Chapter 3

Research Methodology

3.1 Introduction

Methodology refers to the analysis of the methods used appropriate to a field of study. It is a systematic way of accomplishing certain tasks and is defined as a collection of procedures, techniques, tools and documentation aids that helps a software developer to speed up and simplify the software development process (Pressman, 2001).

In this research, a combination of methodologies was used. This chapter describes the methodology for this dissertation and the methodology that is used for system development.

3.2 Research Methodology

The purpose of the research methodology is to provide a view of the methods that was applied into this research. In addition, it defines the system development life cycle (SDLC) for developing the system.
The Research methodology defined here is based on the methods used to collect information on the real world problem pertaining to on-line retail chain stores and to define system requirements. From the analysis study, understanding of the literature reviewed and analysis of questionnaires, will lead the initial requirements for the system. Evolutionary prototype is used as methodology for SDLC. Once the initial requirements are ready, the next step is to design the system, followed by coding and testing.

### 3.2.1 Research Questions and Methodology

In this research, the researcher seeks to solve the following research question related to online purchasing and decision support system:

1. Is the system able to determine which stores should distribute customers’ order based on the lowest cost of order’s delivery?
2. Is the system able to determine another store nearest to the customer to deliver a product in the customers’ order based on the second lowest cost, if this product isn’t available in the first selected stores?
3. Can the system help management apply the concept of decentralization in decision making?
4. Is the system flexible in managing a variable number of head offices and stores?
5. Is the system able to manage product inventory for each store and define which product has reached to the reorder point?
6. Is the system able to find which supplier should supply a product for a store?

7. Are the customers able to buy from the online shop in a convenient way?

Therefore, this research covers to two types of e-commerce, B2C and B2B e-commerce.

3.3 Research Technique

There are many techniques used to collect data. The techniques used to collect data for this research are as follows:

- Literature review.
- Survey (questionnaire).
- Brainstorming.
- E-mail, i.e. send email to a manager in retail chain stores.

3.3.1 Literature Review

As was mentioned in chapter 2, four on-line purchasing systems were reviewed in order to determine similar features and functionalities. The features of the four systems have been summarized and can be seen in the table 2.6.
3.3.2 Research survey

Survey questionnaires are used to obtain quantitative descriptions of what business and customers have and what they need. The structures of the questionnaires are designed to capture data about companies that have online purchasing system, and customers who buy from an online shop. Two sets of questionnaire were designed.

The first set is for companies who have online purchasing system that allows customers to purchase online. This questionnaire is used to capture data about the status of available systems, and invites suggestions on system improvement. (See Appendix A)

The second set was designed for customers and was used to capture data about customers’ behaviors when they are online, such as how they could buy, and what customers look for when they are shopping online. (See Appendix B)

Customer’s questionnaire was sent to a random sample of 217 customers while the company’s questionnaire was sent to a random sample of 22 company addresses. The result of the questionnaires will be discussed in detail in the next chapter.

3.3.3 E-mail

It is used to communicate with persons who works in companies have on-line purchasing system and decision support system to ask them about system. Because
physical meetings conducted is so difficult because some of them out of Malaysia or he hasn't enough time to manage a meeting, so the communicated through e-mails more easily. Actually, the questions that are asked about the features and drawback in current system and what the new features required in new system. In addition, asked questions about the main feature in this thesis.

3.4 System Development Life Cycle

Like a traditional software development, the process of e-commerce development can also be divided into different life cycle steps. This can be done through methodology that will be adopted into the research.

The system development life cycle (SDLC) is the entire process of formal, logical steps taken to develop a software product. There are many life cycle models that exist to develop the system, and the researcher is at liberty to chose a model that fit this project, time and constraint. The phases of SDLC can vary somewhat but generally include the following: Requirements specification, software design, coding, testing, and delivery.
3.5 SDLC for developing the On-line decision Support System for Retail Chain Store (ODSS-RCS)

Due the circumstance surrounding this research, in particular time constraint, the SDLC that was chosen for system development is Evolutionary Prototyping.

The goals of prototyping vary from system to system, and different prototyping strategies may be adopted, depending on the problem domain.

3.5.1 What is Evolutionary Prototyping (EP)?

Evolutionary prototyping uses multiple iterations of requirements gathering, analysis, design, development, and testing of prototype. After completion of each iteration, the result is analyzed by the researcher. Their response creates the next level of requirements and defines the next iteration. And this goes on until the operational system is ready (http://www.doc.mmu.ac.uk).

Advantages

- Suits rapidly changing or poorly understood requirements, so it suits a project in which the development areas are not well known to the developers
- Provides the end-user with clear signs of progress
- Gives the end-user a sense of control over the project’s progress
Disadvantages

- Very hard to set deadlines and make time estimates. In the real world developing a prototype may extend the schedule but the prototyping time may be recovered because rework is avoided.

Evolutionary prototyping focuses on gathering a correct and consistent set of requirements. This lends forward the building of quality software by means of ongoing clarification of real requirements be it clarification of existing requirements and/or the discovery of previously missing or unknown requirements (Carter & et al, 2001).

Building (ODSS-RCS) is a challenging activity. When the thesis stared, the problem domain and the system requirements are often not clearly understood. In order to maximize the likelihood of on-time delivery and to minimize cost and time, it can be useful to construct an initial prototype system. A prototype can help in identifying the system requirements and in minimizing uncertainty or missing requirements. Building prototypes is a good way to SDLC. (Eric H. Nyberg, 2004)

3.5.2 Justification for Using the Evolutionary Prototyping in SDLS for (ODSS-RCS)

1. Clarifies the requirements needed in a system.

Evolutionary prototyping helps to alleviate changing opinions and vague specification by embodying the requirements in a tangible form. So potential users
and supervisor can see their requirements in the prototyped systems, and therefore can validate the requirements reflected in the prototype. By the iterative nature of the prototype’s evolution, a software developer has the opportunity to accept, or change a requirement.

2. Find out unknown requirements.
When a researcher starts a project, he/she does not have a clear picture of what should be developed. Based on the objectives, the researcher may find additional functions that the prototype must provide. “The key is that prototypes are an excellent means of eliciting correct, consistent, and complete specifications of requirements” (Davis, 1992).

3. Requirements Analysis and Design by view
Requirements analysis and design for online systems have two main challenges for a software. First, it is generally difficult to provide a detailed specification for the interface and the visual components of a web site such as graphics, layout, etc. Second, there exist functional requirements which customers may take for granted, therefore EP can help a developer to get rid of these challenges.
4. Flexible to change research assumptions.

Evolutionary prototyping is beneficial to the researcher to shift (update) his assumptions and requirements. Some of these assumptions will be discussed with the supervisor and some written in documentation. Evolutionary development models allow these effects and changes.

5. Provides a method to communicate about Systems.

Evolutionary prototyping is facilitating communication between the researcher and his supervisor. So when researcher has a new idea, the prototype helps him to explain what has been done and if there are any suggestion from supervisor he can easily incorporate the suggestion into the prototype. There is less argument about what a prototype does, and reduce the misinterpretations from vagueness and equivocalness in natural language specifications.

6. Reduce development schedule and minimize cost

Prototyping minimize development costs and, development schedules, if there is any change in project, the researcher can do that in early phase and this will require less time and effort. If there is a wrong in SDLC, the researcher will change in documentation, design and models. "Many stakeholders are also less intimidated by the presentation of a prototype than by the paper avalanche of specifications, designs, screen layouts, and diagrams found too often in methods such as the Waterfall model" (Antón & Carter & Earp & Williams, 2001).
7. Build knowledge from experiment

Evolutionary prototyping helps to build knowledge base for researcher from what he did and if any mistake happens wrong in any phase the researcher will acquire new knowledge and try to avoid this in the next phase. “Evolutionary models of prototyping take advantage of knowledge acquired as development progresses” (Antón & Carter & Earp & Williams, 2001).

3.5.3 Evolutionary Prototyping (EP) for ODSS-RCS

EP for ODSS-RCS has six development phases which are in Requirements analysis/Gathering/Integration, System Design, Implementation (Build Prototype), System Debugging / Testing, User Evaluation, and Deliver to user. As shown in figure 3.1, in the real word, each phase overlaps and repeats the phases until the system is built. Each phase of EP for ODSS-RCS is explained in detail below.
Figure 3.1: The evolutionary prototyping for an online decision support system for retail chain stores (EP for ODSS-RCS)
3.5.3.a Requirements analysis / Gathering and Integration

Requirements definition is the most crucial part of this project. A requirement is a description of what a system should do, (Lutz & Woodhouse, 1997). Figure 3.2 shows the process of gathering the initial set of requirements from the study of literature review, discussion with potential users, and reviewing other similar software systems, so as to contribute to the understanding on what the system must do.

The initial requirements are documented in the initial requirements document template. New requirements are agreed during the analysis and negotiation processes with potential users, whereby, the agreed requirements are then added to the exiting requirements. As in most software processes, the design of a new prototype release occurs as the designers decide how the new sets of requirements will be incorporated into the revised prototypes. Initial requirement set is documented using the initial requirements document and this continues until the final requirements document is completed.

![Figure 3.2: Requirements analysis and gathering model's through EP](image)

Figure 3.2: Requirements analysis and gathering model's through EP
3.5.3.b System Design:

Initial system design begins by using the partial Design Document from the initial requirement document. This is repeated until the software process design of the new prototype release occurs as the designers decide on how the new sets of requirements will be incorporated into the revised prototypes. The architectural design, subsystem and module specification, and interface design are revised and minimally documented as necessary to ensure a design and prototype structure. The system design is considered as the connecting link or bridge between the existing set of requirements and the prototype implementation, as shown in Figure 3.3.

![Figure 3.3: System design model's through EP](image-url)
### 3.5.3.c Implementation (Build Prototype)

Once new requirements are agreed, and the initial design or a change in the design of a new requirement is done, then the researcher will begin developing a prototype or the revised prototypes. The prototype is iteratively modified to respond to initial design for new requirements. Figure 3.4 shows the implementation. At the end of each prototyping cycle, the researcher starts to develop tested prototype.

![Figure 3.4: Implementing prototype model's through EP](image)

### 3.5.3.d System Debugging / Testing

When the prototyping phase and the tested prototype phase is done the researcher and the potential users may judge whether or not the prototype meets their expectations. If the result from partial test isn't satisfactory, then a change in the requirements, design and revised prototypes are carried out. But if everything is satisfactory, then we enter a new iteration for new requirement and this is shown in
Figure 3.5. Programming and debugging is still performed until the requirements are met and the design is fulfilled at the conclusion of system implementation.

![System debugging and testing model's through EP](image)

**Figure 3.5: System debugging and testing model's through EP**

### 3.5.3.e User Evaluation

Figure 3.6 shows the user evaluation model for the system. When implementation prototyping for the system is done, the final prototype goes through extensive testing. At the end of the testing if the researcher and the potential users feel that the system is not satisfactory, then new requirements and modifications are carried out, but if it is satisfactory this means that the system is complete. After that, the system is tested by two categories of users, i.e. first the online company and second the customers. If the feedback from the users are good and there are no
new requirements to add, the system is complete, and is ready to be delivered. Or else, a new iteration of the prototype will be implemented in order to incorporate the new requirements.

Figure 3. 6: User Evaluation Model for System through EP

3.5.3.f Deliver the system

Figure 3.7 shows the process when the system is ready to be delivered. The delivered system should encompass the needed functionality and the approved system qualities as dictated by the users.
3.6 Summary

This chapter has looked into the research methodology which was used in this dissertation. The techniques used to collect the related information from potential users were surveyed and e-mail address. The literature review is used to study the current system and the related research previously done. The evolutionary prototype method was used in the system development life cycle of ODSS-RCS.
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