APPLYING SOFT SYSTEMS METHODOLOGY (SSM) FOR DESIGNING MALAY LANGUAGE LEARNING PORTAL

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ABSTRACT

In today’s fast moving world of technology, we often hear the word portal is used. But not many know the meaning of the word portal. The speculation between a website and a portal has motivated me to open up the differences and the real meaning of a portal and the reason why the term portal has to be used instead of the term website. A Campus Portal is an exciting recent phenomenon forming part of the new generation of online services for all stakeholders in institutions of higher education. Conceptually the general notion of a Portal should be to be distinguished from that of other Web-based applications and the traditional Intranet of the institution. The major objective of this research is to apply a software development methodology called Soft Systems Methodology (SSM) in developing a Malay Language Learning Portal. The SSM has some unique characteristics that can be applied in the development of a user friendly campus portal. While there are many accepted development methodologies for traditional and Web-based Information Systems, no clear body of knowledge on the development of Campus Portals has yet been recognized. Additionally, as this is a new area, the definitions, terms, concepts and important issues agreed to by academic researchers and practitioners, are still evolving. This research, therefore, needs to clarify and identify some important issues regarding the Malay Language Learning curve for the foreign students. This learning curve has to be something which is flexible for their usage and something which is effortless for them to access. A set of research questions were put forward to drive further investigation into design and implementation issues regarding the customization functions of Malay Language Campus Portal among foreign students. In the final phase of the research, the review of existing development methodologies is gone through. Finally, the most appropriate development methodology which is
SSM was selected. The outcome from this research was the implementation of the Malay Language Learning Portal which I designed using the SSM methodology which has supported the requirements identified in this research as critical for the development the Malay Language Learning Portal.
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CHAPTER 1

Introduction

1.1 Introduction

Emerging Internet technologies continue to provide organizations with the ability to improve their relationships with customers and retain a competitive advantage. One of the best known of such technologies was named, “Enterprise Information Portal (EIP)”, by the two researchers, Shilakes and Tylman in 1998. Although the concept of a “portal” has captured the imagination of many since that time, there is still no generally agreed upon terms for types of portals used in organizations, or even a standardised portal definition (Tatnall, 2005b). This study will use the term of “Enterprise Portal” rather than the original EIP, to believe that a portal is more than a central repository of information, but includes the integrated availability of online services for various purposes.

Since the concept of the Enterprise Portal was introduced in 1998, its rate of adoption has greatly increased. In January 2003, a Goldman Sachs IT manager survey (2003) reported than an Enterprise Portal was one of the highest priorities, when companies preferred to invest over following the 12 months. The report estimated various growth rates from 20% to 40% by 2006 and they estimated that market size would reach an approximately 2-3 billion US dollars by 2006. To confirm its popularity, the giant software marker, Microsoft Corporations, announced that they would soon release portal functionality, which would be available out of the box in the next version of its development Visual Studio tools, which would be available in the late 2005, via the DOTNET framework (Patel, Acker and McGovern, 2004).
On the academic side, an institutional portal was initially pioneered by the University of California in Los Angeles (UCLA) in 1999 in cooperation with the University of Washington and the University of Buffalo (Moskiwitz, 2001a). However, the costs of Enterprise Portal solutions were unaffordable for most education institutions and this undoubtedly delayed their development, and the implementation of portals. The term for the kind of portal which is developed for an education institution is known as a “Campus Portal (CP)”. 

“A Campus Portal is a centre location for campus and community information. It has links to other web sites, email, news and events, general information such as weather forecast, and communication tools such as chat and discussion forums.”

This dissertation is focused on the development of a Campus Portal which is called as “Malay Language Learning Portal” for a higher education institute in Malaysia known as University of Malaya.

It is of interest that many higher education institutions, who have decided to develop and implement a Campus Portal, have preferred an in-house Campus Portal development approach instead of purchasing one from vendors. To support this trend, there is an independent organization named “The Java Architectures Special Interest Group (JA-SIG)” that aims to promote the use of Java technologies and architectures within the higher educational communities by supporting the development and adoption at low cost, flexibility and open source solutions based on the best practice and open standard (JA-SIG, 2004).
Although this JA-SIG offered a free, shareable, and invaluable version of the portal framework for a higher education institution, namely, ‘uPortal’ and is being adopted worldwide for more than 140 institutions and serves more than one million students, it does not mean that the project and its implementation will already guarantee success by only implementing the great tools. In fact, uPortal is a technical framework that allows developers to easily develop the portal functionalities and components for their Campus Portal project. However, it does not provide a development methodology for the developers.

Of greater relevance to this dissertation is the fact that only a small amount of research has been done into approaches to portal development, especially those suitable for Campus Portal development. Although some Campus Portal solutions and development methodologies were used by the software vendors, these were kept confidential and only available to institutions that purchased their solutions. Therefore, most academic institution’s developers constructed their development methodology themselves, to produce solutions unique to their situations and requirements (Thomas, 2003a; Bajec, 2005).

Consequently, until now, there is no formal development methodology available for Campus Portals. In addition, there are no guidelines to recommend what kind of methodology would be suitable for Campus Portal development. Therefore, most practitioners apply no development methodology, or just adopted a minimal process of development for the Campus Portal project.
In this situation, there is a high probability of failure for a Campus Portal project. Although most development teams of the higher education institutions have the ability and lots of experience in traditional Information Systems and Web-based application development, the unique characteristics and aspects of the Campus Portal may not be recognized and not truly understood because of its emerging nature. As a result, adoption of an inappropriate development methodology has become a significant issue in the Campus Portal development project.

On another side, users’ needs and behavior when engaged in online activities is believed to be different from those a decade ago. As the Internet becomes an essential part of the service of the academic institutions, they now provided not only an Internet connection but also numerous online services that help students to improve their skills and undertake all aspects of their study. Consequently, the Campus Portal needs to appropriately support the user’s online activities and increasingly tailor these to their own personal preferences and ways of learning.

This dissertation adopts the view that a Campus Portal is quite different from the rest of the institutional Web site. In general, the traditional Web site was developed for a single purpose, whereas the Campus Portal is designed for multiple purposes supporting various online activities. Multiple online contents, links and services are often available through the customized user-interface, which allows the users to select their preferred optional contents and online activities. Ideally, personalized information, contents, links and online services that directly related to the user are provided instantly on the user-interface when the user has been successfully logged-in. The unique characteristics and functionalities of the Campus Portal that
distinguish it from a general Web site, needs to be considered in order to meet the end-users experience, their activities and personal preferences.

In addressing these issues, this research was conducted in three phases aimed at contributing to a better understanding of Campus Portal development in reference to building “Malay Language Learning Portal”. These phases are: the literature review, a preliminary study of existing Campus Portals, and the production of a development methodology for Campus Portals. The results of this research should help foreign students to use the “Malay Language Learning Portal” to learn the basic of our National Language with an effective campus portal which supports the users’ personal preferences.

1.2 Problem Statement

The major issue under consideration in this research work is how to develop an effective portal when there are many difficulties in developing a portal than can serve the target community. Many stakeholders come up with many different opinions that finally when a portal is structured, it fails to depict the exact objective of it, and instead it goes around the bush to actually relate the actual objective. Hereby, I have chosen to develop a Malay Language Learning Portal by using a proper software methodology that hits right to the objective of the portal instead of swaying about the research.

One may ask, why a Malay Language Learning Portal? Well, Malay Language is our National Language and we should encourage everyone to learn the language. It is
known to be a soft and a beautiful language. Mastering a language is not a must, but learning it is an advantage. Many of them have created other languages translation from English, so why don’t we have one too? I believe this is a start for us to have a portal for learning the Malay Language and for a start; I wanted to start within the University Malaya campus and once this has proven for wide usage, then the portal could be accessible to others. I believe in this way, we could encourage more foreign students to study or to work here. In other words, it might be a stepping stone for investment and the economic growth of Malaysia.

Based on interviews done with a few students, e-learning thru portal is perceived to be more effective because of the colourful and interesting way the information is presented. Furthermore, students sometimes find themselves having doubts and questions on what they read in textbooks and have nowhere to turn to for clarifications. Through the message board in a portal, the students will be able to get concise and detailed answers to all their queries.

This project is aimed to solve this major communication gap which foreign students are currently facing in a very user friendly manner among their local friends and the Malaysian community through a proper Malay Language Learning Portal which uses an appropriate software methodology.
1.3  Project Objectives and Questions

The primary objectives of this research are:

- To identify an appropriate methodology to develop a Learning Portal.
- To develop a Malay Language Learning Portal for our university.

In order to achieve this objective, this question needs to be answered.

**Q1:** What are the essential factors of current practices that appear to enable or obstruct the development of a Campus Portal?

**Q2:** How could the development of “Malay Language Learning Portal” lighten up the understanding of these factors?

From the understanding of the issues mentioned in the research objectives, a comprehensive development methodology for the “Malay Language Learning Portal” will be composed in Chapter Four of the research. This will be done by evaluating and modifying the most appropriate existing methodologies for the traditional Information Systems and Web development.

1.4  Research Methodology

This dissertation comprises of 3 parts; literature review, portal development and finally the evaluation of the portal.
My research starts with an overview of a campus portal and the background concepts of what is actually a portal. It adds on to the types of portals and the different portal
perspective on Market Segments and Data Management. I elaborated on each perspective portal type and the classification of it. Besides that, I also wrote a review on the functionalities of a campus portal and the pitfalls of a portal. I summarized the literature review with common questions and answers about the campus portal issues.

The 2nd segment presents the meaning of a methodology and information systems. It also comprises the types of information systems development methodology known in today’s world. This segment also establishes the web-based information systems development methodology in detail. The main part of the segment which is crucial for this research in the selection process for the development methodology used to develop the Malay Language Learning Portal. This segment covers the use of Soft Systems Methodology in the establishment of the Malay Language Learning Portal in terms of its architecture overview of the development.

The final segment comprises of the evaluation of the development portal. This segment discusses the research contribution and recommendations arising from this research based on the evaluation given by 5 foreign students which was randomly chosen. The questionnaire comprises the portal usability, functionality and its quality (Appendix A). It concludes with future research recommendations.

1.5 Research Outcome

This research is able to identify the problems faced by foreign students in University of Malaya in terms of communication. A portal is used to actually solve
their problems of communication in our National Language. This portal is built based on a software methodology called the Soft Systems Methodology (SSM). It also gives opportunity to foreign lecturers or presenters to get their way around with the use of this portal that has a direct translation of words and phrases between English and the Malay Language.

For long term improvement, the portal must be up to date with latest words, phrases and quizzes which can keep foreign students excited to participate. The portal can be easily accessed anywhere and using any kind of devices which has internet connection. This portal is beneficial to everyone around who has the eagerness to learn words.

### 1.6 Dissertation Organization

The first segment of this dissertation, comprising Chapters 2 and 3 which covers the literature review on the various information systems as overall, web development methodologies and characteristics of a campus portal. The literature review in of this research indicates that the major distinguishing characteristics of a campus portal which are

(i) **Personalization**, by which end-users are only able to access information and online services pertinent to their activities.

(ii) **Customization**, by which end-users are able to select their preferred information channels and optional online services.

Chapter 4 and 5 details the development methodology selection process and the use of Soft Systems Methodology (SSM) in the establishment of a Malay Language
Learning Portal. This chapter provides the details of SSM in defining the core of the portal, in planning the development of the portal and also in strutting the thinking of it.

Finally, Chapter 6 concludes the entire dissertation and provides the limitation of this research and also has a few suggestions for possible future research.
CHAPTER 2

Literature Review

2.1 Overview of Campus Portal

A Campus Portal is a relatively new phenomenon that has arrived on the scene in institutions of tertiary education across the globe. The Campus Portal concept is based on emerging Web technology and its implications for the activities of various stakeholders in these institutions. The Campus Portal concept spans many discipline areas, for example Web technology, Human-Computer Interaction, technology adoption, management, and so forth. In the current global economy, education has become a major service industry, so that the need for competitive advantage has become a strategic part of many education institutions. A Campus Portal can perform a vital role in facilitating the business processed of all stakeholders within an institution, thereby enabling the achievement of organization’s goals.

However, the mere implementation of any Campus Portal of itself cannot guarantee that the institution will achieve its goals and retain a business competitive advantage. Moreover, misunderstandings of the breadth of the Campus Portal concept will invariably lead to disaster. As the Campus Portal concept has evolved rapidly over the last few years and involves diverse technological, human and organizational aspects, there is confusion over its terminology, concepts, and related issues that need to be clarified. Ignorance and misunderstanding of these issues has become a barrier to cooperation between management, the development team and the various
groups of users within the institution. This has led to less than ideal outcomes of many Campus Portal projects.

The concept of Campus Portal is a derivative of the more general notion of an Enterprise Portal, which had been adopted in many business organizations. While some academic research is available in this area, most original literature is in the form of practitioner reports published by business organizations and technical portal vendors.

2.2 Background of the Portal Concept

An evolution of a portal can be traced back to the original concept of Internet and Web technologies, which introduced the perspective and concept of the Internet, Intranet and Extranet. On a client side, a standard Web browser is an application that is used for connecting to the portal. On a server side, there are many kinds of servers and applications, the front-end, however, will seamlessly be generated as a standard Web page.

In fact, the conceptual framework of a portal is extended from the original concept of the first personalized Internet portal, My Yahoo (White, 1999b) which was introduced in 1998. Additionally, Campus Portals are mostly derived from concepts of a Corporate and Enterprise portal that was originally introduced by two researchers, Shilakes and Tylman in 1998. In addition, the Campus Portal was initially introduced by the University of California in Los Angeles (UCLA) in 1999 and followed by the University of Washington and the University of Buffalo.
This chapter, therefore, will begin with a concept of the portal in overall. It will then describe issues of both Enterprise Portal and Campus Portal and clarifying the major important issues of relevance to Campus Portal development.

### 2.3 Portal Terminology and Classifications

The concept of Enterprise Portal was typically derived from a Web portal, but the Enterprise Portal more emphasizes on enterprise related issues. It is true that a standardized definition of the Enterprise Portal is still under development and has not yet been finalized even at the time of studying. Consequently, the words of “Business Portal”, ”Knowledge Portal”, “Internet Portal”, ”Corporate Portal”, “Enterprise Portal”, “Information Portal”, ”Enterprise Information Portal” and so forth are used as synonyms and alternately interchangeable (Finkelstein and Perkins, 2000; Dias, 2001) according to the authors and their points of view.

According to Firestone (1999 p.1; 2003a p.3), “Enterprise Information Portal definition is a political process” which

“the process of definition is a ‘political’ business, an attempt to persuade the Investment/IT and ultimately the user community to define Enterprise Information Portal in a manner favoring one’s own vendor or analytical interests. If a vendor gets their favored definition accepted, it gets to say that a competing vendor is not really an Enterprise Information Portal vendor, or lacks this or that required Enterprise Information Portal characteristic. If an analyst or consultant gets its
In early evolution of the portal, a Web portal was recognized as a search engine whose main purpose was to facilitate unstructured information available throughout the Internet (Reynolds and Koulopoulos, 1999; Dias, 2001). Following an advantage of using a Web portal as a search engine, Shilakes and Tylman introduced a new potential of implementing a Web portal within a business organization environment called “Enterprise Information Systems (EIP)” and define Enterprise Information Portal as:

“Enterprise information portals are applications that enable companies to unlock internally and externally stored information, and provide users a single gateway to personalized information needed to make informed business decisions. Enterprise Information Portal as a Browser-based system providing ubiquitous access to business related information in the same way that Internet content portals are the gateway to the wealth of content on the Web” (Shilakes and Tylman, 1998 p.2).

An additional idea by White (1999a) also agreed to the definition that was given by Shilakes and Tylman, he described portals offering business users with a simple and personalized Web interface to any information as enterprise systems regardless of the location of the sources. Eckerson (1999c) has a very similar idea, but points out the name as “Business Portal”, which
“is the business equivalent of the wildly popular consumer-oriented Internet portals, such as Yahoo! and Excite. Simply put, a business portal provides business users with one-stop shopping for any information object they need inside or outside the corporation. These objects can be any number of things: canned or dynamic reports, queries, text documents, spreadsheets, e-mail messages, news feeds, Web pages, audio files, video streams, Lotus Notes documents, and so forth” (Eckerson, 1999c p.3).

Murray (1999) extends the original definition of the portal by Shilakes and Tylman (1998) into a collaborative point of view, he argued that the portal should not only be a gateway to connect people to the information, but also provide the connection to every information, people, and tools needed, and be considered as a desktop environment. Morrison (2000 p.2) defined and supported the idea of Murray (1999):

“A portal is an application that provides a personalized and adaptive interface enabling people to discover, track, and interact with other people, applications, and information relevant to their interests. Its distinguishing features are:

- **P**ersonalization for end users,
- **O**rganization of the desktop,
- **R**esource division,
- **T**racking of activities,
- **A**ccess and display of data stores,
- **L**ocation of important people and things.”
Another perspective that broadens an original definition of a portal with a user-centric focused was mentioned by Reynolds and Koulopoulos (1999 p.4):

“individuals share the responsibility for classifying business-critical information. Publishing and other information-sharing activities generate a rich content environment at the corporate portal level without requiring a comprehensive overview. This new environment creates that single point of access for the increasingly ‘knowledge centric’ patterns of today’s work world. Corporate portal developers focus on user-centric Information Systems that provide access to working information within one interface”.

From my point of view, a broad concept from the enterprise portal of the pioneer contributors, which were previously described, is considered equivalent. Nevertheless, a detailed focusing point enhanced an original concept beyond its limitations. In order to maintain a standardization of the definition of the portal throughout the research and contribute throughout the remainder of this dissertation, I will define an Enterprise Portal as:

“An user-centric enterprise-wide Web-based Information Systems that incorporates all types of enterprise and third-party information.”

2.3.1 Perspectives on the Portal Environment

Generally, a portal user can be anyone who might be customer, employee, manager, venders, and so forth of an organization. Each person however have different activities and requirements and will be assigned as different roles and access
restrictions. There are two main types of the portals considered by this perspective. Activities, and services for providing its stakeholders with a secured personalized and customized single point of access regardless of the original resources by using a standard Web browser.

2.3.1.1 Public Portals

Regarding Internet technologies positioning, a public portal can be placed on the range of Internet applications. This means anyone who has Internet access can visit a public portal.

Adapted from Shilakes and Tylman (1998) and Boettcher and Stauss (2000):
“A public portal is defined in this dissertation as an user-centric Web application that incorporates all types of its and third-party information, activities, and services for providing its users with a secured personalized and customized single point of access regardless of the original resources by using a standard Web browser such as Microsoft Internet Explorer, Netscape, Mozilla Firefox and many more.”

A public portal can be called an Internet Portal (Dias, 2001) or General Portal (Collins, 2001; Tatnall, 2005a). The purpose of the public portal is very similar to the purpose of television, radio and newspaper, that is, to gain a large number of people as subscribers and return back to use the portal as much as possible (Reynolds and Koulopoulos, 1999; Dias, 2001; Firestone, 2003b; Tatnall, 2005a).
As a result of that, an Internet Portal provider will be able to attract business organizations to advertise on the Internet Portal to provide an income stream. Some renowned examples of the Internet Portal are http://my.yahoo.com, http://my.msn.com, and http://my.cnn.com.

2.3.1.2 Private Portals

A private portal is either an Intranet or an Extranet and distinguishes the private portal as two main types which are the corporate portal and enterprise portal.

- **Corporate Portals**
  
  Adapted from Shilakes and Tylman (1998), Boettcher and Stauss (2000), and Collins (2001):
  
  “A Corporate Portal is defined in this dissertation as a user-centric corporate-wide Web-based Information Systems that incorporates all types of enterprise and third-party information, activities, and services for providing its stakeholders within an organization with a secured personalized and customized single point of access regardless of the original resources by using a standard Web browser, such as Microsoft Internet Explorer, Netscape, Mozilla Firefox and many more.”

- **Enterprise Portals**
  
  Adapted from Shilakes and Tylman (1998), Boettcher and Stauss (2000), and Collins (2001):
  
  “An Enterprise Portal is defined in this dissertation is a user-centric enterprise-wide Web-based Information Systems that incorporates all types of enterprise
and third-party information, activities, and services for providing its stakeholders including customer, suppliers, etc with a secured personalized and customized single point of access regardless of the original resources by using a standard Web browser, such as Microsoft Internet Explorer, Netscape, Mozilla Firefox and many more.”

2.3.2 Perspective on Data Management

Roberts-Witt (1999) and Kim, Chaudhury and Rao (2002) recommend three types of enterprise portal that can be viewed from a data management perspective.

- **Data Portals**
  This type of portal is concerned with managing such structured data as corporate databases with a single point of access.

- **Information Portals**
  In contrast to the Data Portals, this type of portal is concerned with managing such unstructured data as e-mail, text, and other documents by using indexing and cataloguing systems and has search and retrieval functionality.

- **Collaborative Portals**
  This type is focused on group interactive functionality as well as the integration of the enterprise by bridging Intranet, Extranet, private source data, and public information. The users are also allowed to access all collaborative functions such
as classified topics, conferencing, team discussion, news channel, calendaring, and the abilities to personalize the interface.

2.3.3 Perspective on Market Segments

Collins (2001) identified and described at least nine types of applications based on available portal market segments on the market.

2.3.3.1 Information Portals

This is the most common category that connects people to the structured and unstructured information of the organization by categorizing into two different sub-types: Intranet Unstructured and Enterprise Reporting. For the Intranet Unstructured, vendors provide systems that enable users to search, categories, organize, and publish the information over the intranet. For enterprise reporting, the reports are generated from the systems that have access to the data warehouse, data mart or business intelligence space.

2.3.3.2 Enterprise Resource Planning (ERP) Portals

Giant ERP vendors such as SAP, Oracle, Baan, and J.D. Edwards have all announced their products that can be classified into this area. The ERP portal uses the advantage of a personalized Web-based user interface that easily allows the users to access the enterprise-wide information and ERP systems.
2.3.3.3 Electronic Commerce (E-Commerce) Portals

The objective of this portal is to use Web-based user interface applications and services to complete the E-Commerce solution, which creates the business relationship between the organization, customers, partners and vendors.

2.3.3.4 Employee Portals

This portal category focuses on human resource management using Web-based user interface applications and services. The portal allows the human resource department to manage everything they need, such as managing positions, compensations, recruiting, hiring, training, promoting, relocating, retiring, pension administration, payroll administration and so forth.

2.3.3.5 Corporate Interest Portals

The corporate interest portal focuses on the online and offline interest resources. The portal uses search engine and directory hierarchies for the listing of business-to-business resources, services, and business products that might be of interest to the employee in the organization. The users are able to search the interested information in this portal instead of exploring the entire Internet searching for particular services.

2.3.3.6 Internet Hosting Portals
The aim of the Internet hosting portal is to provide the Web and application hosting services to organizations including download services, Internet connectivity, and security services. Download services can be used to reduce the printing and mailing cost. Additionally, because the document file can be encrypted, it has a more secure transfer when compared with the traditional mailing systems.

### 2.3.3.7 Collaborative Portals

Similar to the idea to Murray (1999), collaborative portals provide and focus on communication features such as email, discussion and chat room, project management tools, Internet and Intranet messaging services, and include video conferencing. These tools are based on the Internet-based applications and services.

### 2.3.3.8 Expertise Portals

The major objective of the expertise portal is to connect groups of people together for sharing and transferring their expertise. Actually, consolidation of knowledge and reasoning methods are not easily represented in the traditional computing approach. The expertise portals, however, have been designed to do these kinds of job. There is a number of functions: librarian who help employees to find, organize, and interpret needed information; advisor who shares the specialized expertise that is needed; an instructor, who helps employees to learn a task; and a general assistant who takes care of defined routine tasks.
2.3.3.9 Knowledge Portals

The knowledge portal plays the most important role of every market segment. It combines all features and functionalities outlined by each individual segment. The capabilities of this kind of portal are retrieving information from organization Information Systems and presenting it according to the roles of each individual person, maintaining each person’s personalization and providing navigation features, and connecting people for communication and collaboration.

2.3.4 Perspective of Intended Users

Duffner (2003) recommends that a portal should be categorized based on the users who can be internal or external users. In the business organization, a group of users in general terms are customers, staff members, suppliers, partners, etc. On the other hand, a group of users in a higher education institution are students, prospective students, alumni, faculty, academic staff, administrative staff and so forth. This perspective provides a wide range of focus on a single portal that is specifically designed to suit each group of users by developing an individual portal for each group such as an employee portal, consumer portal, student portal and so forth.

2.3.5 Perspective on Information Seeking
A portal should be viewed into two major categories of architecture which are, Horizontal Portals and Vertical Portals. Figure 1 illustrates the basic architecture of the portal in perspective of Information Seeking.

2.3.5.1 Horizontal Portals

A public portal focuses on mass public users. General functionalities of a portal, such as customization and personalization, are provided for its users. Normally, this kind of portal provides broad range of contents such as digital storage space, shopping, weather forecast, stock prices, various channels of news, search engines, discussion groups, horoscopes, calendar, etc. On the other hand, this kind of portal will not provide any organization-specific information, because they are not connected to the organization Information Systems; but are connected to their own site and third-party contents. Examples of this type of portals are My.Yahoo, My.Excite, and My.MSN.

2.3.5.2 Vertical Portals

In contrast to the Horizontal Portals, Vertical Portals provide organization-specific information based on a user-centric perspective. Authentication of this type of portals is much concerned when compared to Horizontal Portals. When users log-on to the portal, the system will retrieve information, contents and so forth based on the roles of users, such as student, faculty, lecturer, staff, and many more.
2.4 The Definition of a Campus Portal

As described in the previous section, a Campus Portal can be viewed as an Enterprise Portal for a higher education institution. A Campus Portal therefore can be defined as “An user-centric campus-wide Web-based Information Systems that incorporates all types of enterprise and third-party information, activities, and services for providing its stakeholders with a secured personalized and customized single point of access regardless of the original resources by using a standard Web browser.”

2.5 Characteristics and Functionalities of the Campus Portal

A Campus Portal offers a broad-range of applications and services (Collins, 2003) that facilitate all stakeholders of an academic institution. To integrate all applications
and services, the functionalities of the portal play an important role in linking all applications and services in order to meet with the user requirements and solve the business problem. However, an integration of the functionalities needs to be consistent with critical portal characteristics. “Due to the breadth of corporate portal functional possibilities, focusing on the key requirements is critical. This framework could be adapted to fit different business requirements” (Aneja, Rowan and Brooksy, 2000 p.3).

This section will identify what appear to be the major critical characteristics of portals that are discussed in the literature applicable to all types of portals within education institutions. Importantly, these characteristics should distinguish a portal from a general Web site, and most Internet applications.

2.5.1 Personalization

“The goal of personalization is to deliver content relevant to an individual user or group of users based on their roles and preferences” (Aneja, Rowan and Brooksy, 2000 p.4). Personalization focuses on each individual user’s interest as well as an organization’s interest. Because each user has particular information attached to the job position, information and contents on the Campus Portal therefore should be reflected in the user’s roles, rights, interests, and specification in the organization. (Eckerson, 1999a; Eckerson, 1999c,)
2.5.2 Customization

From the software implementation viewpoint, “Customization is a socio-technical activity of modifying the properties of packaged software, so that the resulting Information Systems converges with the requirements of the target organization” (Nordheim and Paivarinta, 2004 p.2). Adapted from that perspective, customization is a socio-technical activity modifying the properties of content and services, so that the resulting information and services converge with the requirements of the user. In a Campus Portal, customization is served to suit personal interests and preferences. Because everyone has different needs, each individual user should be able to select a preferred content and personal look-and-feel interface. The most classic example of customization is a Yahoo Web portal which can be found at http://my.yahoo.com. (Eckerson, 1999a; Eckerson, 1999e).

2.5.3 User and Role Centric

The most traditional Web sites have been designed from the perspective of the provider. A portal should be designed to support the user activities and roles. However, it is unnecessary to have a 100% user-based design. Some information that the provider wants to inform users can also be released to the interface via ‘push’ channels. (Firestone, 1999; Reynolds and Koulopoulos, 1999)

2.5.4 Balance of Pull and Push Information
A term of ‘pull’ and ‘push’ components was clearly defined as “information delivery systems” by Kendall and Kendall (1999a). “Companies will need to use both ‘publish’ (pull) and ‘subscribe’ (push) mediums to ensure the right information is available or distributed to the right people at the right time” (Shilakes and Tylman, 1998). However, subscription of the information does not mean that a user has complete rights to subscribe or unsubscribe the minded channels.

A balance between organizational level and personal level needs to be adjusted in order to provide sufficient and efficient information viewpoint. From the organizational level perspective, some information and content that may be classified as a compulsory issue for users within a particular group; it therefore needs to force the information out to the user interface at the same time when the user is logged-on to the system.

From the personal level perspective, channels and information where a user desires to receive information should be displayed and managed as the user’s needs regarding their privileges. Based on a study of Frazee, Frazee and Sharpe (2003), 88% of students would like to receive announcements and 91% would like to be reminded about important dates such as the due dates of their assignments and appointments.

2.5.5 Easy to Use
Users with minimal experience should easily use a portal with minimal training. Overloading information or access services on the screen is the critical matter for novice users or even experience users. (Eckerson, 1999a; Eckerson, 1999c)

2.5.6 Categorization

Because it could be considered as a critical task of an organization because of the enormous volume of information available on the portal, documents should be organized and indexed into category and sub-categories. All information should be well organized into a set of channels. (Aneja, Rowan and Brooksy, 2000; Plumtree, 2002)

2.5.7 Single Point Authentication and Access

A portal should allow users to have only single secured sign-on. Once users signed on their personal contents, the system should securely pass the user name and password to other pages through the portal without asking for access permission again. Content channels, information, and functionalities subscribed by and related to a user should be available instantly in the first page of the site. (Firestone, 1999; Reynolds and Koulopoulos, 1999)

2.5.8 Powerful and Unified Search Engine
An internal search engine can be considered as a help desk for most users when they want to find any specific information rather than having to explore the site themselves. It must access all data sources within the rights of signed-on users. (Eckerson, 1999a; Eckerson, 1999c; Aneja)

2.5.9 Unified Presentation of Information

A portal should provide a seamless integration of the enterprise information sources, which is a combination of unstructured and structured information and which supports most information formats currently available, and in the future. However, the presentation of that information should look, feel and be accessible regardless of the original source. (Eckerson, 1999a; Eckerson, 1999c)

2.5.10 Communication and Collaboration

Email, Web board, and chat rooms are tools that should be available to let people who have the same interests communicate and share knowledge. In addition, users should be able to publish their works to like minded groups. (Eckerson, 1999a; Eckerson, 1999c; Aneja, Rowan and Brooksy, 2000; White, 2000)

2.5.11 Security

Security is the issue of most concern among users who log into a portal. To protect privacy, the portal should provide some kind of security to make sure that only the right person can access the right account and information. (Eckerson, 1999a; Eckerson, 1999c; White, 2000)
2.5.12 Integration and Extensibility

A portal should provide a standard communication protocol in order to integrate all types of structured and unstructured data, applications and services of an organization. In fact, the development of Campus Portal is an ongoing process; new modules will be appended into the system after some applications have already been implemented. Additionally, new technologies always reach the sight of the development team, which may offer a great improvement to the existing system. A portal therefore should be adequately flexible for future extension of the system. (Eckerson, 1999a; Eckerson, 1999c)

2.6 Portal Pitfalls

Although an emerging technological innovation may enhance in many ways the business process to achieve a business goal, the lack of an appropriate development methodology and ongoing management could lead to failure. As a Campus Portal project is a large scale development which needs to integrate all Intranet and other online systems within an organization, a risk of failure is unavoidable. In order to reduce the possibility of a portal project failing, the planning and developing processes need to be critically investigated. META Group by Roth (2002) mentions that lack of user acceptance and lack of supporting infrastructure is the most common pitfalls of the Enterprise Portal. Roth (2002) additionally identifies a number of other
pitfalls and recommends six major steps in the planning process. The following list was adapted from the work of Roth (2002) to the Campus Portal environment:

• **Step 1 – Sponsorship and Ownership**

Most failures of portal projects are caused by the failure to achieve executive sponsorship and clear ownership. A portal needs a management perspective driven by a top-down approach, which requires an executive-level committee to agree on the project development and sponsor it throughout the life of the portal project. A clear identification of ownership is compulsory in order to maintain the necessary level support for the function of development effort.

“Thoughtful portal builders will first draw a roadmap and ask pertinent questions, for example about who will use the portal. Will it eventually be rolled out to additional groups within the company, perhaps even to customers and partners? How large a project should it be? If we start small, which interest group should be the initial target?” (Roberts-Witt, 2000 p.2)

• **Step 2 – Drivers and Benefits**

Problems occur through a lack of a clear vision of the goals of a portal’s implementation. In fact, just because a new technology does not mean it will be able to solve the problems in which an organization is currently facing. A lack of a clear statement of goals, and an inability to appreciate the value of the portal to solve the problems could lead to termination of portal projects. A clear description of each stakeholder and organization benefits is necessary to establish the value of portal development and implementation.
• **Step 3 – Features Inventory**

A single portal that tries to support a range of stakeholders, but practically allows only a certain number of groups to get involved in design and development process often causes problems. In general, each portal owner has a different request because they have different problems and business processes. The development of a portal should include all representatives from all areas during a portal development, especially in the requirement collecting process. “In planning the deployment, the development team concluded it ought not to put up the portal before understanding how the 2,000 individual users—most of whom work from a remote office or their homes—spend their days” (Roberts-Witt, 2000).

• **Step 4 - Infrastructure Impact Assessment**

Although the implementation of a portal may help an organization to solve the problems, insufficient infrastructure to support a portal characteristic and functionalities leads to the failure of the portal project. An evaluation of an organization’s Information Technology infrastructure is necessary to be done before making a further decision on the portal development project.

• **Step 5 – Product Selection**

Selecting an inappropriate product leads to the failure of a portal solution. This does not mean that an organization always needs to buy portal products from vendors. Prior to the development of a portal, the development team needs to research the advantages and disadvantages of each relevant products and find out whether they can solve the problem and achieve the organization goal. Additionally, considering on in-house development and purchasing products needs to be done.
Step 6 – Internal Marketing and Feedback

A portal has always being designed for all stakeholders, which have different roles, activities and purposes. In fact, the content on the portal has to be dynamically generated and needs to reflect the current roles of a stakeholder. However, “By making people, especially those who aren’t used to working in a Web environment, struggle to find what they need, you risk losing them altogether” (Roberts-Witt, 2000). Additionally, some users who already have experience of Internet portals may place self-expectation on the forthcoming portal (Rudnick, 2004). Even if a portal has a beautiful, good looking user interface, a full set of portal functionalities and a full set of features, without solving a problem and facilitating the activities of the users will lead to a failure of the portal project. Encouraging all stakeholders to use the portal is required. Additionally, a training session and feedback channel should be strongly implemented to comfort the stakeholders and track the user satisfaction of the user.

2.7 The Global Trend of the Campus Portal

There has been a rapid growth of foreign students in higher education institutions in most developed countries in last 20 years (Bahal, 2004). In fact, there are 237,235 international students studying at Australian institutions as of April 2004 (IDP, 2004); it has become the third largest export service industry (Bahal, 2004). As a result, a competition between inshore and offshore institutions is unavoidable. Most institutions have considered the Information Technology and Information Systems projects as a strategic plan for their institutions.
According to Englert (2003), Campus Portal development is considered an important emerging technology that supports at the strategic level of the institution: 45% of the institution’s executives replied that the Campus Portal is very important as a strategic level; 29% replied as important, and 22% replied as somewhat important. Englert (2003) further revealed a finding on a stage of Campus Portal development: most institutions already have at least a plan to develop a Campus Portal; 34% already implemented a Campus Portal; 39% are underdevelopment, and 23% are planning to develop a Campus Portal.

2.8 Common Questions and Answers on Campus Portal Issues

Question: What are the similarities and differences between Campus Web site and a Campus Portal?

Answer: Both of them are developed and implemented under a Web technology environment, which needs to have at least two sides of connection: clients and servers. In fact, a Web site can be as simple as a static site where all information and contents are based on unstructured data, for example HTML page, images or it can be complex as a dynamic site where partial or all information and contents are based on structured data that were previously designed and organized into the database system. On the other hand, Campus Portal has to be on a dynamic site and needs to compile with the portal characteristics and functionalities, such as customization and personalization, single sign-on, and so forth.
Question: Does a Campus Portal URL begin with ‘my’?

Answer: According to Jafari (2003 p.25), a framework of Campus Portal aims at the organization level. It therefore should be placed at an organizational level’s URL. It means that a Campus Portal should completely taken place as a root of an institution’s URL, i.e. [http://www.university.edu.au](http://www.university.edu.au) rather than sub-URL, i.e. [http://my.university.edu.au](http://my.university.edu.au). In addition, the first page of an institution’s home page should have a sign-on box for a user to log-on to the Campus Portal. All non-users should be delighted to be a visitor in which all information and contents relevant to the visitor will be retrieved and displayed on the home page interface. Once a user logged-on, the Campus Portal will retrieve all information and contents relevant to a user’s roles and preferences right on the next coming screen.

2.9 Unique Characteristics of Campus Portals

From this review of the literature, it is suggested that the characteristics of personalization and customization, which were implemented in the majority of the descriptions of Campus Portals, are the most common characteristics that distinguish them from other kind of Web-based systems and applications. It is inferred that it is this two characteristics which are personalization and customization that gives a Campus Portal a unique nature and place it among the mature generation among Portals. The users of the Campus Portal can be directly provided with the personalized information and online services through personalization features, whereas the users will also be enabled to select their preferred contents and optional online services by the customization functionality. Personalization and
Customization will therefore receive particular attention in the data collection and analysis of the subsequent phases of this research.

2.10 Summary

This chapter provides some background to the concepts of portals in general and to Campus Portals in particular that forms the basis of the rest of this thesis. This background should be understood before the preliminary and main research study are undertaken and also before commencing the composition of the Campus Portal development methodology in the fourth phase of this research. Although there are many important characteristics of portals that make them interesting, the most unique characteristics identified in Internet Portals, Enterprise Portals and Campus Portals, appear to be: personalization and customization. These will be prominent in all remaining phases of this research.

For Phase Four of the research, some background to development methodologies needs to be studied in order to provide a wider understanding on the development approach that may be most suitable to support the development of Campus Portals regarding all the characteristics identified here but especially the unique characteristics of personalization and customization. Therefore, the next chapter of the dissertation will provide the background of the traditional Information Systems and Web development methodologies that could support the development of Campus Portal projects.
CHAPTER 3
Information Systems and Web Development Methodologies

3.1 Overview

Countless methodologies for Information Systems development have been recommended since the 1970s, and development methodologies in the area are still being produced. In particular, both practitioners and researchers continue to create and recommend new methodologies to facilitate the development of the Information Systems application using new technologies and tools with a current shifted to support the emerging areas of Web technologies and applications.

Prior to the revolution of Web technology, there already existed Information Systems development methodologies available to the practitioners for development projects. The major players at that period were often a large enterprise, which were willing to pay a lot of money for Information Systems development. The reason is quite simple: the need for competitive advantage. To achieve this goal, methodologies had been adopted for the efficient development of their computer-based Information Systems.

When the revolution of Web technology started, small businesses and individuals could also afford to create their own computer applications including a Web site. Amazon.com, Yahoo.com and Google.com are very good examples. They started from unknown companies to be some of the most renowned companies in the world. In fact, they had taken advantage of the Internet and Web technology to drive their business so that the Web now has become a strategic part of the business.
Therefore, Web site development and Web-based Information Systems are placed at the forefront of new business system development. Many companies have tried to at least have a Web site and need it within a small number of weeks. Although there are many available Web development methodologies for practitioners, they not well-known, or are known but many avoid using them.

Undeniably, there are contrary and supporting statements on both sides of the argument on the benefits of adopting a methodology for the Website development process. While it is beyond the scope of this research to study in every available methodology, this chapter will focus on both traditional and Web-based Information Systems development methodologies and examine well accepted methodologies in order to find issues relevant to Campus Portal development.

3.2 The Definition of a Methodology

Before further discussion into details of development methodologies, the definition of the term ‘methodology’ needs to first is clarified. There is controversy among the Information Systems scholars about the distinction between the terms ‘method’ and ‘methodology’. In fact, there is no universal definition of these terms (Tudor and Tudor, 1995). Olica (1988) mention that although methodology and method have very similar meanings, they may however become different where explicit specification is assumed. In this case, the methodology will have a higher level than a method which becomes an approach within the methodology (Oliga, 1988; Avison et al. 1998; Avison and Fitzgerald, 2003a). Maddison et al (1983) mentioned that
individuals and organization Information Systems developers may develop methods of solving their problems and then combine with their supporting procedures, techniques and tools to form as a methodology.

As agreed upon in this viewpoint, the “methodology” term used in this research has higher level than “method”. Therefore, the methodology is “a method of developing Information Systems, with identified phases and sub-phases, recommended techniques to use in each phase and sub-phases, and recommendations about planning, management, control and evaluation of development project and its various phases and sub-phases” (Maddison et al. 1983 p.4). “

In a modern organization where almost all people have some experiences in computer technology and the Internet, the definition and scope of original methodology, however, needs to be adjusted.

As the brief summary in Figure 3 describes that there are two distinct areas of development which are Information Systems development and web development. It is true that traditional Information Systems development was generally started in an
early generation of the computer-based system in an organization. After the Internet technology was widely accepted from the public sector, an organization started to adopt the Internet and the Web to facilitate their business processes. However, an initial adoption of the Web within an organization was more likely to use as a publishing tool. It, therefore, makes a clear distinction between Information Systems and web development.

At present, the capability of Internet and Web technologies tools are more advanced and completely changed to be a platform of development, a completely replacement of the traditional Information Systems can be done by using Web technology, which then is called Web-based Information Systems (WBIS) (Takahashi and Liang 1997a; Takahashi and Liang 1997b). Moreover, a portal can be considered to be a part of Web-based Information Systems; it, however, has its own characteristics and functionalities which are unique from other Web-based applications as clarified in the Chapter 2. As a result, the portal development needs to be separated from WBIS development. It, however, will be still categorized as a subset of WBIS.

To understand how to approach a methodology for Campus Portal development, all related development methodologies need to be discussed. Details and issues on the development methodology of each segment in the development, which already described in above paragraph, will be further discussed in this chapter.

3.3 Information Systems Development (ISD)
There are numerous numbers of methodologies for ISD that have been developed and used in an organization for the last three decades; this research, however, will not be able to cover all Information Systems development methodologies (ISDM). In fact, this research therefore will investigate a number of ISDMs, which were well established and well implemented in an organization. Alternatively, this research will also call ISDMs as traditional development methodologies.

3.3.1 What is Information Systems?

There is an argument among practitioners, students and researchers between the covered area and definition of “Information Systems” and “Information Technology”; it can be differentiated in the definition between Information Systems (IS) and Information Technology (IT) as follows:

*Information Systems* combines people and their requirements (including their activities (Korpela, Mursu and Soriyan, 2001), data, processes, and the use of *Information Technology*, which interrelates to collect, process, store, retrieve, transmit, manipulate and display information regarding to the business and organization needs; whereas *Information Technology* is a combination of computer hardware, software, telecommunication, and other physical devices (Alter, 1996; Laudon and Laudon, 1998; Whitten, Bentley and Dittman, 2001; Whitten, Bentley and Dittman, 2004).

Davis (Avison and Wood-Harper, 1990 p.3) defines information as, “an integrated man/machine system for providing information to support the operations, management and decision making functions in an organization. The system uses
This means that Information Systems development should cover many aspects i.e. people, organization, and technology, in order to retain and balance each of these important elements to solve problems and achieve the business goal.

### 3.3.2 What is Information Systems Development Methodology?

There are many types of Information Systems which vary from the operational level to the management level; each kind of Information Systems therefore needs a different kind of development methodology. It can be indicated that many Information Systems development methodologies are started back in the 1970s (Howcroft and Carroll, 2000; Avison and Fitzgerald, 2003a; Avison and Fitzgerald, 2003b). However, a terminology of development methodology varies among Information Systems researchers and practitioners (Baskerville and Pries-Heje, 2001; Avison and Fitzgerald, 2003a). Various definitions of methodology are described as follows:

The most well-known definition of Information Systems development methodology was envisaged by Avison and Fitzgerald (Avison and Fitzgerald, 1988; Avison and Fitzgerald, 1995; Kautz and Pries-Heje, 1999; Avison and Fitzgerald, 2003a p.20), “A collection of procedures, techniques, tools and documentation aids which will help the systems developers in their efforts to implement a new Information Systems. A methodology will consist of phases, themselves consisting of sub-phases, which will guide the systems developers in their choice of the techniques that might be
appropriate at each stage of the project and also help them plan, manage, control, and evaluate Information Systems projects.”


Addition to the well-known definition, Avison and Fitzgerald (2003a p.528) argued the definition of Maddison (1983) that the methodology should address the essential issue of philosophy and further extend Maddison’s (1983) definition as “A systems development methodology is a recommended means to achieve the development, or part of the development, of Information Systems based on a set of rationales and an underlying philosophy that supports, justifies and makes coherent such as a recommendation for a particular context. The recommended means usually includes the identification of phases, procedures, tasks, rules, techniques, guidelines, documentation and tools.

“A systems development methodology is a very formal and precise system development process that defines a set of activities, methods, best practices, deliverables, and automated tools for system developers and project managers to use to develop and maintain most or all Information Systems and software” (Whitten, Bentley and Dittman, 2001 p.78).

Whitten, Bentley and Dittman (2004 p.87) later made minor improvements to their definition in the new edition: “A systems development methodology: a standardized
development process that defines a set of activities, methods, best practices, deliverables, and automated tools that system developers and project managers are to use to develop and continuously improve Information Systems and software. A common synonym is system development process” (Whitten, Bentley and Dittman, 2004 p.87).

“A system development methodology provides guidelines to follow for completing every activity in the system development life cycle, including specific models, tools, techniques, and a system development life cycle. Some methodologies are home-grown, developed by systems professionals in the company based on their experience. Some methodologies are purchased from consulting firms or other vendors” (Satzinger, Jackson and Burd, 2000 p.64).

Essentially, these recent definitions are only an example and part of the Information Systems development methodology definitions which were defined by both researchers and practitioners. Noticeably, the terms “Information Systems development methodology” and “system development methodology” are interchangeable depend upon the context of the proposed definition by respective authors.

3.3.3 Information Systems Development Methodologies

Because of the limitations as previously mentioned, this research will study some well established and accepted methodologies. Traditional System Development Life Cycle (SDLC), Structured System Analysis and Design Method (SSADM), Jackson
System Development (JSD), Soft System Methodology (SSM), Effective Technical and Human Implementation of Computer-based Systems (ETHICS) and Multiview will be studied.

3.3.3.1 Traditional System Development Life Cycle (SDLC)

Traditional SDLC is the first system development approach and methodology for the Information Systems project which is generally called the “Waterfall Model” (Blum, 1984; Fitzgerald, 2000; Avison and Fitzgerald, 2003a; Avison and Fitzgerald, 2003b). In terms of approach, SDLC can be universally considered as recommended stages which may apply to other development methodologies in different contexts, procedures, technique, and approach. In terms of methodology, it also provides procedure; techniques, tools, and approach to system development projects (Kendall and Kendall, 1999b).

It can be stated that traditional SDLC is a common methodology for Information Systems and software development in many organizations (Bosch et al. 1982; Hoffer, George and Valacich, 1996). With the traditional SDLC, a process of Information Systems development is divided into major phases, i.e., feasibility study, planning, analysis, design, developing, implementation and maintenance.

However, the phases may vary depending upon the system developers and development methodology’s authors (Blum, 1984; Hoffer, George and Valacich, 1996; Kendall and Kendall, 1999b; Avison and Fitzgerald, 2003a). Because the traditional SDLC took place in the early-methodology era, the theme of the following
development methodologies were undeniably obtained and influenced some concepts from traditional SDLC (Avison and Fitzgerald, 2003a).

SDLC approach has been well tested by many Information Systems development projects and is also very structured and disciplined with good document in order to ensure the development will complete all specifications in all stages (Avison and Fitzgerald, 2003a). As a result, it reduces the disregarded details of the development (Davis, 1999).

Generally, traditional SDLC methodology has highly sequential structured stages which each stage needs to be completed before continuing to the next stages (Burns and Dennis, 1985; Hawryszkiewycz, 1994). As a result of inflexibility in a model which all process needs to be completed before making changes to the system are permitted, there may be dissatisfaction from users who really use the system (Burns and Dennis, 1985). An accurate reflection of current business environment in additional is an apprehension, because the length of the full cycle of system development may be very time-consuming (Davis, 1999).

3.3.3.2 Structured Systems Analysis and Design Method (SSADM)

SSADM is a structured method which was developed by UK consultants Learmonth and Burchett Management Systems (LBMS) and the Central Computing and Telecommunications Agency (CCTA) (Rose, 1991; Avison and Fitzgerald, 2003a; Yeates and Wakefield 2004). Initially, it introduced methodology for very large government projects (Yeates and Wakefield, 2004).
The concept of SSADM was adopted from SDLC, which initially introduced as a first approach to system development (Rose, 1991). The objectives of SSADM are to facilitate an IT project team to truthfully analyze the requirement for an Information Systems, and to design and specify and Information Systems to efficiently meet that requirement (Tudor and Tudor, 1995).

In the system development process, SSADM covers most aspects of the Information Systems by providing techniques in each aspects and stages of the Information Systems development (Al-Humaidan and Rossiter, 2001). In general, the process of structured analysis is to convert conceptual problems into a logical design, whereas a structured design focuses on converting the logical design into a physical Information Systems (Davis and Yen, 1999).

The life-cycle of SSADM version 4+ is composed of seven major stages (stage 0 to stage 6): feasibility, investigation of current system, business systems options, definition of requirements, technical systems options, logical design, and physical design (Avison and Fitzgerald, 2003a; Yeates and Wakefield, 2004). The documentation that is required in every stage remains a major approach to this development methodology.

Large-scale system development projects which generally require well-documented and step-by-step approaches can take benefits from this methodology (Davis and Yen, 1999; Avison and Fitzgerald, 2003a). Moreover, the distinction between logical analysis and physical design is noticeable in this development methodology (Mason...
and Willcocks, 1994). Additionally, an integration of other approaches such as a rapid application development (RAD) model is acceptable (Avison and Fitzgerald, 2003a). Due to the detailed step-by-step approach which requires well documented, time-consumption and inflexibility is unavoidable (Davis and Yen, 1999).

### 3.3.3.3 Jackson System Development (JSD)

Jackson system development (JSD) is a development methodology that focuses technical aspects in the software development life cycle (McNeile, 1986; Rollo, 1991), and can be considered as an extension of Jackson Structured Programming (JSP) (Yeung, Smith and Topping, 1991; Avison and Fitzgerald, 2003a). JSP was developed in 1970s by Michael Jackson (1975), and became a popular design method in Europe (Ourusoff, 2003b; Ourusoff, 2003a). Because the JSD emphasis is on the software oriented rather than context and needs oriented in the organization, it leads to a possible criticism on the overall development of Information Systems (Avison and Fitzgerald, 2003a).

The original formulated development step was composed of six steps: the entity action step, the entity structure step, the initial model step, the function step, the system timing step, and the implementation step; these steps were finally modified and rearranged into three major phases in JSD: the modeling phase, network phase, and implementation phases (Jackson, 1994; Avison and Fitzgerald, 2003a).

Jackson (1994) expressed the detail that the real world is transformed into events, entities, roles, event orderings, and entity attributes in the modeling phase. In the
network phase, inputs and outputs are analyzed to generate processes for inputs and produce outputs. In the implementation phase, the result of this phase is a final system which also covers physical design of network and databases.

Avison and Fitzgerald (2003a) categorized JSD as a type of process-oriented methodologies that provides a dynamic approach to system development. Additionally, the methodology has clear concepts that combine well-defined activities and fundamental principles (Mathiassen et al. 1996).

Because a core concept of JSD emphasizes the development of software, organizational and requirement issues are overlooked (McNeile, 1986; Avison and Fitzgerald, 2003a). Regarding the recommended phases of the JSD, the implementation phase of this method is complex with lots of technical details and some graphical symbols of its concepts are difficult for developers (Mathiassen et al. 1996).

### 3.3.3.4 Soft System Methodology (SSM)

SSM can be categorized as organizational-oriented methodologies (Avison and Fitzgerald, 2003a). In fact, SSM is one of the most famous soft methodologies originally developed in 1981 by Peter Checkland (Mason and Willcocks, 1994; Avison and Fitzgerald, 2003a). In general, most Information Systems development methodologies view problem situations as hard problems which are more technological perspectives (Couprie et al. 1997). SSM, on the other hand, views the problem situations in the real world from various perspectives of various stakeholders in the system (Checkland and Scholes, 1990; Mason and Willcocks,
SSM was developed to understand the complex problem situations in which hard system methodology fail to address the real problem situation (Vidgen et al. 2002).

Bulow (1989) in Checkland and Scholes (1990 p.28) describes that “SSM is a methodology that aims to bring about improvement in areas of social concern by activating in the people involved in the situation a learning cycle which is ideally never ending. The learning takes place through the iterative process of using systems concepts to reflect upon and debate perceptions of the real world, taking action in the real world, and again reflecting on the happenings using systems concepts. The reflection and debate is structured by a number of systemic models. These are conceived of as holistic ideal types of certain aspects of the problem situation rather than accounts of it. It is taken as given that no objective and complete account of a problem situation can be provided.”

During the process of system development, it is the fact that there are many other stakeholders rather than end-users and system developers. In practice, each stakeholder requires different needs and has different perceptions (Mason and Willcocks, 1994). To approach the best solution to problems, any group and level of stakeholders should also be studied in order to develop an effective Information Systems. Additionally, SSM is also one highly participative approach in the area of system development methodology.

In the time of the first book of SSM was written, numbers of development life cycles that required a sequential process throughout the whole process were being presented (Checkland, 1999). Although the SSM recommends a seven-stage model in order to
understanding the problem situations, the arrows represents a logical structure rather
the step-by-step sequence of the first stage one to seventh stage (Checkland and
Holwell, 1998; Vidgen et al. 2002). “In practice, experienced SSM practitioners use
SSM ideas and framework as a guide to organizing an intervention and not as a
recipe book” (Vidgen et al. 2002).

3.3.3.5 Effective Technical and Human Implementation of Computer-based
Systems (ETHICS)

ETHICS is a methodology based on the participative approach (Nandhakumar and
Jones, 1997) to Information Systems development, and can be categorized as people-
oriented methodologies (Avison and Fitzgerald, 2003a). The methodology was
developed by Mumford (1983b; 1983a; 1995) as a problem solving methodology,
which focuses on maximization of human gains by assisting organizational systems
with new technology to achieve their business goal (Mumford, 1983a). In fact, the
philosophy of ETHICS is different from most Information Systems development
methodologies, because it emphasizes on the socio-technical perspective in which IT
must rely on social and organization factors (Avison and Fitzgerald, 2003a).

Mumford (Avison and Fitzgerald, 2003a p.449) describe ‘the socio-technical
approach’ as “one which recognizes the interaction of technology and people and
produces work systems which are both technically efficient and have social
characteristics which lead to high job satisfaction.” Additionally, Mumford and Weir
(Avison and Fitzgerald, 2003a p.449) defines ‘job satisfaction’ as “the attainment of
a good ‘fit’ between what the employee is seeking from his work – his job needs,
expectations and aspirations – and what he is required to do in his job – the organizational job requirements which mould his experience.”

Mumford (1983a) identifies and explains three objectives of ETHICS which related to the management of change. The first objective is to legitimate a value position in which all users at all organizational levels involve a major part in the design of the Information Systems by allow them to influence the design of the system. By doing so, an increase of job satisfaction and efficiency are more likely a result. The reason is that these user groups know their own job satisfaction needs and have more excellent knowledge of day-to-day information needs than any one outside the group of specialists.

The second objective is to facilitate the group participation and position job satisfaction objectives on top of the common technical and operational objectives. Because the human impact of a new computer system is more likely unpredictable, a clear answer on the achievement of job satisfaction and quality of working life objectives, as well as the computer systems and related organization of work are needed. Otherwise, it may lead to the failure of the system.

The third objective concerns the compatibility between the new technical system and overall organizational system, because technical design is only a small part of the designing process of the Information Systems, which combines work procedures, individual and group activities, specifications regarding the departments, and so forth; it therefore should be well fit to other related systems.
ETHICS is composed of 15 steps (Mumford, 1983a) as follows:

(1) why change?,
(2) system boundaries,
(3) description of existing system,
(4) definition of key objectives,
(5) Definition of key tasks,
(6) key of information needs,
(7) diagnosis of efficiency,
(8) diagnosis of job satisfaction needs,
(9) future analysis,
(10) specifying and weighting efficiency and job satisfaction needs and objectives,
(11) the organizational design of the new system,
(12) technical options,
(13) the preparation of a detailed work design,
(14) implementation,
(15) evaluation.

3.3.3.6 Multiview

Multiview is a user participative approach (Nandhakumar and Jones, 1997) and exploratory approach (Avison and Fitzgerald, 2003a) used in Information Systems development. The methodology perceives Information Systems development as a hybrid process which involves with many stakeholders such as computer specialists who will develop the system and users who will use the system during the process of
its development; it therefore emphasizes both human and technical aspects of the Information Systems (Avison and Fitzgerald, 2003a).

Additionally, Avison and Fitzgerald (2003a p.497) state that, “Multiview is a contingent methodology rather than highly prescriptive, because the skills of different analysts and the situations in which they are constrained to work always has to be taken into account in any project.”

### 3.4 Web Site Development

Although Web technology can be considered as a part of Information Technology and Information Systems described in the previous section, its characteristics are completely different in many ways.

Firstly, the original purpose of Web development is to build an alternative type of medium that extends a channel of communication to online publishing purpose for internal and external stakeholders. In addition, a purpose of the Information Systems development is to facilitate business transactions and works of an organization.

Secondly, the development life cycle of a general Information Systems is a long cycle while a short life-cycle of Web development is quite common for many traditional Web projects. A new proposal of the attitude towards the development life-cycle of Web development will be finally reallocated to the long development life-cycle.
Thirdly, a Web site is content intensive, and composed of unstructured information use while structured information and its flow are the major focus of traditional Information Systems.

Finally, Web development is a rich graphical approach, though it may be an optional to most Information Systems development projects. Consequently, the methodology to Web development needs to be discussed separately from the traditional Information Systems development.

On the other hand, the issues regarding the dynamic Web and Web application development which includes a sophisticated database system will be discussed in section 3.6, Web-based Information Systems.

3.4.1 Characteristics of Static Web Development

A static Web site or read-only information site (Mayhew, 1998) can be classified as a type of publishing tool that adopts the Internet as a communication channel to reach the global audience. The original concept of Web development is to use hypertext to enhance the paper-based system in order to be able to publish the information over the Web. Web development therefore did not initially apply any Information Systems development methodology to develop Web documents in the first period of time. Because of the potential features of the Internet and Web technologies, i.e. global availability, low-cost, and easy to implementation and maintenance, these features make the traditional Web site to have extremely high acceptance and adoption rate throughout the world (Vora, 1998).
In practice, most developers code HTML tags by using a simple text editor (Strauch and Winter, 2002). After the release of graphical Web browser ‘Mosaic’ in 1993, however, the adoption of rich text and images used within the document had thoroughly become very popular. At the same time, many visual HTML editors had been introduced to facilitate Web developers to have a preview of their finished product before officially being published on the online site.

Additionally, a Web developer writes a set of HTML documents and then transfers them to the remote site, which may be located within or outside an organization. The content and information on the published site will stay unchanged and present exact information to all people and every time they visit. Although it is very handle in terms of there are reasonable numbers of documents, in most cases, however, there are usually uncountable numbers of documents, especially, within business organizations. Therefore, the developers will finally encounter some difficulties to handle and maintain the static Web site.

### 3.4.2 Static Web Development Methodologies

Although most Web development projects are currently at least a simple dynamic Web site, a study of the original Web development approach to a static Web site is extremely important because a core structure of dynamic Web sites is still involved with similar techniques as a static Web site.
In most cases, static Web developers start to create a document on the editor software without hesitation in order to make an analysis and design; this ‘ad-hoc’ approach can lead to problems (Linden and Cybulski, 2004). Similar to word processing applications, modern HTML editors allow Web developers to easily create, edit, update and publish the documents directly to their online sites. As a result, a broad range of Web developers, who may have no or little technical background in system development, will have an advantage, and seamlessly be able to create their own sites without hiring the programmers.

Although some contents may appear functional, they nevertheless may inefficiently display the contents in acceptable responded timing. Misunderstanding of the method of usage leads to suffering. Only a short period of time after a massive increase in Web sites, some concerns regarding Web development had become very important issues. Additionally, increasing image usage and a large scale of documents are primary concerns to most Web developers (Fuangvut, 2000). Adoption of some techniques and methodologies may help Web developers to reduce these kinds of problems. Developing a Web site without analysis and design is actually comparable to the pre-methodology era of the system development methodology mentioned by Avison and Fitzgerald (2002; 2003a; 2003b).

Power (2000 p.26) states that, “today a crisis similar to the ‘software crisis’ of the late 1960s exists in Web development. A few years ago most Web sites were little more than digital brochures, and were often termed ‘brochure ware’. Creating such a site didn’t require a great deal of planning – often, simply developing an interface and then populating the site with content worked adequately. Today sites are
becoming much larger and more complex. With the introduction of e-commerce and
dynamic pages, sites have clearly moved away from brochure ware to full-fledged
software application. However, many developers have yet to adopt a robust site-
building methodology and often continue to rely on ad hoc methods.”

Although Powell (2000) mentions about the needs for Web development
methodology and adoption of information development methodology such as the
Waterfall Model, Modified Waterfall and Joint Application Development (JAD) to
Web development, he did not clearly explain a procedure and method of doing so.
However, he recommends a site-building methodology for Web design and
development which explains a guideline for users, site, page, and user-interface
design.

Site-building methodology recommends some guidelines, techniques and tools for a
dynamic Web development projects, on the other hand it may more suitable for static
Web development projects rather than completely fulfilling a requirement for
developing a complex Web application development projects. Similarly, site-
building methodology also can be found in many books by different authors (Sklar,
2000; Valqui and Freire, 2001; Sklar, 2003). Most of them have a very similar idea
and are very useful for basic Web development projects including dynamic Web
development, it, however, will guide only basic techniques to design a Web site in
overall.

3.5 Web-based Information Systems Development (WIS or WBIS)
Web-based Information Systems (Takahashi and Liang, 1997a, Takahashi and Liang, 1997b) can be considered as a superset of Information Systems (Strauch and Winter, 2002). In the traditional Information Systems, a set of computer applications is usually developed dependent to the operating system platform. In the past five years, most medium to large organizations, however, start to transform their computer application into Web-based applications which offer more independence to the operating system as well as increasing the flexibility of development, implementation, and maintenance. The Web now has become a development platform for computer applications.

Web-based applications are usually combinations of multi-functional systems (Standing, 2002). An approach to develop a business application within most organizations has rapidly changed. Previously, the Web applications were developed as a front-end application supported by a traditional Information Systems back-end. Currently, both front-end and back-end applications are generally developed in a Web platform.

There is a fact that a number of organizations rush to develop and implement Web-based applications in order to maintain and gain a competitive advantage. However, the current practice of Web development is more likely an over emphasize on an ad hoc approach which reveals problems such as non-maintainable and user dissatisfaction when developing medium to large Web applications (Koch, 1999; Linden and Cybulski, 2004). Although there are many existing web design methodologies available; the practitioners do not apply these development methodologies (Linden and Cybulski, 2004).
This research will not argue on the matter whether practitioners should adopt the Web design methodologies or not. Conversely, this research would strongly support that the appropriate selection of the methodology should it be applied to both traditional Information Systems and Web-based Information Systems

### 3.5.1 Characteristics of Web-based Information Systems Development

In general, it is quite common that technology adoption needs some time before repositioning itself in order to be able to develop additional functionalities (Moore, 1991; Norman, 1998; Scharl, 2000). The reason is that the development technology available in that period of time may have some limitations such as hardware capability, cost, user experience and so forth before being able to overcome these limitations (Bhavnani, 2005; Gates, 2005). Undoubtedly, the Web development compiles in the same manner as other technology developments.

As it was previously mentioned, the introduction of the methodology for the Web-based Information Systems comes from massive needs of Web site and application development. It can be simply identified and described characteristics of Web applications, putting them into two major categories which are:

- **Basic Web System.**

  The major purpose of this characteristic is to develop Web documents and publish them online to inform and promote them to the internal (via Intranet) and external stakeholders (via Internet). The performance and availability of
the site are not a major critical issue to an organization. Most available pages within the Web site are static pages.

- Advanced Web System.

Adoption of database, transaction server, server-side technology programming, and many other business servers are implemented to facilitate business transactions in the organization. Consequently, fresh content of structured information can be retrieved from the databases and displayed directly to Web page. The performance and availability of the site are a major critical issue to an organization. Because of the complexity of the site, specialists are required to carefully design in every single component of the site. In general, these kinds of Web sites are deployed in the environment of the Intranet and Extranet, which is available only to employees and business partners.

3.5.2 Web-based Information Systems Development Methodologies

A Web-based Information Systems development methodology has derived a concept from hypermedia development methodology. Usually, hypermedia is a combination of rich texts, graphics, audio, video, and so forth by using the concept of a hyperlink in order to provide a cross reference and navigation to other pages or sections of the application. Any hypermedia design and development methodology should be able to adapt to the development of a Web-based Information Systems (Coda et al. 1998).
3.5.2.1 Relationship Management Methodology (RMM)

Relationship Management Methodology (RMM), one of the hypermedia development methodologies, is the most widely accepted for developing Web applications (Scharl, 1999). Isakowitz, Stohr and Balasubramanian (1995) views “hypermedia as a vehicle for managing relationships among information objects” and proposed RMM to accommodate the design and development of hypermedia applications. In fact, RRM addresses design and implementation of large and highly structured hypermedia applications (Lowe and Hall, 1999 p.479).

A major concept of this development methodology was taken from E-R approach (Barna et al. 2003), and is as known as the ‘Relationship Management Data Model’ (RMDM) (Koch, 1999). With the data model, a part of the abstract of the real world is revealed and will be able to expresses an application’s design (Isakowitz, Stohr and Balasubramanian, 1995). In fact, the E-R approach has been used long-time in many traditional Information Systems projects. Most practitioners therefore are very familiar with it and should understand it easily with this methodology.

Isakowitz, Stohr and Balasubramanian (1995) mentioned that feasibility, requirement analysis, and testing are very important phases in software development. However, these are outside the scope of their article. Therefore the original version of RMM focuses on seven steps of the designing phase, which are Entity-Relationship (E-R) design, slice design, navigational design, conversion protocol design, user-interface design, protocol conversion design, run-time behavior design, and construction and testing.
A while after the development methodology had taken place in many real project developments, the major author, Isakowitz, mentioned that there are some limitations of this development methodology in particular to the Web-based Information Systems projects (Isakowitz, Kamis and Koufaris, 1998b). Isakowitz, Kamis, and Koufaris (1998b) listed some limitations, which are: poor slice contents, lack of context in navigation, top-down design only, and loss of the big picture. The extended version of RMM therefore was introduced to overcome these limitations.

In the extended version of RMM, Isakowitz, Kamis and Koufaris (1998b) differentiate Web-based Information Systems applications into three major modelling levels: presentation level (Frasincar, Houben and Vdovjak, 2001), storage level, and logical level (Frasincar, Houben and Vdovjak, 2001). At the presentation level, information is grouped and hyperlinked into web pages. At the storage level, the information including its related images is organized and detailed into physical storage units such as databases, folders, files, and so forth. At the logical level, the presentation level and storage level are linked through a range of modeling techniques such as object-oriented and E-R design.

To overcome the limitations, Isakowitz, Kamis and Koufaris (1998b) introduce two new components and extend the whole process from requirement to implementation. The first component is an application diagram where it is possible to represent the whole application by focusing on both top-down and bottom-up approaches. The second component is called ‘m-slice’, which extends the ability from the original version allows combining elements from any entity in the E-R diagram.
3.5.2.2 Object-Oriented Hypertext Design Method (OOHDM)

Object-Oriented Hypertext Design Method (OOHDM) was originally developed by Daniel Schwabe and Gustavo Rossi who tried to recommend an object-oriented approach to Hypermedia application design including Web-based applications (Schwabe and Rossi, 1995; Schwabe and Rossi, 1998a; Schwabe and Rossi, 1998b). This development methodology was claimed to be suitable for building large and complex hypermedia applications such as web sites, Web-based Information Systems, interactive multimedia applications and so forth (Schwabe and Rossi, 1998a; Rossi, Schwabe and Lyardet, 1999).

Originally, the methodology consists of four major activities, namely, conceptual design, navigational design, abstract interface design, and implementation (Schwabe and Rossi, 1998a; Schwabe and Rossi, 1998b; Koch, 1999; Rossi, Schwabe and Lyardet, 1999). Based on the original authors, it can be summarized as follows.

In conceptual design, OOHDM uses its own modeling, which is similar to those in UML. A model of a system, however, can be constructed using any object-oriented modeling (Schwabe and Rossi, 1998a). “Conceptual modeling is aimed at capturing the domain semantics as ‘neutrally’ as possible, with little or no concern for the types of users and tasks (Rossi, Schwabe and Lyardet, 1999 p.242)”.
Navigation design is an essential for every hypermedia and Web applications and is constructed by taking from a conceptual model. Therefore it allows the developers to build regarding to different user profiles (Schwabe and Rossi, 1998a).

A concept of an abstract interface design is to describe the user-interface of the hypermedia application by using Abstract Data Views (ADVs) (Carneiro et al. 1994) to model static aspects of the interface while a technique based on Statecharts (Harel, 1987) is used to model dynamic aspects of the user-interface (Koch, 1999).

In the final phase, implementation, all models were already constructed and should be implemented regardless of the computer platform (Schwabe and Rossi, 1998a).

A separation of activities allows designers and developers to focus on each activity at a time. However, a sequential order of each activity seems to be needed as the outcomes of each activity are strongly related to the next activity. The authors of the development methodology claim that OOHDM can be used regardless of whether the system is purely object-oriented or a hybrid environment. Additionally, OOHDM has claimed to be sufficient design of most Web-based Information Systems.

Recently, a requirement gathering phase was added to be the first step of OOHDM to capture stakeholder requirements (Rossi, Schwabe and Guimaraes, 2001). Based on the information from the official site of OOHDM by the original authors (OOHDM_Site, 2005), stakeholders of the system and the tasks they must perform need to be identified. Then scenarios can be obtained for each task and type of stakeholder. User Interaction Diagrams were adopted to represent the scenarios in a form of Use Case (Rossi, Schwabe and Guimaraes, 2001).
3.5.2.3 Web Information Systems Development Methodology (WISDM)

Web Information Systems Development Methodology (WISDM) was developed by Richard Vidgen and the inventors of Multiview, David Avison, Bob Wood and Trevor Wood-Harper (Vidgen, 2002; Vidgen et al. 2002; Avison and Fitzgerald, 2003a). The methodology adapted the Multiview2 framework, which originated the design for the traditional information development to the design of a Web-based Information Systems. Therefore, the fundamental assumption of WISDM is derived from Multiview2 (Avison and Wood-Harper, 1986; Avison and Wood-Harper, 1990; Avison et al. 1996; Avison et al. 1998).

According to Vidgen et al (2002), the framework of the methodology is consisted of development method matrix to help developing a Web-based Information Systems. However, there is no sequential ordering of each phase of the development process. The development method matrix is comprised of two dimensions: socio (organizations and people) and technical, and analysis (‘what’ is required) and design (‘how’ it will be accomplished) (Vidgen et al. 2002). In fact, one side represents a hard approach and the other represents a soft approach to Web development.

Stages of Web Information Systems development are: organization analysis, which represents the value creation, work design, which represents the user satisfaction, information analysis, which represents the requirement specification, technical design, which represents the software model, and human computer interface design, which represents user interface (Vidgen et al. 2002).
Additionally, Vidgen et al (2002) explained that the methods matrix uses the metaphor of a still camera where the focus of attention changes as the camera zooms in and out to find the aspect and situation and it can move from one to another when the situation changes. All fives aspects are potentially seen at the same time; the level of resolution, however, may be different.

3.5.2.4 Web Site Design Method (WSDM)

Web Site Design Method (WSDM) was originally developed by De Troyer, O. and Leune, C. (De Troyer and Leune, 1998; De Troyer, 2001). There are two major characteristics of the methodology. Firstly, the WSDM has a user-centered approach (‘audience-driven’) to Web development. Secondly, the methodology makes a clear distinction between a conceptual design which does regardless of any implementation detail, and presentation design, which focuses more on the technical issues (De Troyer and Leune, 1998, De Troyer, 2001).

The development methodology originally focuses on a kiosk type of the Web site (De Troyer and Leune, 1998). It however, was enhanced to support the Web application in its latest version (De Troyer 2001). In contrast to a data driven approach, WSDM starts with a set of potential Web site’s users who are classified into user classes. Each user class will have a different set of data which is modelled on a perspective from the user classes. The authors claim that by this approach there is more satisfaction from users regarding a better set of available data, which is tailored to each user group (De Troyer and Leune, 1998).
Originally, the development methodology consists of four major phases: user modeling, conceptual design, implementation design, and implementation. In user modeling, there are two sub-phases, namely, user classification and user class description. Potential users of the Web site are first identified and categorized into classes. The authors mention that “each organization or process can be divided in a number of activities. Each activity involves people. These people are potential users of the site. These activities and the users who are involved can be represented in a schema” (De Troyer and Leune, 1998 p.88).

In conceptual design, there are two sub-phases, namely, object modeling and navigational design. The information requirements of users in each class are transformed into object modeling, while an appropriate set of navigation for each class is also designed. In the implementation design, the look and feel of the Web site is designed based on the conceptual design phase. In the final phase, implementation, the emphasis is to work on a technical perspective that combines all related web technologies.

A minor changed version of WSDM was mentioned by De Troyer (De Troyer, 2001); it, however, still be concentrated on kiosk-type of Web site. The first step of the methodology is recommended with a mission statement, which was assumed to be a dummy part in the original version. In the conceptual design, object modeling has been renamed as information modeling.
Currently, De Troyer and Casteleyn (2003) mentioned that the revision of the conceptual phase of WSDM is to handle a complex Web applications development. Task modeling was recommended to replace information modeling. This gives more details of the process of each task regarding the users and their requirements.

### 3.5.2.5 Internet Commerce Development Methodology (ICDM)

The Internet Commerce Development Methodology (ICDM) was created by Craig Standing (Standing, 2001; Standing, 2002). Although Internet commerce is a primary concern of this methodology, the author of the methodology claims that it can be adapted to other Web-based Information Systems. Based on a paper from Standing (2001, 2002), the methodology can be summarized as follows.

Major objectives of ICDM are to focus on different aspects of the development, which includes both technical and organizational issues, and providing a framework for developers. In fact, ICDM considers e-business development as part of a combination of many different issues within an organization. It therefore needs to address other parts such as business strategy, managerial and organizational culture issues in the development. In contrast to the majority of Information Systems development methodologies, ICDM is a business analysis methodology and system development methodology.

ICDM provides both management and technical strategies by dividing the process into a set of components: Web management strategy, strategy development phase, met development strategy, user involvement, site and component development,
requirement analysis techniques, functional requirements framework, physical architecture framework, design phase, and implementation and evolution phases.

- In the Web management strategy, a big picture of the management and development of the e-commerce project is divided into three tiers: metadevelopment and management perspectives which provide a framework for development, components development, and developing and implementation of the system, which needs to include various perspectives from specialists.

- In the strategy development phase, a competitive situation of the organization is analyzed using a SWOT analysis, which examines the Strength, Weakness, Opportunities, and Threats of the business. Additionally, value chain analysis and scope of change should be performed.

- In the meta-development strategy, the Web management team is responsible for selecting appropriate strategies for developing the Web site based on regulation or control in both content and design.

- In terms of user involvement, users of the Web site should be able to be involved in various stages of operations and reviews. Questionnaire and interview can be used during the process of the development.

- In site and component development, a multi-disciplinary team is still necessary in order to manage and implement business strategy perspective, rather than only a technology perspective.
• In requirement analysis techniques, gathering techniques are implemented for obtaining information from users. Prototypes also can be developed in order to facilitate and define requirements.

• In the functional requirements framework, a detailed definition of each function needs to be defined in this stage.

• In the physical architecture framework, this phase is to identify techniques for defining the requirements for the Internet project by referring to a type of the project.

• In the design phase, various types of design such as desired image, usability, promotion and so forth are considered.

• In the implementation and evolution phases, the implementation and evolution plan needs to be set in order to oversee the site by the Web management team.

3.5.2.6 Intranet Design Methodology (IDM)

The Intranet Design Methodology (IDM) was developed by Lee (1998). The methodology emphasizes on the navigation and user-interface design for the construction of the Intranet site which was generally implemented within an organization. Additionally, the users are employees.
This methodology provides a set of feedback loops which located in many sections of the methodology. The feedback loops are flexible to improve the quality of the design. Lee (1998) claimed that the methodology enables the designer to alternate use between top-down and bottom-up approach because the abstraction which the information is categorized into a local and global coherence, and the instantiation mechanisms, which application components can be evaluated and redesigned, are supported in this methodology.

The methodology is composed of many stages: navigation requirement analysis, information requirement analysis, navigation design, file structure design and virtual structure design, user interface design, and implementation and testing. Based on Lee (1998), it can be summarized as follows.

- **Navigation Requirement Analysis.** The navigation can be divided into navigation domains which are the sub-application domains and the navigation thresholds which represents a group of the information elements.

- **Information Requirement Analysis.** This phase is a continuing analysis process regarding the navigation requirement analysis. An appending of missing or removing the redundancy information will need to be done. Additionally, this phase concerns about information security which the individual access privileges can be identified.

- **Navigation Designs.** The identified information will be categorized into nodes with links. In order to complete this task, two concepts, which are meta
information structure and information structure, are recommended. The meta information structure implements a set of node types to manage the information, whereas each node of the meta information structure are organized using the classes, sub-classes, instances, attributes, and attribute values in the information structure process.

- File Structure Design and Virtual Structure Design. A file structure can be simply explained as a set of files which contain a structure of nodes and links.

- User Interface Design. The concept of the user interface design was adapted from the frame concept that mentioned by (Minsky, 1975). Lee (1998) mentioned that user interface is a collection of meta information structure frame systems, which composed of the menu, index, and the content sub-frame systems.

- Implementation and Testing. In the implementation process, the specification according to the design phase can be implemented by mapping identified nodes and links into the files and links.

### 3.6 Summary

This chapter reviews the issues from selected development methodologies, which have already been well-accepted within the area of traditional and Web Information Systems development. Although the characteristics of them are somewhat different, their major objectives are considered the same as they try to facilitate the developer team in developing the system.
Developers may already realize that a single development methodology may not fit with all situations facing the Information Systems and Web project. Until now, the methodology for portal development, especially in Campus Portal is not widely mentioned by practitioners and researchers. In fact, some of Campus Portal and enterprise portal methodologies are hidden from the public because they are embedded with the commercial portal system.

According to the literature reviews, it can be realized that there is no comprehensive formal development methodology for the Campus Portal available for the practitioners. Therefore, an adoption of the formal development methodology, that suitable to the characteristics of the Campus Portal and the users’ requirements is in doubt.

Before evaluating and selecting an appropriate formal development methodology, which suitable in major aspects of the Campus Portal development, a clear understanding in the current practice from the other institutions can reflect the direction of the development. Moreover, some limitations and problems on the current implemented sites may be detected.
4.1 Overview

According to Wynekoop and Russo (Hirschheim, Iivari and Klein, 1997), the finding of their research, which studied the adoption of the traditional system development methodologies, shows that 65% of the respondents in 100 organizations had constructed their own in-house development methodology; 89% believed that the formal development methodologies, which are available, should be adapted on a project-by-project basis. Additionally, Hardy, Thompson and Edwards (Hirschheim, Iivari, and Klein, 1997) found that 38% of the methodology used was in-house developed, whereas 88% of them customized other methodology in order to fit to specific projects.

According to Avison and Fitzgerald (2002; 2003a; 2003b), the decline in the adoption of development methodologies is caused by some factors, i.e. not contingent on local factors, a one-dimensional approach, inflexibility, and so forth. Moreover, the transformation of the development platform, which has shifted from the traditional environment to a Web-based environment since the mid 1990s, may be a possible factor regarding the perceived risk of failure in development and implementation.

Recently, the Web has become a development platform in itself, which allows developers to build their Information Systems project completely in the Web-based...
environment. In fact, most large organizations have transformed their organizational Information Systems applications into a Web-based platform.

The possibility of failure, which has always been present in traditional Information Systems with the acceptance and adoption of any development methodology, will likely become a serious problem for Web development. This is in part due to the need for a shorter development cycle with the Web platform and environment. Certainly, the problems may occur through the adoption of methodologies for Campus Portal development if those methodologies cannot fulfill the requirements and oversee the real problems regarding the development platforms of Campus Portals.

4.1.1 A Web Development Crisis

The Web development crisis may be caused by two major factors as described in the following points.

• Misunderstandings of the Web Development Concept

Many Web sites are created without planning or analysis. In fact, most Web developers are not interested in adopting any standard development technique and methodology. More importantly, the Web system development often relies heavily on an individual or a small group of developers. According to Ginige and Murugesan (2001b), although the Web development has an important artistic side, it should follow the same discipline as in science and engineering. Moreover, a study of Barry and Lang (2001) shows that there were only a small number of respondents who
implemented a methodology for hypermedia development when they developed the system.

- **Incorrect Selection of the Development Methodology**

Vidgen (2002 p.178) mentions that “although the design of the human computer interface (HCI) has long been a fundamental activity in the system development process, the area of graphic design for the Internet represents a significant departure for the traditional Information Systems developer.”

Many traditional Information Systems development methodologies are based on outdated concepts that go back to the 1990s. Although these methodologies have been utilized to develop Web sites, the scope and capability of these methodologies are very limited because they are not designed with this kind of purpose in mind. Because the characteristics of the traditional and Web-based systems are different, it is necessary to carefully select an appropriate development methodology that is suitable to a Web development project. These factors should definitely be taken into consideration when developing a Campus Portal.

**4.1.2 An Awareness of the Campus Portal Development Crisis**

The crisis regarding the Campus Portal is somewhat similar to that in Web-based development in general because of the lack of a clear understanding of the requirements and behaviors of Campus Portals. As a result, some developers may apply none or the wrong type of methodology to Campus Portal development.
In fact, the Campus Portal integrates broad ranges of content and many online services across the campus into a single complex project. Very often, the Campus Portal is viewed more as a user interface application by some developers. The Campus Portal is more than a user interface application. It is really a Web-based Information Systems, which needs to be integrated with many other views such as organization, stakeholders and technology, in order to develop the system effectively. Moreover, the Campus Portal development methodology, therefore, should be balanced between Information Systems and general Web development perspectives.

4.2 Soft Systems Methodology as a Selection of the Development Methodology for a Campus Portal

This research places its emphasis on the Soft Systems Methodology for in-house development of a Malay Language Campus Portal. In order to select the appropriate development methodology to develop a Campus Portal, this section will provide an overview of the nature of Campus Portals, some selection criteria, a comparison between the traditional and Web development methodologies and a filtering process to match the criteria to the characteristics of the Campus Portal. The research will then investigate the details in the SSM as selected existing methodologies which can match the major characteristics and demands of Campus Portals.

4.2.1 Criteria for the Selection
Ginige and Murugesan (2001a) state that disciplined approaches and new methods and tools for Web development are extremely necessary in order to avoid a perceived Web crisis and achieve success in the development of complex Web-based systems. Murugesan (1999) also mention that there are a number of criteria, such as the unique features of the new medium, the operational environments, scenarios and multiplicity of user profiles, and the skills and knowledge of people building Web-based systems, that need to be considered in order to successfully develop and implement Web-based systems.

Adapting the criteria of Murugesan (1999) to the Campus Portal development, the selected development methodology therefore should match the following criteria, taking into account the special characteristics of Campus Portals.

• **Multi-dimensionality**

Previous research shows that factors influential in major failures of development project are: lack of commitment in top management and inadequate user involvement (Wallace and Keil, 2004). To satisfy user needs, a system must be developed accordingly and fulfill the requirement of the users. Campus Portal users are composed of many groups of stakeholders that require different needs and may have a direct or indirect relationship to each others. Each group also performs different activities to facilitate and achieve their objectives. The development methodology therefore should consider the development of a Campus Portal with a user focus from the multiple views of stakeholders.

• **Flexibility**
Inflexibility in the development methodology inevitably leads to problems (Avison and Fitzgerald, 2003a). A Campus Portal is a complex project, integrated with many Web-based Information Systems and other online services. Consequently, the development methodology should be flexible enough to allow the developers to adjust methods, tools, and techniques as well as the process of the development to suit the local situation.

4.2.2 Comparison of Existing Development Methodologies

Avison and Fitzgerald (2003a p.555-572) provides a framework for comparing methodologies in the final chapter of their book. They mentioned that “comparing methodologies is a very difficult task, and the results of any such work are likely to be criticized on many counts. There are as many views as there are writers on methodologies. The views of analysts do not necessarily coincide with users, and those views are often at variance with those of the methodology authors” Avison and Fitzgerald (2003a p.555-572).

They also mentioned that a number of additional elements might be appended to the framework in order to compare methodologies for a particular purpose. As most traditional Information Systems methodologies have been referred to by Avison and Fitzgerald (2003a), this research will also adopt their approach in order to explain the traditional development methodologies. This will be extended to Web development methodologies in this research.

Because of the wide range of differences between the traditional Information Systems development methodologies and Web-based development methodologies,
(2003a), this research will customize and use only some elements of their framework for comparing development methodologies against the Campus Portal’s criteria as described in the previous section. This comparison will concentrate on positive aspects, rather than on the disadvantages or pitfalls of all possible development methodologies in order to select and justify the most appropriate development methodology for the Campus Portal based on the defined criteria.

4.2.2.1 Philosophy

The general philosophy of all Information Systems and Web development methodologies is to improve the areas of development in each respective world. An in-depth philosophy of each development methodology, however, varies and depends on many factors such as paradigm, objectives, domains and targets (Avison and Fitzgerald, 2003a).

• Paradigm

A paradigm is “the most fundamental set of assumptions adopted by professional community that allows its members to share similar perception and engage in commonly shared practices” (Hirschheim and Klein, 1989 p.1201). Avison and Fitzgerald (2003a) identify two major sets of paradigms: a science paradigm, which focuses in hard scientific development or physical world (Hirschheim and Klein, 1989), and a system paradigm, which is characterized by holistic approach or social world (Hirschheim and Klein, 1989).

Among the traditional Information Systems development methodologies, SSM, ETHICS and Multiview2 are categorized into system paradigm and that SDLC,
SSADM and JSD belong to the science paradigm. The reason is that SSM, ETHICS and Multiview provide a perspective for both technical and social perspectives, whereas the others emphasis on the technical perspective of the Information Systems development.

4.3 SSM as Selected Development Methodology for Malay Language Campus Portal Project

It can be concluded from the analysis above that there is only one methodology which fits the unique characteristics of a Campus Portal which is the Soft Systems Methodology. The reasons whereby are SSM can:

- Achieve the systems and holistic view of the situation under consideration;
- Obtain the worldviews of various participants involved in the situation;
- Awareness of the conflicting perspectives and issues within the system;
- Involve the participants when looking for the solution to the issues rose thus giving them the control over the situation;
- Involve all participants in cycle of action and learning; and
- Develop relevant system.

4.3.1 Understanding Soft Systems Methodology (SSM)

Within systems thinking there are two complementary traditions which are the hard systems and the soft systems. Influenced by control and information theory, hard systems include Systems Engineering, Systems Analysis, and Operations Research.
Soft systems represent a reaction to the inability of hard systems to adequately respond to real world problems (Checkland, 1981a, 1981b; Jenkins, 1969).

Hard systems methodologies are used when addressing issues that are clearly defined and that fits to well define decision-making procedures. Soft systems methodologies (SSM), on the other hand, have proven effective where human behavior is irrational and in addressing complex or “messy” problems (Checkland, 1981b).

The core of SSM is the construction of models of the systems that are being studied. These models are used to understand and discuss how to bring about organizational change. SSM is made up of seven-stage process as shown in Figure 4.

**Stage 1. Explore the problem situation within the real-world frame of thinking.**

Information such as organizational history, culture, structure, types and number of stakeholders, their perspectives and assumptions first needs to be collected. The purpose of this analysis phase is to vaguely have an idea of the problem situation even though the idea can be unstructured so that a range of possible and hopefully relevant choices can be made.

**Stage 2. Express the problem situation.**

The product of the second stage is used to build a rich picture of the problem situation. This rich picture should draw the structure and processes of the organization which it operates. The picture by structure is the physical layout, hierarchy, reporting structure, and the patterns of communication which can formal and informal communication. Where else, the picture by process is the organization’s
basic activities such as resource allocation, deployment, monitoring, and control. The relation between structure and process of the rich picture should show the problems, tasks, and elements of the environment in an understandable way. It should identify relevant themes, develop a shared understanding of different perspectives, and be a basis for further discussion (Checkland, 1981b).

**Stage 3. Root definitions of relevant systems in the problem situation.**

This stage is generally the most difficult part of the process. There must be a root definition which is a statement defining what is relevant to the system and who is either affected by it or could affect it. The root definitions is built using the mnemonic CATWOE as shown in Table 1 below.

<table>
<thead>
<tr>
<th>C customer</th>
<th>Who would be the victims/beneficiaries of the purposeful activity?</th>
</tr>
</thead>
<tbody>
<tr>
<td>A actors</td>
<td>Who would do the activities?</td>
</tr>
<tr>
<td>T transformation process</td>
<td>What is the purposeful activity expressed as Input --------- Transformation--------Output?</td>
</tr>
<tr>
<td>W Weltanschauung</td>
<td>What view of the world makes this definition meaningful?</td>
</tr>
<tr>
<td>O owner</td>
<td>Who could stop this activity?</td>
</tr>
<tr>
<td>E environmental constraints</td>
<td>What constraints in its environment does this system take as given?</td>
</tr>
</tbody>
</table>

**Table 1: CATWOE**

The core of the root definition is in the transformation process, which changes inputs which can be either logical or physical concrete or an abstract into outputs. Inputs
and outputs are expressed as nouns in SSM and can be transformed where by an actions does not get transformed.

There are five criteria by which the transformation process is judged which are:

- Means that justify the ends of the transformation process
- Consideration of the resources
- Effectiveness of the transformation process
- Ethicality of the transformation process
- Elegance of the transformation process

The next step is the construction of a conceptual model once stage 3 is completed.

**Stage 4. The construction of a conceptual model(s).**

The conceptual model is not a description of the real world. It is actually build to understand the activities that require to bring upon changes, and to conceptually construct a system that represents stakeholder perspectives about the desired system and associated human activities (Checkland & Scholes, 1990). The conceptual model is measured against the five criteria mentioned in Stage 3 above.

**Stage 5. Comparing the conceptual model(s) with the real world problem situation.**

The conceptual models constructed in Stage 4 gives a meaningful structure about the problem situation and it highlights the differences between the actual situation and perceived reality. The discussions around this model allow the participants to rethink their assumptions and discuss improvement changes in the problem situation. This discussion leads to Stage 6.
Stage 6. Determining desirable and feasible changes.

The target of this stage is to explore desirable and feasible changes. Checkland (1981b) has described three types of changes which comprise changes in structure, in procedures, and in attitudes. Changes in structure are referred to organizational groupings, reporting structures, or structures of functional responsibilities. Changes in procedures include all the activities that go on within the organization, such as operational processes and reporting conventions. Last but not least, changes in attitude refer to changes in the expectations that people have of the behavior of other actors as well as changes in their readiness to rate certain kinds of behavior as bad or good relative to others.

Stage 7. Making changes to improve the situation.

This is the implementation step. This stage relates to the person responsible in taking the action and the types of action that should be taken. Besides that, timetables, resources and scope are important here. Behavioral changes need to be considered along with the impacts and effects on current systems. There should not be a change for the sake of a change. This stage looks out for a solid seeks to commitment and responsibility, to organize an action plan.
As a conclusion, when it comes to applied to complex real world hurdles, SSM enables the user to organize a problem situation that has multiple conflicting objectives, purposes, and values which can be discussed. SSM also becomes a process with which it can mend through conflicting objectives in search of feasible solutions that can lead to qualitatively new solutions.
CHAPTER 5

The Use of Soft Systems Methodology in the Establishment of a Malay Language Learning Portal

5.1 Using SSM to Define the ‘Core’ University Malaya Portal Functions

This chapter establishes the framework for conducting the Malay Language Learning Portal project. The method for the project is developed from Soft Systems Methodology (SSM). The methodological approach adopted is shown in the diagram below.

![Methodological approach to the work on core UM Portal Functions](image)

**Figure 5:** The methodological approach to the work on core UM Portal Functions
The rough model provides the conceptual foundation for undertaking this research in information systems development. The development of SSM (including structured analysis) provides the method for operational of the rough model. Taken together, they form the intellectual framework for the Malay Language Learning Portal development project reported in the next section.
5.2 Using SSM in Planning the Development of the Malay Language Learning Portal

In this section, I have used SSM in 3 different ways during my research study of the development of the Malay Language Learning Portal. The 3 different ways are:

- To help plan the project
- To do parts of it
- To structure the author’s way of thinking about it

Based on the University Malaya Campus Portal, a few foreign students were interviewed. Basically these entire interview sections consisted of several phases:

1. Information collection and familiarization.

   These were an informal interview which I ran by querying the foreign students on their understanding level of the Campus Portal. I collected their answers and started my study based on that.


   The foreign students came up with some suggestion and analysis, which needed some processes to be set up. This entire process took 2 days effort.

3. Testing out the concept.

   I gave some examples of other language sites and tested out their needs for easy understanding for further development needs of the portal.

4. Agreeing proposed changes

   On the final day, I presented them with the rough model of the portal in which they agreed upon.

5. Implementation.
This phase was the development phase of the accepted portal analysis. It was agreed by the team of foreign students that this development phase has to address and solve a few issues such as the role of the Malay Language Learning Portal, the performance level and the future implications for University Malaya.

The Malay Language Learning Portal uses internet technologies to serve a limited private community of users. They are often associated with organizations - ‘a private computer network that uses internet standards and protocols to enable members of an organization to communicate and collaborate more efficiently with one another’ (Greer 1998). There are many technological aspects to consider when developing a portal. Smith (1999) highlights eleven main items to be assessed: network infrastructure, hardware platforms, firewalls, server software, client software, site management software, application development tools, application servers, implementation approaches, what databases to use and e-mail.

According to Telleen (1996a) within the infrastructure of a portal there are two basic types of page: content pages and broker pages. Content pages contain the information of value to users, and broker pages provide the context for users to find the content pages useful for their current requirements. The content pages can take various forms such as plain text or as active pages where information is gathered from a database operating behind-the-scenes. Broker pages also appear in various formats but all serve the same purpose, to give the user information that is relevant to requirements. The most common forms of broker pages are those of hyperlink, and search engines. However, it is increasingly common for a combination of both of these to be used. These are seen in the form of search engines returning hits in the form of hyperlinks.
that are categorized in context to the search criteria. The main functions of a portal are:

- Publishing information
- Searching for information
- Transacting with functionality (for instance legacy systems)
- Interacting between individuals and groups
- Recording organizational memory

According to Telleen (1996a) an ideal portal infrastructure relies on four distinct roles for managing the formal content, which also formulates the root definitions that illustrates the CATWOE analysis and model:

- The Web Administrator - is responsible for facilitating co-operative opportunities among the various parties - e.g. departments - in the enterprise and administering the enterprise content management infrastructure. By contrast, the Webmaster is responsible for the technical infrastructure. The same person may serve in both roles.
- Publishers - determine what kinds of formal information will be created and maintained by their organization. The publishers own the processes and policies that officially sanctioned information must follow.
- Editors - determine what official information will be created for specific activities and manage the information creation and update process, including the formal review cycles.
- Authors - create the content of the intranet by contrast, discerns five key roles in intranet initiation and implementation: technology champion, organizational sponsor, coordinator, developer and content provider. The people who carry out the intranet roles may require formal organizational structures to provide communication and co-
ordination support as they do their work. The three basic organizational bodies (Telleen 1996b) are the Web Council, Editorial Boards and Web Technical Committee.

As with all technical innovation, stakeholders may exhibit different levels of enthusiasm. Moore (1991) categorizes them as:

- Early adopters (those who are willing to try out a new idea)
- Mainstream adopters (the more conservative group who prefer gradual change, this makes up the majority of the population)
- Laggards (very resistant to change and unwilling to adopt an innovation)

5.3 Use of SSM in Doing Part of the Work and Structuring the Thinking

The intervention took the following two stage shape:

1. The analysis stage concentrated on making sense of the present situation. Research techniques included interviewing, document study and interview. All interactions were recorded using the diary technique. Analysis techniques included interaction models, and rich pictures.

2. The conceptualization stage concentrated on scenario building. A version of root definitions known as system definitions (Mathiassen et al 2000), together with interaction modeling, were used to help conceptualize new ways of working and portal support. Transformation modeling was used to help design the process. The method is derived directly from the framework in the previous section. The first conceptualization is of a desired (negotiated) set of purposeful interactions. The
second conceptualization, dependent on the first, is of a transformation, a set of organized change activities intended to achieve the desired state. Action is based upon the development plan. The method for achieving the analysis and conceptualizations is given by the developed SSM model (Figure 5). Where interactions (regularities in social practice) are analyzed or conceptualized, interaction models (SSM) based on the ‘dimensions of the duality of structure’ model are used. Where transformation is analyzed or conceptualized, tools based on transformation modeling (SSM) are employed. The objective is to arrive at ‘defensible conceptualizations of desirable and feasible future interactions supported by UM’ and ‘actions consistent with achieving those future interactions.’ Defensibility rests on the well-argued theoretical derivation of the method and tools, together with meticulous and well-reported execution of the process.

Stage 1

The analysis of the Malay Language Learning Portal focused on one area (corresponding to earlier structured thinking about information systems):

1. The portal in development: analysis of the social practice through development of a new portal.

2. The problem situation which has been identified is that the foreign students find it difficult to communicate in our National Language which is the Malay Language. This hinders them from a user friendly environment of communication and getting them around the campus easily.

Stage 2
The work in stage two involves conceptualization and planning. With the help of the systems and structured tools, and much discussion with stakeholders, an understanding of how the portal will be developed is defined. Scenario building took the form of a workshop with academic staff, administrators and foreign students. A series of potential development routes were discussed (table 3).

| A portal that support foreign students in terms of their problems in adapting to a new environment. |
| An interactive medium which facilitates dialogue between students and students, and students and staff. |
| A portal to the major information system sites of interest around the globe. |
| A portal which supports on-line teaching and learning. |
| A series of topic-based learning zones (knowledge management, system development, networks.........) |

**Table 2: Potential development routes**

**Stage 3**

At this stage, I would like to stress upon the root definitions in our current problem situation which involves the foreign students. To construct root definitions, I have used the mnemonic CATWOE in relation to the problem situation (Table 2).

<table>
<thead>
<tr>
<th>C customer</th>
<th>Q1: Who would be the main users of the portal?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ans: <strong>Foreign Students and Lecturers.</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A actors</th>
<th>Q2: Who would be the actors of the portal?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ans: <strong>Lecturers and foreign students of the Computer Science Faculty of University Malaya.</strong></td>
<td></td>
</tr>
</tbody>
</table>

| T transformation process | Q3: What is the purposeful activity expressed as Input ----
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>--------------</td>
<td>Transformation--------Output?</td>
</tr>
</tbody>
</table>


Table 3: Root Definitions and Answers

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
</table>
| W Weltanschauung | Q4: What view of the world makes this definition meaningful?  
    | Ans: Development of Malay Language Campus Portal is collaborated with foreign students and lecturers of University Malaya. |
| O owner | Q5: Who would be the owner of the portal?  
    | Ans: University Malaya Web Portal Administrator. |
| E environmental constraints | Q6: What constraints in its environment does this system take as given?  
    | Ans: Reduces the time for classroom teaching. |

The core of the root definition shown in Table 2 is actually the link that connects the transformation process. The transformation process which is spoken about is to change the foreign students from do not the Malay Language to knowing the Malay Language.

**Stage 4**

Stage 4 relates to the conceptual model. The conceptual model for this problem situation can be categorized to few approaches. From my structural thinking, the foreign students can learn the Malay language by taking part in group discussions, exchanging ideas among peers, communication among peers who know the Malay Language, using translation books or dictionaries and nevertheless, also from
watching Malay movies which comes with English subtitles. Figure 7 below illustrates the conceptual model of the Malay Language Learning problem situation which we are currently facing.

Figure 7: Conceptual Model of the Problem Situation Faced by Foreign Students of University Malaya

Stage 5
The conceptual model constructed in Figure 7 gives a structure to a meaningful problem situation which we are currently facing. It arises many queries and it also gives a clearer picture of the real world scenario and the conceptual scenario. In the real world which is from my observation, many foreign students use classroom activities to learn the Malay Language. Classroom activities comprises of group discussion and exchanging ideas between peers who knows the Malay Language.
Once they are out of the classroom, they don’t actually have any means to learn the Malay Language which is flexible and convenient to them. Figure 8 below shows the real world scenario.

![Classroom Activities Diagram]

**Figure 8: The Real World Scenario of the Problem Situation Faced by Foreign Students of University Malaya**

**Stage 6**

At this stage, based on the real world scenario and the conceptual model, we need a more flexible platform to actually allow foreign students to learn our National Language. With our fast moving technology, having a portal which can be accessed at any time and from anywhere would be the best choice for them to learn the Malay Language at their own pace of time. The details of the portal activities are illustrated as models in this stage.

These models are relatively easy to convert into conventional project plans, since these are also based on decomposition of activities. Each of the activities becomes a
project activity, and can be allotted resources and scheduled. The difference is, however, that whereas orthodox project planning focuses on the planning whilst assuming that the project activities are obvious, the activities in these models are supported by much prior analysis, itself based on theoretical justification.

The understandings gained through analysis, scenario development and planning were developed into an action plan. The proposals were discussed at a high level planning meeting, adopted with some changes, and are presently being implemented.

- Planning for inclusion of foreign student home pages as part of induction exercises
- Acquisition of a tool to manage the interface between databases and web pages.
- Development of prototype for alerting the students to personally relevant new pages (combining database and HTML technologies).

The Table 4 below details out the differences and the similarities between the conceptual model and the real world scenario. Basically, it summarizes Figure 7 and Figure 8 on the differences and similarities.

<table>
<thead>
<tr>
<th>Differences</th>
<th>Similarities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The conceptualize model is designed in such away that the foreign students uses books and dictionaries to learn the Malay Language compared to the real world scenario.</td>
<td>1. The real world scenario and the conceptualize model has similarities in which, the foreign students have been seen exchanging ideas and have been in communication among Peers who know the Malay Language.</td>
</tr>
<tr>
<td>2. The conceptualize model has the foreign students to watch and listen to Malay Programs in Television and Radio compared to the real world scenario.</td>
<td>2. The real world scenario and the conceptualize model has another similarity in which, foreign students have been participating in Group Discussions for learning the Malay Language.</td>
</tr>
</tbody>
</table>

**Table 4: Differences and Similarities between Conceptual Model and the Real Scenario of Malay Language Learning Portal**
Figure 9: Use Case diagram for Malay Language Learning Portal
The Use Case Model in this research is used to describe the interaction between users and a system, as in this research is illustrated in Figure 9.

Stage 7
Stage 7 comprises of the implementation stage. Hereby, I have detailed out the portal layout which is what the actually the implementation layout of the Malay Language Learning Portal.

The actors (users) describe the roles of the parties involved in the portal. In this case, users of the portal are differentiated into Student, Lecturer, and Administrator which I have grouped into 4 different modules of scope; Student Management, Learning Management Module, Quiz Module and finally the Forum Module (Figure 10).

- **Student Management**

  Student Management Module comprises of student registration which can allow them to login to the system as normal users to follow the learning materials. The system will give out an error message if the password is incorrectly entered. Administrator will grant access to the new users before they can actually login
and use the system. The Administrator by default has access to all and can administer the platform to add/delete users. This student management module database is kept in Apache web server which is used in this development of portal. Apache accounts for around 60% of the web server market, putting it ahead of all other contenders combined.

- **Learning Materials Module**

This learning materials module consist of the vocabulary, grammar and the phrases pages in the portal. This can be accessed by both registered students and lecturers. Lecturers have special rights to read and write to the learning management module which will be updated to the administrator as the page has been updated and the administrator will thereafter upload the portal which the recent changes. Students only has the read access to the portal, where else the Administrator has full access to the portal. This entire model was scripted using PHP scripting tool. Like ASP, PHP script is processed by the Web server. After the server plays with the PHP code, it returns plain old HTML back to the browser. This kind of interaction allows for some pretty complex operations.

- **Quiz Module**

This Quiz Module is actually a test yourself module. This aims for students to test themselves on their level of understanding. The Quiz Module is updated in a monthly manner by the Administrator. This module was created using the PHP scripting tool.

- **Forum Module**
The Forum Module has 2 pages of the portal which is the Guestbook and the Forum page. The Guestbook is for students to sign off with some feedback, while the Forum Page is a discussion room for student and lecturers. Students and Lecturers can exchange their views and ideas through this Forum Module and future enhancement can be reviewed from the Forum Module. The administrator can send system announcement as well to all users of the portal.

The intervention of this research should be seen as part of an evolving change to working practices and the portal, rather than the whole development picture. The intervention deliberately focused on the social elements rather than technical details, but these were naturally also important. Interestingly, technical rationality was sometimes used in a legitimizing role. Participants with better technical knowledge had better credibility in the political decision making process simply because development was viewed as a predominantly technical arena as shown in Table 5 and lastly the layout design of portal shown in Figure 11.

<table>
<thead>
<tr>
<th>Functionalities of the Portal</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>To learn simple sentences and translation from English to Malay Language.</strong></td>
<td>Grammar Page is created which has translation from English to Malay Language.</td>
</tr>
<tr>
<td><strong>To learn basic vocabulary in Malay Language.</strong></td>
<td>Vocabulary Page is created which has translation from English to Malay Language.</td>
</tr>
<tr>
<td><strong>To learn common phrases in Malay Language.</strong></td>
<td>Phrases Page is created which has translation from English to Malay Language.</td>
</tr>
<tr>
<td><strong>To test the users knowledge and understanding of the Malay Language.</strong></td>
<td>Quiz Page is created which has a few test for the users.</td>
</tr>
</tbody>
</table>
Table 5: Solution for Malay Language Learning Portal matching the Conceptual Model

Figure 11: Malay Language Learning Portal Layout Design
5.5 Conclusion

This chapter outlined a Malay Language Learning Campus Portal which used the framework developed in Figure 12. Interaction and transformation modeling, together with appropriate structured analysis were used to help analyze and plan for development of the campus portal. The shape of the intervention followed the rough model. Initially, analysis helped to gain insight into the current set of interactions. The insights in University Malaya Campus Portal helped in the conceptualization of an improved set of interactions (information practice) focused around a more student centered portal. The screenshot of each page is in the Appendix B and the web portal address is http://elearn.100webspace.net/login/login.php
CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

6.1 Overview

This chapter provides a summary and discussion of the key issues associated with the results and findings of the multiple studies detailed in their respective chapters of this dissertation. The contribution, limitations and future directions of the research are also presented.

6.2 What Has Been Achieved?

In the literature review conducted in Phase One of the research and presented in Chapters 2 and 3, it was apparent that there was no clear definition of Campus Portals, let alone an accepted methodology for their development. Before being able to choose a development methodology for a Campus Portal, knowledge and understanding of Campus Portal issues and concepts needed to be identified, built up and clarified. This research adopted the model for accumulating knowledge and understanding, which was proposed by Carroll and Swatman (2000), to fit to the theme of this research. By adopting this approach, a series of phased studies were undertaken to help build understanding in the area of Campus Portals.

The main objective of this research, as stated in Chapter 1, was “to compose a comprehensive and thorough development methodology for Campus Portals which
will help practitioners to effectively develop a Campus Portal with regard to its critical and unique characteristics in supporting the variety of users’ online activities and their preferences”. To demonstrate that this has been achieved, the phases of the research are logically been summarized together with the associated conclusion.

6.3 Evaluation of the Portal

The success of this portal is determined by a test of the effectiveness and efficiency of the portal and also by user satisfaction. In order to achieve this, the evaluation part is divided into a few parts:-

I. Personal details
   - By which, I asked a few foreign students about where they studies, their related program and their contact details such as contact number and email address.

II. The web pages
   - I asked questions about the portal layout, the usage of the dual language (English and the Malay Language) and the content of the portal.

III. Objective achievement section
   - The most important section is the objective achievement section. This section consists of the usage frequency of the portal, hours spent and whether the forum of the portal was useful or not.

III. Personal comments
- This part requests the students to comment on the knowledge gained by the portal and suggestions for improvement of the portal. The Questionnaire Form which is in Appendix A has the portion for Personal Comments for students to fill up. Based on their feedback, this portal can be enhanced further for future use.

6.4 Discussion of the Evaluation Results

These results are gathered from five foreign students who took part in the portal sessions. The results are charted in the graph as shown below. The results were summarized based on the 10 questions set for them. There were 3 categories, which are Poor, Good and Excellent. The details are explained in Figure 11 below.

![Figure 13: Overall results of the questionnaire from 5 students](image-url)
Based on the summary of the results, most of the foreign students felt the colour coordination of the portal was too dull and they were not too happy with the colour and the overall layout. 3 of them were happy with the easy usage of the portal and to navigate from one page to another and on-line help. As overall, they felt this portal can be improved in terms of more words and more quizzes could be added.

6.5 Contribution of the Research

This research makes a significant contribution to the use of Soft Systems Methodology in Portal Development. Basically, it narrows downs all possible inputs of stakeholders and gives out one precise objective in which I had elaborated in this research using the chosen methodology which is SSM which is best suited for the development of the Malay Language Learning Portal.

6.6 Limitations of the Research

Every research has its own weakness and limitation as a perfect and complete research does not really exist. There are numbers of limitations found in this research, as will now be described.

Firstly, all the stages of the Soft Systems Methodology (SSM) cannot be fully described in this research because there are other important issues related to the development of the Campus Portal that needed to be clarified and identified prior to the actual construction of the development methodology. However, the important
issues to the development of the Campus Portal have been identified and clarified. For the next version of an enhanced SSM, the current one should be further evaluated and tested in future research.

Secondly, the elucidation of the user requirements from the usage pattern of online activities differed somewhat from the method recognized by many researchers and practitioners. In general practice, most researchers and practitioners gather the user requirements using interviews, questionnaires and discussion group methods, and asking users directly what kind of needs they have of the system. The approach in this research was found to be very useful in terms of showing the visual pattern of online activity and making sense of them to determine the appropriate level of personalization and customization that should be designed and implemented in Campus Portal projects.

In the case of the development in a Campus Portal project, a stage for the design of the personalization and customization characteristics needs to be appended into the Soft Systems development methodology. These highlights to all software engineering students that they need to critically consider the issue of personalization and customization throughout the development, and include this functionality in the basic design of the portal. Moreover, they need to make sure that at the implemented level the personalization and customization continues to support the current usage pattern of the end-users’ online activities throughout the life of the portal.

In this important section of the chapter, the result of the selection process for the proposed development methodology particularly suitable for the Campus Portal
projects has been presented, discussed and justified. The characteristics of the Campus Portal, which are personalization and customization as well as usability, were identified and proposed as crucial to the design stage of the development methodology.

Because there are numbers of issues and criteria which influence the decision to select an appropriate methodology for Campus Portal development, this chapter has discussed and described these in addition to establishing the selection criteria in order to filter the characteristics of the existing methodologies to meet the requirement and characteristics of Campus Portal development.

In addition, the attributes in both traditional and Web-based development methodologies, which were described in the Chapter 3, were investigated and analyzed to align them with the critical characteristics of the Campus Portal.

### 6.7 Future Research Direction

As previously mentioned in the first chapter, there are many areas related to development methodology research and so future research on this topic can be extended. Firstly, SSM needs to be extended and modified in terms of customization and personalization for a more user-friendly solution. Based on the customization and the personalization, the new modified SSM needs to be tested in terms of its usability.
It is hoped that the significant contributions of this research to the relevant body of knowledge will benefit other Information Systems and system development researchers and, most importantly, the practitioners.
REFERENCES


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APPENDIX A

Personal Details:

Name: ………………………………..  Semester/Year: ………………………………
University Name: ………………………  Course Taken: ………………………………

<table>
<thead>
<tr>
<th>Questionnaire for Malay Language Learning Portal</th>
<th>Poor</th>
<th>Good</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. It is easy to use the portal.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. It is easy to find the words or phrases I need.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. The user interface is pleasant.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. The system gives error message if a word or phrases is not found.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. The information provided in the system is easy to understand.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. How is the speed of the portal when navigating through different pages?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Are the quiz questions easy to understand?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Is the on-line help useful?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. How is the performance of the UNDO to reverse control actions?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Are you happy with the overall structure and usability of the portal?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Personal Comments:

……………………………………………………………….
……………………………………………………………….
……………………………………………………………….
……………………………………………………………….
……………………………………………………………….


APPENDIX B

New User Registration Page
Login Page
Welcome Page
<table>
<thead>
<tr>
<th>English</th>
<th>Malay</th>
</tr>
</thead>
<tbody>
<tr>
<td>I'm sorry for coming late.</td>
<td>Maaf, saya datang terlambat.</td>
</tr>
<tr>
<td>Please excuse me, I have forgotten.</td>
<td>Maaf, saya sudah lupa.</td>
</tr>
<tr>
<td>Excuse me sir, what is the name of this road?</td>
<td>Maaf, saya, tuan, ape nama jalan ini?</td>
</tr>
<tr>
<td>That was not done intentionally. Please excuse me.</td>
<td>Maaf, haluan sengaja, saya lupa.</td>
</tr>
<tr>
<td>Where do you live?</td>
<td>Di mana rumah anda?</td>
</tr>
<tr>
<td>Where is your house?</td>
<td>Di mana rumah anda?</td>
</tr>
</tbody>
</table>

Phrases Page
Vocabulary Page
Forum Page
Guestbook Page