to validate more subjective and yet detailed insights derived through qualitative research. When well designed, the information needs database serves as a repository of survey information that can be accessed, processed and queried to answer a host of typical questions that one would expect from an information needs analysis exercise. Finally, a number of practical guidelines and examples have been included to assist those carrying out an information needs analysis survey and wishes to use electronic means to survey respondents.
References


