PHASE 2: SYSTEMS ANALYSIS

System Requirements

Steps in the Analysis Phase
Requirements Definition
Requirements Analysis Techniques
Requirements Gathering Techniques

Steps in the Analysis Phase

System analysis is the second phase of the systems development life cycle (SDLC).

In the systems planning phase, we have discussed the process of preliminary investigation to determine the feasibility of the project through a feasibility report.

If the report was accepted by the steering committee, a project plan was performed, and on that basis, the systems analysis phase is started.

In the analysis phase, our objective is to:

- Determine and document how the current system works
- Determine how the system could work better
- Develop a logical or business model of the new system
- Make recommendations to management

We will go through three major steps to address the above objectives:

- Determine Systems Requirements
- Analyze Systems Requirements
- Evaluate Alternative Solutions

The major output of the systems analysis phase is a Systems Proposal that describes the findings of the analysis.

In this section, we discuss the process of determining requirements.

Requirement analysis will be discussed in several sections, through the discussion of data-flow diagrams, data dictionary, entity-relationship diagrams, and process description.

Finally, evaluation of alternative solutions will be discussed in another section.
Requirements Gathering Techniques

The feasibility report in the systems planning phase did not contain details of the systems requirement. Thus a full-blown study for the requirement of the system is necessary to understand the detail operations of the business.

To determine system requirements, the analyst sought information of the current system and the opportunities for improvements in the following areas:

- **System Objectives:** (Provide Examples)
  - Identify the objectives of the current system
  - Evaluate these objectives

- **System Inputs and Outputs:** (Provide Examples)
  - Identify the inputs and outputs of the current system
  - The origin of the inputs and the destinations of the outputs

- **System Functions:** (Provide Examples)
  - Define the functions of the current system
  - Identify the components of the systems: manual procedures, user interfaces, computer programs, files and databases
  - Identify timings of input, output and processing
  - Identify controls on data entry, security, and processing

In order to gather this information, the analyst uses various information-gathering techniques. Some of the techniques are:

- Interviews
- Questionnaires
- Observation
- Work and Product Sampling
- Joint Application Design (JAD)
- Prototyping

The systems analyst uses more than one technique to collect required information.
The interview is the most common method of information-gathering techniques. There are several basic steps to the interview process:

- Preparation for the Interview
- Design of Interview Questions
- Conduct the Interview
- Document the Interview
- Perform a Follow-Up Interview.

Preparation for the Interview

To plan for the interview, the systems analyst first reviews the documents available on the company, existing system, and users. He or she examines:

- Company’s goals and objectives
- Forms, reports, and business models of the current system
- Organization chart and user roles.

By consulting the organization chart and in discussion with the sponsoring agent of the organization, the analyst prepares a list of interviewees who will provide various levels of information for the current system and future needs of the system.

Higher levels of management normally provide an overview of the current system and its future needs. The lower-level users provide the details of operation of the system.

Thus, the top management is interviewed first, then the department heads, followed by the next level of employees in the hierarchy, up to the lowest levels of the users.

Once a list of prospective interviewees is generated, the analyst schedules interview with the personnel.

Designing Interview Questions: There are three types of interview questions

- **Closed-ended questions**: Closed-ended questions enable analysts to control the interview and obtain information they need. Answers to the questions require only a short answer of one or two words (true/false, multiple choice, rating on a scale, or ranking).

- **Open-ended questions**: Open-ended questions are those that leave rooms for further elaboration by the interviewee. These questions provide additional information or problems that a user normally does not like to talk about.

- **Probes**: These are follow-up questions in response to one of the above questions, when the analyst is unclear about the answer.
**Interview Outline**

<table>
<thead>
<tr>
<th>Interviewee: Name of person being interviewed</th>
<th>Interviewer: Name of person leading interview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location/Medium: Office, conference room, or phone number</td>
<td>Appointment Date: Start Time: End Time:</td>
</tr>
<tr>
<td>Objectives: What data to collect</td>
<td>Reminders: Background/experience of interviewee Known opinions of interviewee</td>
</tr>
<tr>
<td>On what to gain agreement</td>
<td></td>
</tr>
<tr>
<td>What areas to explore</td>
<td></td>
</tr>
<tr>
<td>Agenda: Introduction</td>
<td>Approximate Time:</td>
</tr>
<tr>
<td>Background on Project</td>
<td>1 minute</td>
</tr>
<tr>
<td>Overview of Interview</td>
<td>2 minutes</td>
</tr>
<tr>
<td>Topics To Be Covered</td>
<td>1 minute</td>
</tr>
<tr>
<td>Permission to Tape Record</td>
<td>5 minutes</td>
</tr>
<tr>
<td>Topic 1 Questions</td>
<td>7 minutes</td>
</tr>
<tr>
<td>Topic 2 Questions</td>
<td>...</td>
</tr>
<tr>
<td>Summary of Major Points</td>
<td>2 minutes</td>
</tr>
<tr>
<td>Questions from Interviewee</td>
<td>5 minutes</td>
</tr>
<tr>
<td>Closing</td>
<td>1 minute</td>
</tr>
</tbody>
</table>

**General Observations:**

- Interviewee seemed busy — probably need to call in a few days for follow-up questions, since he gave only short answers. PC was turned off — probably not a regular PC user.

**Unresolved Issues, Topics not Covered:**

- He needs to look up sales figures from 1996. He raised the issue of how to handle returned goods, but we did not have time to discuss.
Conduct the Interview

There are certain guidelines for a successful interview. Some of them are:

- Listen very carefully to the interviewee and give opportunity to answer.
- Take careful notes. Take a second person, if needed to take notes.
- If permitted by the organization, record the interview.
- Ask questions, even if they sound “dumb”. Not asking questions may result wrong conclusion causing further potential problems.
- Give the interviewee opportunity to ask questions.
- Separate facts from individual user opinions. Facts are important but opinions are not.
- Do not make any premature promise on any part of the delivery of the system.
- Thank the interviewee at the end and mention that a follow-up interview may occur to further clarify questions that may arise.

Document the Interview

After the interview, the analyst should organize and type interview notes within 48 hours (i.e., before fading away from memory) in the form of a report.

Write down any unclear or additional questions that may arise during this process and make a list of questions for follow-up interview.

The report is sent to the interviewee with a request to read, make comments, and his or her approval.

Follow-Up Interview

Follow-up interview arises due to the questions that may arise in writing the interview report and obtaining a response of the report.

Depending on the number and type of questions, the follow-up interview can be performed in person or over telephone or any other suitable mechanism (mail, fax, and e-mail).
INTERVIEW SUMMARY

Project: The Georgeson Department Stores
Date: January 20, 1993
Prepared By: George Kubal
Interviewee: Maria Lopez, Store Manager, Highland Park, IL

Project Scope: Ms. Lopez wishes to change the existing sales transaction system in the store in order to speed up customer checkout, improve tracking of inventory, automate the reordering of merchandise, and obtain up-to-date information on sales revenue and the profits yielded each month. Although the present system uses an OCR system to scan merchandise tags, prices of sale merchandise or special coupon discounts must be entered manually. The OCR wand appears to have a high error rate, causing the sales clerk to manually key in data for each item purchased. Even when the wand is working, the clerks prefer to use the manual entry method. The handling of credit cards such as VISA and MasterCard is also very slow and requires the clerk to manually key in all pertinent information. The credit transaction then requires a separate slip to be written manually by the clerk. The use of the store’s own credit card requires the same lengthy process. Whenever the store offers a special sale with discounts on selected merchandise, the clerks must manually enter the discount rate. If one item is wrong on a sales slip, the entire sales slip must be manually rekeyed.

The inventory tracking portion of the present system is not working to her satisfaction; merchandise runs out frequently. Sales forecasting is desirable but can be delayed until the sales transaction system has been improved.

System Objectives
1. To improve speed and ease of sales transactions.
2. To reduce manual keying of sales data.
3. To produce current information regarding sales volume, revenue, and profits per monthly period, preferably by the 5th of each month. On demand queries are also desired.
4. To automatically create the orders for restocking merchandise and do so in a timely fashion. Note: Individual items require a separate lead time for goods.

Required System Features
1. Speedy and accurate customer transaction procedure.
2. Monthly sales reports (prepared no later than the 5th of each month).
3. Reorder of merchandise on an as-needed basis.
4. Sales forecasting to be installed later.
A project that requires input from a large number of people, the questionnaire can be a valuable tool to determine system requirements.

A questionnaire is a document containing a number of standard questions that can be sent to many individuals.

Questionnaires can be used to obtain information about workloads, reports received, volumes of transactions handled, types of job duties, difficulties, and opinions of how the job could be performed.

**Choosing Respondents to Questionnaire**

It is important to select the right group of people to send the questionnaire. The group should be a representative sample of all users of the system.

In general, the following methods can be used to obtain a representative sample:

- **Random Sample:** Select randomly any number of persons to interview, or from a list of documents select any number of documents to review. For example, out of 100 users, select any 20 persons to interview.

- **Systematic Sample:** Select every nth person to interview or every nth document to review. For example, out of 100 users, select every 10th person.

- **Stratified Sample:** In this case, select a representative from a category of users. For example, select users from sales, accounting, inventory departments, and so on. (Select people form different zip codes.)

- **Purposeful Sample:** Select only those people who satisfy certain criteria. For example, select users who worked with the system for more than two years.

- **Convenient Sample:** These are the people who are willing to be surveyed, or those most motivated to respond.
Designing Questionnaire

When designing a questionnaire, the most important rule is to make sure that the questions collect the right data that can be used to further fact-finding information for the system.

Some guidelines for designing questionnaire are:

- Brief and user-friendly
- Clear instructions
- Ask questions related to the requirement
- Questions in logical order
- Simple wording to avoid misunderstanding
- Avoid leading questions
- Open-ending questions are difficult to tabulate
- Limit questions raising concern/negative issues
- Section for general comments
- Test the questionnaire in advance
**Advantages and Disadvantages of Interview and Questionnaire**

**Interview**

- Interview is a good tool to collect detailed information.
- It allows exploration and follow-up questions.
- Interviews build rapport between the users and the systems analyst.
- Interviews are time-extensive and expensive.
- Interviews cannot be performed with many people in a short time.

**Questionnaire**

- Questionnaires are most useful when used for specific purposes rather than for more general information gathering.
- Questionnaires can be given to many people at a time, whereas interviews can be performed on a single person at a time.
- They are most useful for closed-end questions, although some open-ended questions can be included for information gathering.
- Questionnaires are less expensive and less time-consuming.
- Questionnaires can be performed on paper, over the telephone and electronically.
- Questionnaires are a rigidly structured means to obtain answers to pre-selected inquiries.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Interviews</th>
<th>Questionnaires</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Richness</td>
<td>High (many channels)</td>
<td>Medium to low (only responses)</td>
</tr>
<tr>
<td>Time Required</td>
<td>Can be extensive</td>
<td>Low to moderate</td>
</tr>
<tr>
<td>Expense</td>
<td>Can be high</td>
<td>Moderate</td>
</tr>
<tr>
<td>Chance for Follow-up and Probing</td>
<td>Good: probing and clarification questions can be asked by either interviewer or interviewee</td>
<td>Limited: probing and follow-up done after original data collection</td>
</tr>
<tr>
<td>Confidentiality</td>
<td>Interviewee is known to interviewer</td>
<td>Respondent can be unknown</td>
</tr>
<tr>
<td>Involvement of Subject</td>
<td>Interviewee is involved and committed</td>
<td>Respondent is passive, no clear commitment</td>
</tr>
<tr>
<td>Potential Audience</td>
<td>Limited numbers, but complete responses from those interviewed</td>
<td>Can be quite large, but lack of response from some can bias results</td>
</tr>
</tbody>
</table>
Observation

The observation of current operating procedures of the system is another fact-finding technique.

- A system can be understood better and faster through observation than other techniques.

- It also allows opportunities to verify statements and answers gathered through interviews and questionnaires.

- It also allows opportunities to build relationships with the users.

- A successful observation should be planned. In preparing a checklist for observation, consider the following:

  - Ask questions to obtain a good understanding of the system operation procedure.
  
  - Observe all steps in the processing cycle and note the output from each procedural step.
  
  - Examine each form, record, and report. Determine the purpose of each item on the documents.
  
  - Consider observing each person working with the system to complete a process.
  
  - Talk to people who receive current reports to see whether the reports are complete, timely, accurate, and in a useful form.

  - *Consider the Hawthorne Effect:* During the observation day, people may work more efficiently than the normal day. Operations may also run less smoothly because people might be nervous during observation.
Work and Product Sampling

Sampling refers to the collection of examples of actual documents or products of the system. The samples might include:

- Data-entry forms and screens
- Program codes (if any)
- Transaction records
- Work requests
- Reports (qualitative and quantitative)
- Web site
- Operational Procedures and manuals
- Error logs
- Complaint summaries
- Memos

The main objective of any sampling is to ensure that it represents the overall population accurately. For example, while sampling inventory transactions, select a sample of transactions that are typical of actual inventory operations.
Joint Application Design (JAD)

Developed by IBM, Joint Application Design (JAD) represents an alternative to interviewing users.

Instead of separate interviews, a work session consisting of a task force of users, managers, and IT professionals is conducted to gather information, discuss business needs, and define the new system requirements.

This group usually meets over a period of several hours to few days in a meeting room outside the work area.

Because of the wide range of user input, JAD produces the best possible requirements of a new system than a single analyst can provide.

The Organization of the JAD Session

All participants attending a JAD session plays a role according to following:

- **Session Leader**: The session leader organizes and runs the JAD. This person guides the team to keep on agenda, aids participants in openly expressing ideas, and resolving conflicts and disagreements between participants.

- **Active Participants**: The users and managers who know the necessary facts and details regarding both the current system and the objectives of the future system.

- **Observers**: These are IT staff such as analysts, programmers, operators, or any other technical person who can learn by participation. They may also provide some technical assistance when needed. Expert in some functional areas of business (accounting, billing, etc.) may also participate to provide assistance.

- **Recorders**: These are IT personnel who document the discussions and conclusions of the session. This record is formally published and distributed to the participants after the session.
Prototyping

The prototyping is an iterative process involving analysts and users whereby a rudimentary version of an information system is built and rebuilt according to user feedback.

Prototyping methodology covers three phases of the SDLC: analysis, design, and implementation, concurrently and repeatedly in a cycle until the system is completed.

In order to develop a prototype during the requirement analysis, the analyst performs some interviews and collects necessary documents.

With the basic requirements from the users, a quick analysis and design of the system is performed, and a prototype of the system containing main features of the requirements, are developed.

The prototype is then handed to the users for testing and to provide comments; which are then reanalyzed and redesigned, and a second prototype is developed.

The process continues in a cycle until the users and developers agree to a final systems requirement.
Advantaging and Disadvantaging of Prototyping

Advantages of Prototyping

- Prototyping is most useful when user requirements are not clear or well understood.
- One or a few users are involved with the system.
- Possible designs are complex and require concrete form to evaluate.
- Tools (such as form and report generators) and data are readily available to rapidly build working systems.

Disadvantages of Prototyping

- A tendency to avoid creating formal documents of system requirements, which can then make the system more difficult to develop into a fully working system.
- Prototyping can become very idiosyncratic to the initial user and difficult to diffuse or adapt to other users.
- Prototypes are often built as stand-alone systems, thus ignoring issues of sharing data and interactions with other systems.
- Prototyping might miss some very important system requirements such as security, data entry controls, or standardization of data across systems.

Selecting the Appropriate Techniques

<table>
<thead>
<tr>
<th>Type of Information</th>
<th>Interviews</th>
<th>Joint Application Design</th>
<th>Questionnaires</th>
<th>Document Analysis</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>As-is, improvements to-be</td>
<td>High</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Depth of Information</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Breadth of Information</td>
<td>low</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Integration of Information</td>
<td>Medium</td>
<td>High</td>
<td>low</td>
<td>low</td>
<td>low</td>
</tr>
<tr>
<td>User Involvement</td>
<td>Medium</td>
<td>low-Medium</td>
<td>low</td>
<td>low</td>
<td>low-Medium</td>
</tr>
<tr>
<td>Cost</td>
<td>Medium</td>
<td>low-Medium</td>
<td>low</td>
<td>low</td>
<td>low-Medium</td>
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</table>