Managing and Developing Internet Commerce Systems with ICDM

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Abstract
Internet commerce applications are significantly different from the information systems that were being developed just a few years ago. Multi-skilled, collaborative teams are required to oversee the start-up and on-going development of Web applications for Internet commerce. The evolutionary nature of these systems requires a different management approach. Business strategy is the driving force behind these applications and is now needed as part of the methodologies.

This paper proposes a methodology for the development of Internet commerce applications within organisations. It emphasises the formulation of business strategy which can be translated into an Internet commerce strategy. Techniques and approaches for capturing requirements in a group setting are explained as well as frameworks for functional and physical requirements.

Keywords
Methodology, Internet Commerce, ICDM.

INTRODUCTION

Although there has been tremendous growth in the number of organisations engaging in electronic commerce there are still few methodologies that focus specifically on the tasks involved. Those that do cover the development of Internet applications deal mainly with the design issues in developing Web sites. This paper proposes a methodology for developing Internet Commerce systems within an organisational context. Specifically the paper describes the strategic planning and analysis phases of this methodology.

Internet applications differ significantly from many traditional organisational information systems. These differences are covered in the first section of the paper. The Internet Commerce Development Methodology is then described with a detailed description of the methods and techniques used in the strategy and analysis phases. Finally, suggestions for future research are covered.

THE NEED FOR A METHODOLOGY FOR INTERNET COMMERCE DEVELOPMENT

Internet based applications differ in a variety of ways to traditional information systems applications. As a developer it is important to be aware of these features so that the appropriate methods, design approaches and tools are employed in the development process.

Web sites often evolve into multi-functional systems. There are cases where Web sites have started out as a solitary Web page providing information about the company and have gone on

to become multi-functional sites. They can evolve into systems for providing information to users or customers, for developing relationships with customers, for enabling customers to perform transactions, as well as document management systems for internal users. The multi-functionality of many systems forces organisations to transcend traditional functional boundaries. When the emphasis becomes "how to meet the customer's needs?" then sales, marketing, customer service and IS, for example, must collaborate and in doing so forget about traditional boundaries and internal politics.

The focus of IS teams developing applications has been on implementing technology. Even teams made up of different business representatives may not be adequate for developing Web applications, especially if they are IS led. The problems associated with representative teams are that members do not speak the same language and have different goals and expectations. The teams that are required for Internet applications development need to have a business focus and be led by a 'Producer' type figure who has expertise in the technical, marketing and business aspects of the organisation. The analogy of a film production team is apposite as such teams have one goal in mind but manage the diverse skills and tasks in the process.

Due to the multi-functionality of many Web sites there are frequently diverse groups of stakeholders (McKeown and Watson, 1997). Stakeholders can include people internal or external to the organisation. Internal stakeholders could be specialised categories of employees and external stakeholders could be current customers or key suppliers. These stakeholder groups can live locally, or reside inter-state or overseas. Overseas users may have a different cultural and linguistic background and this may have to be considered in Web application development (Rockwell, 1998). As a result responsibility for the Web site within the organisation can be ambiguous with the potential for the overall management of the Web strategy to be given little consideration (Treese & Stewart, 1998).

The content and functionality of Web sites change through time. Because of this the notion of project completion is inappropriate. Even the standard six monthly update reviews used with traditional IS applications may be unsuitable for managing the rapid amount of change required. Web sites can be viewed as organic systems that are continually adapting to their environment. Some components of Web sites flourish under certain conditions whilst other components become redundant and whither away. Systems can start off as Intranets and go onto develop an Internet or Extranet component, and others start off as Internets/Extranets and develop an Intranet component.

Developments and amendments made to the Web site do not necessarily rely on IS experts. The work can be done through HTML code or more likely web authoring tools like Macromedia Dreamweaver, Microsoft Frontpage etc., that attempt to simplify the process of developing Web pages and applications (McKeown and Watson, 1997). When the environment is one where the user departments or individual users have the skills, tools and authority to make additions and amendments to the system careful consideration needs to be given to the overall management process of the application to avoid chaos.

Web site development lacks the type of specialised methodologies that exist for more traditional IS applications. There are tools to document Web sites and monitor their activity but they do not form an integrated suite of tools for the development process. Likewise, evaluation of Web site efficiency and effectiveness cannot be done in the same manner as IS professionals use with typical core business applications.

There are few methodologies that are appropriate for the development of Internet applications. Fournier (1998) describes the factors involved in developing client server and Web based systems. The method uses Joint Facilitated Sessions to determine requirements, however, the methodology concentrates on the technical level issues mostly rather than strategy,

organisational and business issues. IDM (Lee, 1998) is an intranet development methodology. Its focus is design issues and it makes little mention of gathering requirements.

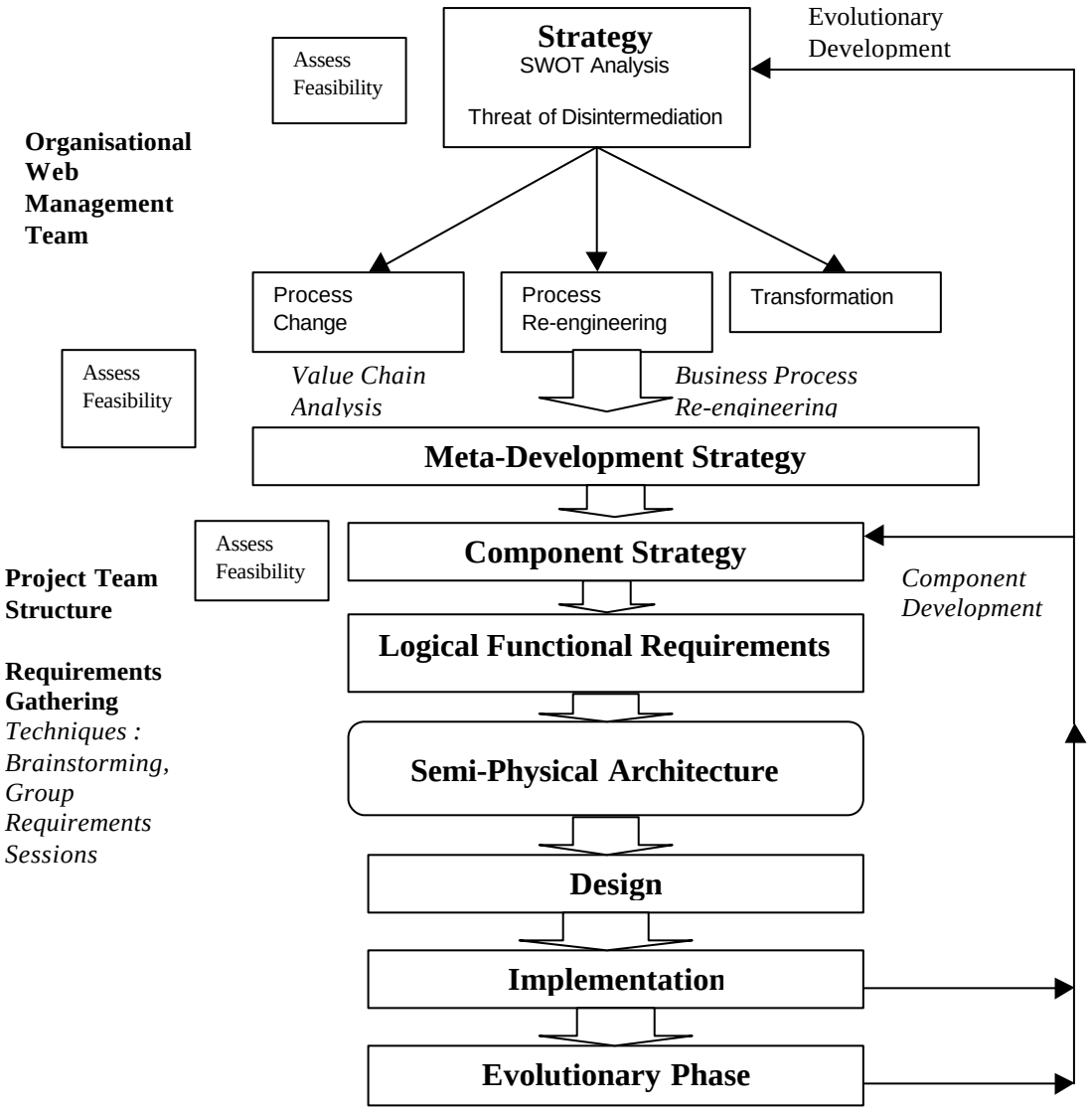

Figure 1: ICDM Phases

AN OVERVIEW OF INTERNET COMMERCE DEVELOPMENT METHODOLOGY (ICDM)

This paper proposes the Internet Commerce Development Methodology (ICDM) as a framework for the development of Internet Commerce in an organisational context (figure 1). ICDM provides both a management strategy and a development strategy. Although it includes design issues the focus in this paper is on describing and explaining the strategy and analysis of requirements phases of the methodology.

ICDM has the following components and features (figure 1) which are described in the remainder of the paper.

? Web Management structure
? Meta-development strategy
? Strategy development phase
SWOT Analysis

Level of Change - Business Process Re-engineering or Value Chain Analysis

? Analysis phase
    Requirements techniques
    Functional requirements framework
? Physical architecture framework
? Design phase
? Component implementation

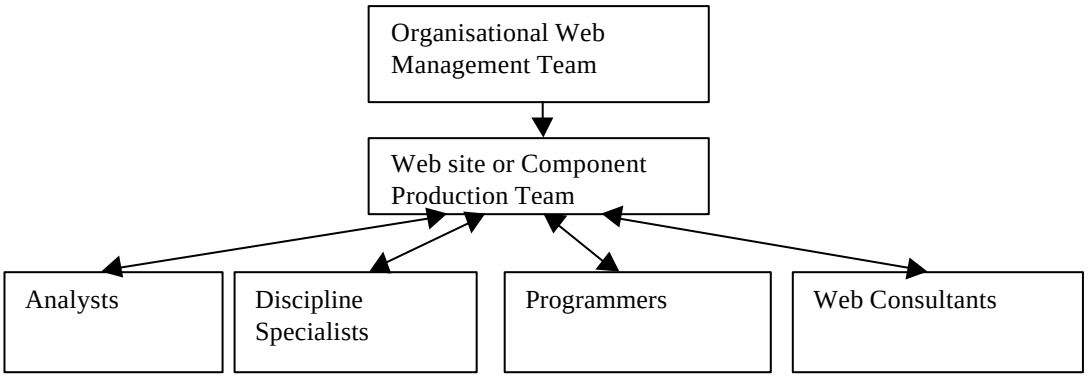

Figure 2: Web Management and Development Structure

WEB MANAGEMENT STRATEGY

ICDM recommends the development of Internet systems on two levels (figure 2). The overall development of the entire Web strategy can be seen as a project in its own right as well as a functional component of a Web application. The first tier is a meta-development and management perspective that provides a framework for development. The second tier concerns the development of the components of the Web site. At both levels the work must be seen as being evolutionary in nature, to cope with the inevitable changes that will have to be made.

Meta-Development Strategy

There are a number of strategies that can be employed by a company when developing a new Web site. The key options are listed below.

1) Plan the entire site and strictly regulate its distributed development.
2) Plan the core of the Web site (out-sourcing or in-house) and make no further changes.
3) Plan the core of the Web site and let user departments develop their own neighbourhoods.
4) Plan the core of the Web site and loosely regulate the development of the rest of the Web site.
5) Allow unregulated development of the entire Web site.
6) Plan the entire Web site, develop the core and then incrementally develop the rest of the site.

A decision on which option to adopt should be taken by the Web management team.

Strategy Development Phase of ICDM

The use of the Internet for business purposes can take many forms. The Internet can be used strategically as a transformation agent to radically change the nature of the business. It can also be employed to improve processes or parts of processes over time and incrementally add-value to the business. The Internet Commerce Development Methodology (ICDM), proposed in this paper, provides a strategic planning approach that considers which option is most

appropriate for a given situation (figure 2). ICDM draws upon Business Process Re-engineering (BPR) and Value Chain Analysis for its core strategic planning tools.

To decide upon a strategy for a business, business unit or functional area, managers need to assess an organisation's competitive situation. This involves assessing the organisation and its environment. The process is known as competitive analysis. SWOT analysis is one method of competitive analysis (Thompson & Strickland, 1995). The competitive situation for the company is assessed by examining its strengths (S), weaknesses (W), environmental opportunities (O) and threats (T). The competitive analysis will yield different results for each business examined (figure 3).

The strengths examined in the SWOT analysis are the strengths of the business. The internal strengths are features of the organisation such as streamlined administrative systems, or technologically adept staff. The internal weaknesses of the organisation can be detailed in much the same way. The wider environment can be scanned for economic, technological and social trends that can be exploited. New government legislation may create an opportunity for some organisations. For example, government departments may require suppliers to be year 2000 compliant. This creates opportunities for software consultants and IT training organisations who could help companies become accredited. The external threats need to be considered because future prosperity depends on how the organisation deals with these.

Besides performing a competitive analysis, organisations should assess the threat of disintermediation. Due to the ease with which suppliers of products and services can market and sell directly to consumers those companies that act as intermediaries in the distribution chain risk being by-passed. This would clearly have disastrous consequences for the intermediaries and is termed disintermediation. The businesses that are most at risk of disintermediation are those that do not significantly add value to the products and services they are distributing.

From the SWOT analysis and review of the threat of disintermediation a decision on the level of change required should be made (figure 3). If the business has very significant strengths and few real weaknesses and threats then incremental improvement of processes would seem appropriate in most cases. However, if there are significant threats and, for example, there is a real threat of disintermediation then a more radical transformation is probably required. Between these courses of action there may be increasing competition and therefore the use of technology such as the Internet to re-engineer key processes can be a method of gaining a competitive advantage.

The scale and scope of the changes should fall in to one of three categories: process change, process-re-engineering, or transformation. Process change is related to the enhancement or modification of an organisational process with the aid of the Internet. Value chain analysis can be used to identify where value can be added for the customer. Process re-engineering is the complete redesign of a process with the aid of the Internet. Transformation is the radical change of a business leveraging Internet technology.

Business Process Re-engineering

The concept of re-engineering emerged in 1990 (Hammer, 1990) and was further developed in a work produced by Hammer and Champy in 1993 (Hammer & Champy, 1993). They define business process re-engineering (BPR) as the fundamental rethinking and redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance. Their approach implies a radical approach to business change. Manganelli and Raspa (1995) suggest that a clean slate approach to re-engineering is not always necessary as the business may have great strengths which require developing and improving. Therefore,

incrementally improving or replacing key processes may be the preferred strategy. BPR is enabled by information technology and takes an added-value customer focus to the redesign and integration of organisational processes.

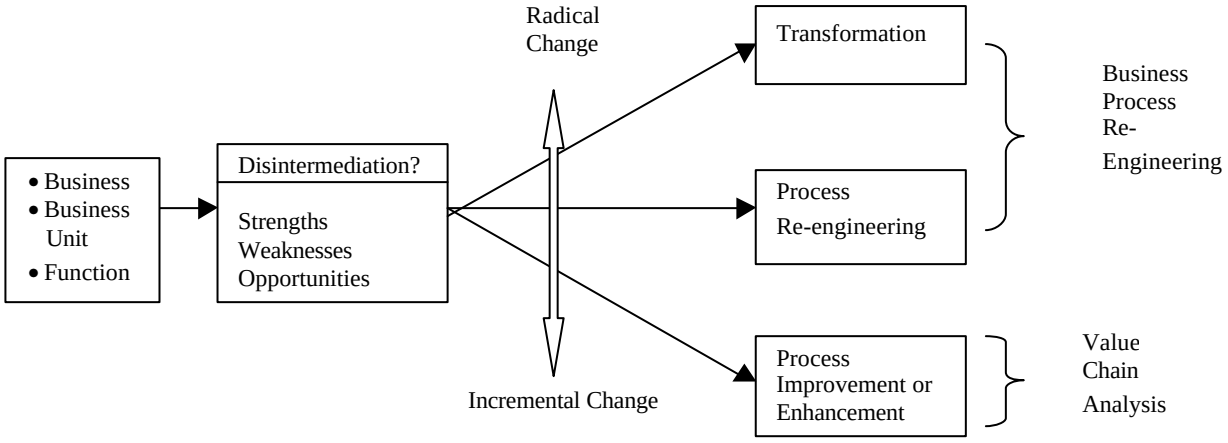

Figure 4: ICDM Strategic Planning Phase

Option 1 Transformation

Transformation, as the word suggests, is a radical method of re-engineering a business. It usually takes a clean slate approach where fundamental questions are asked about the business purpose and goals. Then alternative ways of achieving those goals are examined. The resulting systems and business can be substantially different to current operations. Features of a successful transformation might be (Talwar, 1996):

- Significant improvements in business performance;
- Significantly improved staff satisfaction;
- Significantly improved perception of the business by customers and suppliers;
- Mission, purpose and direction are clearly articulated and understood across the organisation.

Besides a change in processes there is a cultural change within the business. The impact of transformation is far-reaching, radical and involves considerable risk.

Global Strategy

The growth of the Internet has created a large global market of over 100,000,000 consumers. Some companies are able to take advantage of the global opportunities provided by the Internet. National borders, time zone differences and the cost of advertising in remote areas become less of a problem. The flexibility provided by the Web means that a one-person operation can develop a global strategy and implement it in a cost effective way. A global strategy needs to consider the differences in culture, language and in the distribution mechanisms. The Web can be used to gather information or source products and services from suppliers to cut costs or provide a stimulus for improvement. A small environmental protection consultancy, for example, could use the Web to find suitable projects and research grants. Their expertise may be in demand world-wide but they may only be applying for projects within a restricted geographic domain because the publications they use as a source of information are locally or nationally oriented.

Option 2 Process Re-Engineering

Process re-engineering is probably the most popular form of BPR. It involves the fundamental re-design of an entire process in order to achieve significant improvements in the organisation. A process is considered to be a set of logically related tasks performed to achieve a defined business outcome. Process re-engineering is not as radical or high risk for the business as transformational BPR and does not require the same level of cultural and attitudinal change.

Business Process Re-engineering (BPR) looks particularly at enterprise processes that cut across business units. The information systems built for specific functions or units often become out-dated because new processes transcend these compartmentalised functions. BPR is about identifying, and modelling business processes and changing existing systems to support those processes.

The need for business process redesign comes about because of the following:

- Rapidly changing technologies;
- Shorter product life-cycles;
- Increased competitive pressures and the increased demand for quality products and services;
- Inefficient use of organisational resources due to organisational change, or lack of change (Davenport, 1993).

Some organisations have used Internet applications to re-engineer after sales service. Web sites can include information on how to use and care for the product they have bought with details about accessories that can be purchased. Many internal organisational processes such as internal promotion or administrative systems have been shifted entirely to Intranet applications.

Option 3 Process Improvement

Process improvement involves improving or streamlining part of a process rather than re-designing the entire process end-to-end. It often focuses on improving the tasks of the process rather than eradicating the delays between the tasks. Adding value at various points along the value chain is a key feature of process improvement.

Value Chain Analysis looks at the organisation as a large input-output system (Porter, 1985). The inputs are resources brought into the organisation, processed in some way to add value, and then marketed and sold as outputs. The chain is usually supplemented by after sales service. Value can be added at various points throughout the chain, such as acquiring products or resources more efficiently. The costs associated with each step and task in the value chain are determined. The costs are then compared with the competitors' costs and changes can be made to gain or sustain a competitive advantage.

The Internet can be used to make changes and improvements in organisational value chains. The value chain consists of primary and support activities. The primary activities are the key tasks and processes that return the most value. The secondary activities support the primary activities and do not provide the same level of returns. These include administration, research and development, human resource management and information systems development. Web applications can contribute to both primary and secondary activities. The approach results in incremental improvements to the organisation.

The cosmetics company, Avon, decided to use the Internet to reach new customers (Kalin, 1988). They enhanced the marketing function of the value chain by using on-line product catalogues. Their research told them that the Web site would reach new customers rather than persuade old customers to abandon their salespeople. The site was expected to generally boost Avon's brand and that this would help the representatives.

Site and Component Development

Functional or divisional components of the Internet system can be approached as discrete projects. The implications of the integration with other components of the Web application still need to be considered. A functional component could be a component that provides customers with the option to interrogate a database of products, or to obtain details about customers for marketing purposes. Even so, a multi-disciplinary team is still required because any component of a Web site is still concerned with implementing business strategy not just technology.

Component Focus

When the meta-development strategy has been finalised the individual components of the Web site can be developed. A component of a Web site can be based on:

- A division of the organisation
- A department
- A section
- A group
- A functional component that transcends departments

ANALYSIS PHASE OF ICDM

In the traditional life-cycle approach to developing an information system the study of the problems associated with the existing system is given considerable emphasis. However, in the development of Internet systems there is often 'no existing system' to study and hence, the importance of this phase is substantially reduced. Analysing the current problems associated with a system or process is most relevant to the process-re-engineering and process change strategies discussed earlier. Even in these two options though it is not wise to focus too much on 'looking for problems'.

A more creative and entrepreneurial approach is required when changing and re-engineering processes. There is a constant stream of new techniques, theories and technology which can be used creatively and innovatively to improve organisational performance. Simply, solving problems that arise may not be enough to keep an organisation competitive.

Requirements Analysis Techniques

There are a number of information gathering techniques that are especially relevant to the process of defining the requirements of Web application projects. These methods are useful for projects where some degree of innovation can substantially improve the success of the system by providing a competitive edge for the organisation.

Web Requirements Sessions

Using group communication techniques can speed up the definition of the logical requirements for a Web application. The two group communication techniques used in the Internet Commerce Development Methodology (ICDM) are brainstorming and the Group Requirements Sessions (GRS). The first is used to define alternative ways of using Internet

commerce in the business and the second is about obtaining the detailed requirements within a relatively fast time frame.

Brainstorming is a term used to describe the process of creative thinking. It can be used by a small team of up to eight key people to generate new approaches and ideas. A facilitator is required for brainstorming sessions. The facilitator tries to create a supportive environment for drawing out thoughts and ideas and may synthesise ideas, either verbally or by writing them on a board. A person who can write down notes is also useful for a brainstorming session so that the facilitator does not have to interrupt the flow of ideas in order to record what has been decided. Lateral thinking should be encouraged in the sessions as should the generation of radical or unconventional ideas.

The composition of such a brainstorming group would need to be thought out carefully. At least two marketing specialists, an information systems analyst and designer, managing director and several other representative senior managers would be an appropriate nucleus for the team. The goal of the session or sessions should be to explore alternative options for the on-line company image and to rank each option with the intention of adding some further detail to the ones that show the most promise.

Group Requirements Sessions

Group requirements sessions are similar in format to brainstorming sessions but the emphasis is on obtaining detailed logical requirements for the system. For example, the types and number of documents to be managed on the Web, who will access them and how often, how often they will require updating, how much graphics will be included and so on. For transaction systems, information needs to be gathered on the data required to make a decision by the customer, and the fields of data required by the system. For these sessions the composition of the group could differ significantly. Instead of the most senior people in the organisation who are responsible for strategic initiatives, people involved in operational activities can play a substantial role. The group size is allowed to increase from the maximum of eight for brainstorming to ten for GRS. Plan to hold up to three of these sessions, usually of half-day duration, over a two weeks period maximum. Some of the participants may change if other people have specialist knowledge. The actual number of sessions required will depend on the size and complexity of the system being developed.

Well run and managed Group Requirements Sessions can have a number of benefits:

- The time taken to capture the requirements can be significantly reduced;
- There is interaction between different functional groups in the organisation which can help in viewing the system as an organisational resource;
- The multi-functional team approach can improve communication between user groups;
- The quality and value of the system can be increased.

GRS may not always be appropriate for developing Web applications. If the requirements can be well defined by several users and others have little or no knowledge of the type of application proposed then it is better to have interviews individually or in a small group with the people concerned.

Prototypes can be developed to help in defining the requirements. In particular, the detailed information requirements of transaction and marketing systems can be trialed. The prototypes, however, will be used to a greater extent in the design phase of development.

FUNCTIONAL REQUIREMENTS FRAMEWORK

Web applications fall into a number of categories. These functional applications need the detailed definition of their requirements. Broad types of systems or modules are listed below. It is beyond the scope of this paper to explain the detailed requirements of these systems but the analysts need to use the analysis techniques described earlier to make sure that the business objectives are being met.

Types of Web Applications

Promoting the company image On-line
Retail Transaction Systems
Customer Service Systems
Marketing and Promotion Systems
Enquiry Systems
Public Relations Systems
Promoting professional services

PHYSICAL ARCHITECTURE FRAMEWORK

The techniques used for defining the requirements for an Internet project depend on the type of system and its functionality. There are three fundamental types of Web systems: document publishing systems, basic interactive systems, and complex transaction systems. It is not always the case that Web projects intending to transform the organisation require complex transaction systems. Useful information, clearly and effectively presented, with some simple database interactivity has the potential to make a major impact on a business.

Document publishing systems

Most Intranet and Internet systems developed as document publishing systems. As Intranets they are typically contain information on company policies and procedures, minutes of meetings, company and departmental strategy, promotion application details etc. In fact, Intranets have been used to present information that was once produced on paper and circulated around the organisation. Although the emphasis of these systems is usually on text, graphics and multimedia objects can be incorporated to enhance the aesthetic appeal and to add functionality.

Internets often provide a mine of information to customers about the organisation. They can be used to raise the corporate profile and image and for details about the products and services offered. The Internet can help an organisation to define its brand or image if it isn't already clearly focussed. This is an example of where strategy leads to more detailed logical requirements. The physical design issues are left until the design phase.

Basic interactive Web systems

Simple interactive Web applications can be described as Web pages that are connected to a database for simple querying and a small amount of updating. These can be used for example, for querying of a small database, telephone lists and enrolments for a University course. The user through a browser on a client system connects to the Web server on the Internet or intranet. The Web server accesses the database server and the data is sent back to the Web server where it is converted into HTML format and this is sent to the client browser.

Complex Web transaction systems

This is a more sophisticated type of application which includes complex transaction functions. The system allows insertion, deletion and updating of records. The Web application connects to several corporate databases such as stock and order processing from the Web server via an application server.

DESIGN PHASE

The design phase, although not discussed in detail in this paper, involves designing the network infrastructure, developing the Web site and developing security controls. The Web site design should consider:

- Desired Image - This covers the tasks of designing an aesthetically appealing site that fits in with company image.
- Usability - The usability of the Web site is related to the navigation around the site, how easy it is to read the text and performance aspects such as the time involved in downloading the Web pages.
- Promotion - Promotion of the site can be done though registering the site through major search engines, advertising on other sites, including links on other sites, running special events to attract interest in the site and sending e-mails and other promotional literature to potential customers.
- Evaluation - The site should be evaluated in various ways. One method is to obtain users' feedback and comments. Monitoring the number of people accessing the site is another method.

IMPLEMENTATION AND EVOLUTION PHASES

The implementation of the Web site relates to the meta-development strategies discussed earlier. It is unlikely, unless the Web site is small, that all the site will be designed and implemented in one project cycle. Web applications evolve and so rarely have a well defined project completion. However, there are cases where components of the Web site, such as transaction modules can be implemented and remain reasonably stable. The continual evolution of the site should also be managed by the organisation's Web management team. This team should be made up of senior people from each functional unit of the organisation. It is their task to oversee the implementation of the Web strategy and changes in strategic direction. They should also set policy on who can add to the Web site and content and design guidelines.

DISCUSSION AND OPPORTUNITIES FOR FURTHER RESEARCH

If an IS methodology is viewed from an holistic perspective then its success is interwoven with the methods, organisational structures, policies, culture and trends in the wider organisational and business environment. Methodologies that have a restricted organisational role may work adequately for narrowly defined tasks but initiatives that are far reaching and in some cases require organisational transformation need methodologies that can interrelate with the complex components of organisational life. ICDM is both a business analysis and systems development methodology that encourages an evolutionary approach to Internet commerce. Its key features are listed below.

- ICDM is a business analysis methodology as well as a systems development methodology.
- The Internet Commerce Development Methodology (ICDM) takes into account the wider trends in the business world and society in its strategy development phase with the SWOT analysis.
- ICDM is organisationally aware in that it considers the merging of functional boundaries and the political and cultural nuances of working in teams.

- The Internet Commerce Development Methodology (ICDM) can only be successful if its context is appropriate and effective. An organisational methodology, such as ICDM, is inextricably linked with the organisational structures, management strategies and approaches.
- ICDM recommends a management structure for the evolution of Internet commerce in an organisation.
- Transforming an organisation involves a cultural change for the workforce (Talwar, 1996). The methodology can play a role in facilitating this shift if it empowers the individual.
- ICDM has a number of component phases to guide the development of the Web site. Issues related to Web page design, database connections, security issues, and implementation tools and methods are all covered.

The paper has presented a description of a methodology for developing Internet Commerce systems in organisations. The emphasis has been given to the description of the strategy and analysis phases. Internet Commerce requires a collaborative approach. Due to the evolutionary nature of these types of systems it also requires a management structure to oversee the on-going development of the applications.

Further research can examine the detailed management approaches that can be used in managing the Web resource. For example, should these types of systems be managed in a rigid bureaucratic manner or be left to develop in a less regulated organic way? Documenting Web based applications is also an issue of concern since many Web sites are made up of thousands of pages. Associated with this problem is the development and selection of appropriate CASE tools. These, along with the topics covered in the paper, are important issues that need to be researched and tested since Web applications are rapidly becoming a unifying portal for organisational information systems.

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