แก้ไขครั้งล่าสุดเมื่อวันที่ 3 กุมภาพันธ์ 2568

2301361

SYSTEMS ANALYSIS AND DESIGN

3

Requirements Determination

The Analysis Phase

The analysis phase is so named because the term **analysis** refers to breaking a whole into its parts with the intent of understanding the parts' nature, function, and interrelationships. In the context of the SDLC, the outputs of the planning phase (the system request, feasibility study, and project plan), outline the business goals for the new system, define the project's scope, assess project feasibility, and provide the initial work plan. These planning phase deliverables are the key inputs into the analysis phase. In the analysis phase, the systems analyst works extensively with the business users of the new system to understand their needs from the new system.

The basic process of analysis involves three steps:

- Understand the existing situation (the **as-is system**).
- Identify improvements.
- Define requirements for the new system (the **to-be system**).

Sometimes the first step (i.e., understanding the as-is system) is skipped or done in a limited manner. This happens when no current system exists, if the existing system and processes are irrelevant to the future system, or if the project team is using a RAD or agile development methodology in which the as-is system is not emphasized.

As an example, let us say that a user states that the new system should "**eliminate inventory stock-outs.**" The new requirements will then be based on the issues that truly need to be fixed.

In this case, the requirements might include, in part:

On hand inventory is the amount of inventory that a company owns and has in stock.

- The system will update on-hand inventory levels twice per day.
- The system will produce an out-of-stock notification immediately when an item quantity on hand reaches the item reorder point.
- The system will include a recommended supplier with every out-of-stock notification.
- The system will produce a supply purchase order that is sent to the appropriate manager for approval.
- The system will send an approved supply purchase order to the supplier via secure electronic communication.

As this example demonstrates, it is unrealistic to expect the true requirements to be delivered on a silver platter during a few conversations with the business users. The analyst must be prepared to dig into the situation and discover requirements. This is rarely an easy process.

ต้องสะสมประสบการณ์ เริ่มจากระบบเล็ก ๆ แล้วขยับไปทำระบบที่ใหญ่ขึ้น ถ้าเป็นกิจการส่วนตัว เช่น software house จะมีแรงจูงใจให้ทำ System Analysis (SA) สูงกว่าการทำงานในองค์กรมาก เพราะถ้าวิเคราะห์ผิด จะส่งผลต่อกำไร/ขาดทุนโดยตรง ถ้าวิเคราะห์ถูกงานก็เสร็จเร็ว ได้กำไรเยอะ

Requirements Determination

Requirements determination is performed to transform the system request's high-level statement of business requirements into a more detailed, precise list of what the new system must do to provide the needed value to the business.

What Is a Requirement?

A **requirement** is simply a statement of what the system must do or what characteristics it needs to have. During a systems development project, requirements are created that provide different perspectives. For example, we may describe what the business needs (**business requirements**); what the users need to do (**user requirements**); what the software should do (**functional requirements**); characteristics the system should have (**nonfunctional requirements**); and how the system should be built (**system requirements**). Although this list of requirement categories may seem intimidating at first, the categories merely reflect the purpose of the requirements and the stage in the SDLC in which they are defined.

YOUR TURN 3-1 Identifying Requirements

One of the most common mistakes made by new analysts is to confuse functional and nonfunctional requirements. Pretend that you received the following list of requirements for a sales system:

Requirements for the proposed system:
The system should . . .

1. be accessible to Web users.
2. include the company standard logo and color scheme.
3. restrict access to profitability information.
4. include actual and budgeted cost information.
5. provide management reports.
6. include sales information that is updated at least daily.
7. have 2-second maximum response time for predefined queries and 10-minute maximum response time for ad hoc queries.
8. include information from all company subsidiaries.
9. print subsidiary reports in the primary language of the subsidiary.
10. provide monthly rankings of salesperson performance.

Questions

1. Which requirements are functional business requirements? Provide two additional examples.
2. Which requirements are nonfunctional business requirements? What kind of nonfunctional requirements are they? Provide two additional examples.

Functional Requirement	Description	Examples
Process-oriented	A process the system must perform; a process the system must do	• The system must allow registered customers to review their own order history for the past 3 years. • The system must check incoming customer orders for inventory availability. • The system should allow students to view a course schedule while registering for classes.
Information-oriented	Information the system must contain	• The system must retain customer order history for 3 years. • The system must include real-time inventory levels at all warehouses. • The system must include budgeted and actual sales and expense amounts for the current year and 3 previous years.

FIGURE 3-1 Functional requirements.

Nonfunctional Requirement	Description	Examples
Operational	The physical and technical environments in which the system will operate	• The system will run on Android mobile devices. • The system should be able to integrate with the existing inventory system. • The system should be compatible with any Web browser.
Performance	The speed, capacity, and reliability of the system	• Any interaction between the user and the system should not exceed 2 seconds. • The system downloads new status parameters within 5 minutes of a change. • The system should be available for use 24 hours per day, 365 days per year. • The system supports 300 simultaneous users from 9–11 a.m.; 150 simultaneous users at all other times.
Security	Who has authorized access to the system under what circumstances	• Only direct managers can see staff personnel records. • Technicians can see only their own work assignments. • The system includes all available safeguards from viruses, worms, Trojan horses, etc.
Cultural and Political	Cultural and political factors and legal requirements that affect the system	• The system should be able to distinguish between US currency and currency from other nations. • Company policy is to buy computers only from Dell. • Country managers are permitted to authorize custom user interfaces within their units. • Personal information is protected in compliance with the Data Protection Act.

Source: The Atlantic Systems Guild, www.systemsguild.com

FIGURE 3-2 Nonfunctional requirements.

CONCEPTS IN ACTION 3-A | What Can Happen If You Ignore Nonfunctional Requirements

I once worked on a consulting project in which my manager created a requirements definition without listing nonfunctional requirements. The project was then estimated based on the requirements definition and sold to the client for $5,000. In my manager's mind, the system that we would build for the client would be a very simple standalone system running on current technology. It should not take more than a week to analyze, design, and build.

Unfortunately, the client had other ideas. They wanted the system to be used by many people in three different departments, and they wanted the ability for any number of people to work on the system concurrently. The technology they had in place was antiquated, but nonetheless they wanted the system to run effectively on the existing equipment. Because we did not set the project scope properly by including our assumptions about nonfunctional requirements in the requirements definition, we basically had to do whatever they wanted.

The capabilities they wanted took weeks to design and program. The project ended up taking 4 months, and the final project cost was $250,000. Our company had to pick up the tab for everything except the agreed upon $5,000. This was by far the most frustrating project situation I ever experienced. *Barbara Wixom*

Functional Requirements

1. Drone Sales Management

1.1 The system will enable drone sales order creation.
1.2 The system will determine if the requested drone model is in stock.
1.3 The system will display all available customization options for a specific drone.
1.4 The system will create a final approved sales order.
1.5 The system will prepare a shop work order based on final approved configuration.
1.6 The system will process a customer deposit.
1.7 The system will process a customer final payment.

2. Drone Customization Shop Management

2.1 The system will send a Parts Request for needed drone components on an order to Drone Inventory department.
2.2 The system enables assignment of a work order to a specific technician.
2.3 The system records the arrival of component parts as they arrive in the shop parts room.
2.4 The system notifies the assigned technician when all required components are available for a shop work order.
2.5 The system enables the technician to record work start time on a work order.
2.6 The system allows the technician to record when shop order is completed.
2.7 The system notifies the customer of the order completion.

FIGURE 3-3
Sample requirements definition.

Nonfunctional Requirements

1. Operational

1.1 The system should run on tablet devices to be used by salespeople.
1.2 The system should be Web-based and run on any browser.
1.3 The system should connect to printers wirelessly.

2. Performance

2.1 The system should provide response times of 3 seconds or less.
2.2 The system should be updated with new customer orders and drone inventory levels every 5 minutes.

3. Security

3.1 Customer accounts should be maintained securely.
3.2 Only the customization shop supervisor may approve non-standard customizing options.
3.3 Use of each tablet device should be restricted to the salesperson to whom it is assigned.

4. Cultural and Political

4.1 Company policy says that all computer equipment is purchased from Dell.

FIGURE 3-3
Sample requirements definition.

Requirements Elicitation in Practice

to get or produce something, especially information or a reaction

You must include all the key **stakeholders** (the people who can affect the system or who will be affected by the system). … Finally, do everything possible to respect the **time commitment** that you are asking the participants to make. … Although, as we will see, **interviewing** is the most used technique, other indirect methods may help the analyst develop a basic understanding of the business domain so that the direct techniques are more productive. … In general, a useful strategy for the analyst to employ is to begin requirements gathering by interviewing senior managers to gain an understanding of the project and get the "**big picture**." … In our experience, identifying improvements is commonly done through **JAD sessions** because these sessions enable the analysts, users, and other key stakeholders to work together and create a shared understanding of the possibilities for the to-be system.

1. Interviews
2. Joint Application Design (JAD)
3. Questionnaires
4. Document Analysis
5. Observation

Name	Position	Purpose of Interview	Meeting
Andria McClellan	Director, Accounting	Strategic vision for new accounting system	Mon, March 1 8:00–10:00 a.m.
Jennifer Draper	Manager, Accounts Receivable	Current problems with accounts receivable process; future goals	Mon, March 1 2:00–3:15 p.m.
Mark Goodin	Manager, Accounts Payable	Current problems with accounts payable process; future goals	Mon, March 1 4:00–5:15 p.m.
Anne Asher	Supervisor, Data Entry	Accounts receivable and payable processes	Wed, March 3 10:00–11:00 a.m.
Fernando Merce	Data Entry Clerk	Accounts receivable and payable processes	Wed, March 3 1:00–3:00 p.m.

FIGURE 3-4 Sample interview schedule.

ในชีวิตจริง stakeholder มีงานประจำของตัวเอง ไม่ค่อยมีเวลาให้สัมภาษณ์ หรือไม่ค่อยอยากให้สัมภาษณ์ ยกเว้นลงเรือลำเดียวกัน คือถ้างานไม่เสร็จ stakeholder จะได้รับโทษไปด้วย ผู้รับเหมาอาจจะเขียนสรุปรายงานการสัมภาษณ์และให้ผู้ถูกสัมภาษณ์เซ็นรับรองไว้เป็นหลักฐาน เพื่อที่ว่าหากต้องแก้ไขระบบเพราะผู้ถูกสัมภาษณ์ให้ข้อมูลมาผิด จะได้ใช้เป็นข้ออ้างในการขอเวลา/ค่าใช้จ่ายเพิ่ม

CONCEPTS IN ACTION 3-B | Selecting the Wrong People

In 1990, I led a consulting team for a major development project for the US Army. The goal was to replace eight existing systems used on virtually every Army base across the United States. The as-is process and data models for these systems had been built, and our job was to identify improvement opportunities and develop to-be process models for each of the eight systems.

For the first system, we selected a group of mid-level managers (captains and majors) recommended by their commanders as being the experts in the system under construction. These individuals were the first- and second-line managers of the business function. The individuals were experts at managing the process but did not know the exact details of how the process worked. The resulting to-be process model was very general and nonspecific. *Alan Dennis*

Question

1. Suppose you oversaw the project. Create an interview schedule for the remaining seven projects.

Types of Questions	Examples
Closed-Ended Questions	• How many telephone orders are received per day? • How do customers place orders? • What information is missing from the monthly sales report?
Open-Ended Questions	• What do you think about the way invoices are currently processed? • What are some of the problems you face on a daily basis? • What are some of the improvements you would like to see in the way invoices are processed?
Probing Questions	• Why? • Can you give me an example? • Can you explain that in a bit more detail?

FIGURE 3-5 Three types of questions.

No type of question is better than another, and usually a combination of questions is used during an interview. At the initial stage of an IS development project the as-is process can be unclear, so the interview process begins with **unstructured interviews**, interviews that seek a broad and roughly defined set of information. In this case, the interviewer has a general sense of the information needed, but few closed-ended questions to ask. These are the most challenging interviews to conduct because they require the interviewer to ask open-ended questions and probe for important information “on the fly.”

As the project progresses, the analyst comes to understand the business process much better, and he or she needs specific information about how business processes are performed (e.g., exactly how a customer credit request is approved). At this time, the analyst conducts **structured interviews** in which specific sets of questions are developed prior to the interviews. There usually are more closed-ended questions in a structured interview than in the unstructured approach

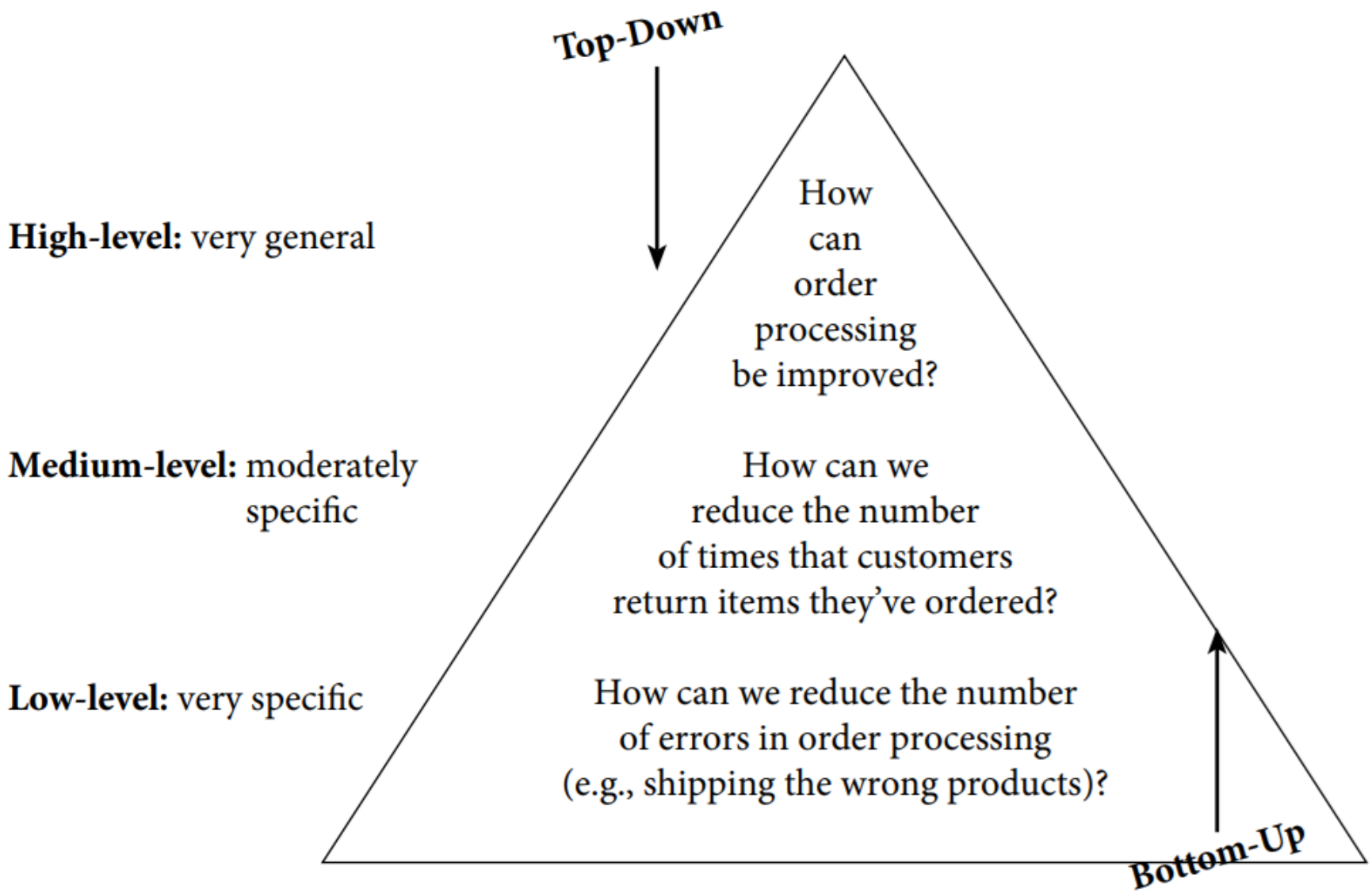

FIGURE 3-6
Top-down and bottom-up questioning strategies.

Interviewee: Paul H., Human Resources Director

Interview purpose/goals: Understand Paul's requirements for the new performance measures and reporting of measures to be used to monitor the staff of consultants.

Interview strategy: Top-down design. Begin with general discussion of his need for performance measures. Ask open-ended questions about what he is currently missing from the performance measures he has. Explore ideas for new metrics he thinks would help him. Finish with closed-ended questions to confirm understanding of specific metric ideas. Discuss any other areas of concern such as confidentiality issues.

Behavioral issues to expect (if any are known): Expect Paul to be supportive and enthusiastic. He has been asking for these improvements for quite a while.

Interview topics and outline:

General introduction, discuss purpose and goals of meeting

Understand his current approach to understanding the performance of consulting staff
- Current metrics (if any)
- How are these metrics collected and reported (if at all)?
- How are these measures inadequate?

Ideas for improved performance measures
- Develop list of items he thinks would be useful
- Understand the underlying data source of each item—need to know exactly what each one means and how the relevant data is or could be collected

How would he like to receive these metrics?
- Regular reports? If so, how often?
- Dashboard?
- Queries?

Other concerns:
- Are metrics confidential?
  - If yes, identify which ones are confidential and who is allowed to view them.
  - If no, how widely shared will these metrics be?

FIGURE 3-7
Sample interview preparation form. A template for this figure is available on the student website.

PRACTICAL TIP 3-1

Developing Interpersonal Skills

Interpersonal skills are those that enable you to develop rapport with others, and they are very important for interviewing. They help you to communicate with others effectively. Some people develop good interpersonal skills at an early age; they simply seem to know how to communicate and interact with others. Other people are less "lucky" and need to work hard to develop their skills.

Interpersonal skills, like most skills, can be learned. Here are some tips:

- **Don't worry, be happy.** Happy people radiate confidence and project their feelings on others. Try interviewing someone while smiling and then interviewing someone else while frowning and see what happens!
- **Pay attention.** Pay attention to what the other person is saying (which is harder than you might think). See how many times you catch yourself with your mind on something other than the conversation at hand.
- **Summarize key points.** At the end of each major theme or idea that someone explains, you should repeat the key points back to the speaker (e.g., "Let me make sure I understand. The key issues are . . ."). This demonstrates that you consider the information important—and also forces you to pay attention. (You cannot repeat what you did not hear.)
- **Be succinct.** When you speak, be succinct. The goal in interviewing (and in much of life) is to learn, not to impress. The more you speak, the less time you give to others.
- **Be honest.** Answer all questions truthfully, and if you do not know the answer, say so.
- **Watch body language (yours and theirs).** The way a person sits or stands conveys much information. In general, a person who is interested in what you are saying sits or leans forward, makes eye contact, and often touches his or her face. A person leaning away from you or with an arm over the back of a chair is disinterested. Crossed arms indicate defensiveness or uncertainty, while "steepling" (sitting with hands raised in front of the body with fingertips touching) indicates a feeling of superiority.

Joint Application Development (JAD)

Joint Application Development (JAD) is an information gathering technique that allows the project team, users, and management to work together to identify requirements for the system. IBM developed the JAD technique in the late 1970s, and it is an especially useful method for collecting information from users.

The JAD group meets for several hours, several days, or several weeks until all the issues have been discussed and the needed information is collected.

One problem with JAD is that it suffers from the traditional problems associated with groups: sometimes people are reluctant to challenge the opinions of others (particularly their boss), a few people often dominate the discussion, and not everyone participates.

ให้ junior ได้พูดก่อน ให้ senior พูดทีหลัง หรือค่อยเชิญ senior มาทีหลัง เพื่อปิดการประชุม หรือแก้ไขความขัดแย้ง (ถ้ามี)
senior ที่ดีจะไม่ค่อยพูดก่อน เพราะจะ dominate the discussion บางที senior ก็ไม่เข้าประชุมไปเลย

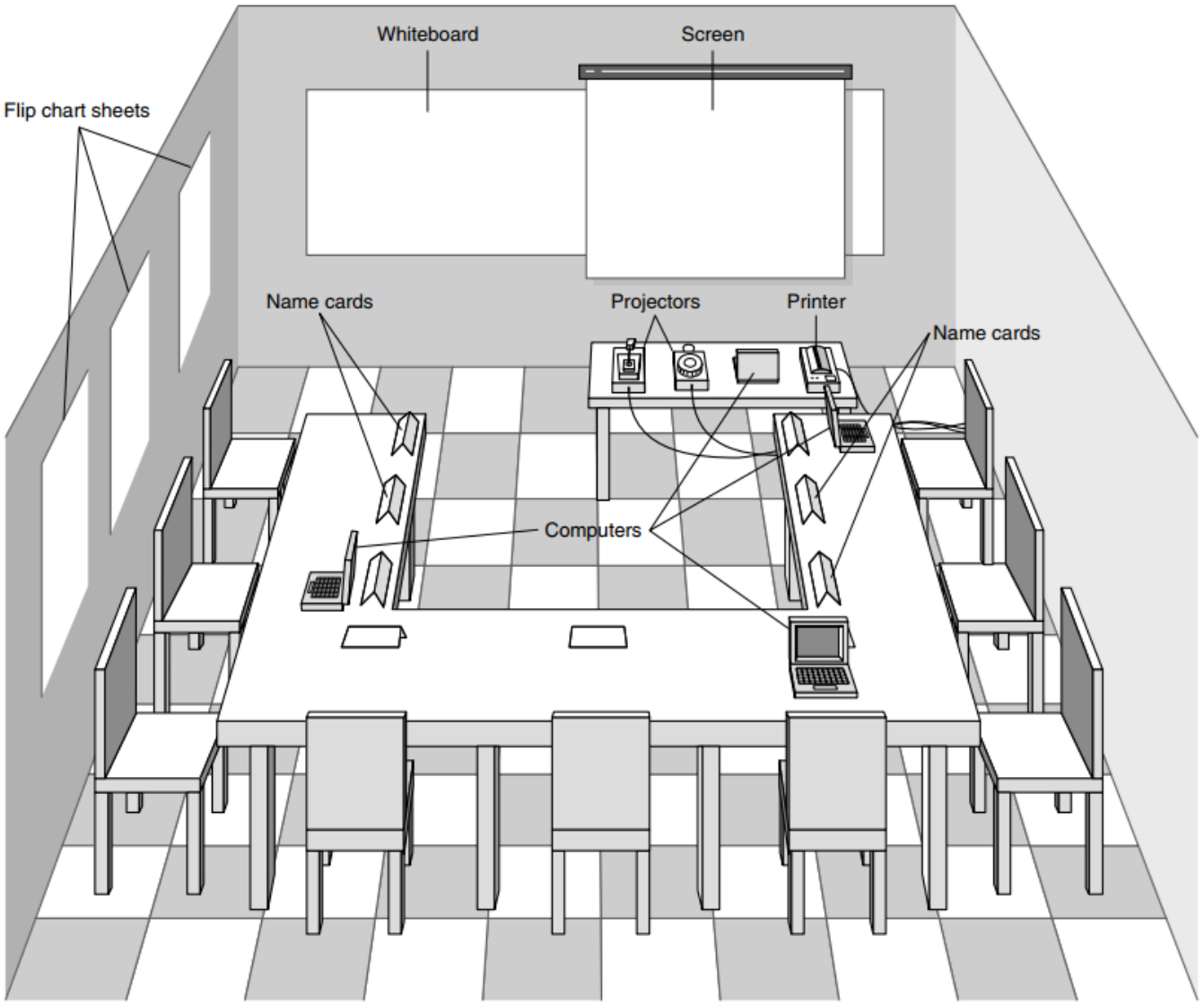

FIGURE 3-9 Joint application development meeting room.

Stakeholder หลายคนช่วยกันดู ว่าตกหล่นอะไรไปหรือไม่
หาข้อสรุปที่ทุกคนพึงพอใจในกรณีที่ต้องการ requirements ไม่ตรงกัน

การแยกสัมภาษณ์ที่ละคนอาจจะได้ข้อมูลไม่ครบถ้วน
โดยเฉพาะผลกระทบที่อาจจะเกิดกับคน ๆ ดังนั้นจึงต้องทำ JAD

No team meeting should be so large that two pizzas can't feed the whole group.
(Former Amazon CEO Jeff Bezos)

PRACTICAL TIP 3-2 Managing Problems in JAD Sessions

I have run more than a hundred JAD sessions and have learned several standard "facilitator tricks." Here are some common problems and some ways to deal with them.

- **Reducing domination.** The facilitator should ensure that no one person dominates the group discussion. The only way to deal with someone who dominates is head on. During a break, approach the person, thank him or her for their insightful comments, and ask them to help you make sure that others also participate.
- **Encouraging noncontributors.** Drawing out people who have participated very little is challenging because you want to bring them into the conversation so that they will contribute again. The best approach is to ask a direct factual question that you are *certain* they can answer. And it helps to ask the question using some repetition to give them time to think. For example, "Pat, I know you've worked shipping orders a long time. You've probably been in the Shipping Department longer than anyone else. Could you help us understand exactly what happens when an order is received in Shipping?"
- **Side discussions.** Sometimes participants engage in side conversations and fail to pay attention to the group. The easiest solution is simply to walk close to the people and continue to facilitate right in front of them. Few people will continue a side conversation when you are 2 feet from them, and the entire group's attention is on you and them.
- **Agenda merry-go-round.** The merry-go-round occurs when a group member keeps returning to the same issue every few minutes and will not let go. One solution is to let the person have 5 minutes to ramble on about the issue while you carefully write down every point on a flip chart or computer file. This flip chart or file is then posted conspicuously on the wall. When the person brings up the issue again, you interrupt them, walk to the paper, and ask them what to add. If they mention something already on the list, you quickly interrupt, point out that it is there, and ask what other information to add. Do not let them repeat the same point but write any new information.
- **Violent agreement.** Some of the worst disagreements occur when participants really agree on the issues but do not realize that they agree because they are using different terms. An example is arguing whether a glass is half empty or half full; they agree on the facts but cannot agree on the words. In this case, the facilitator has to translate the terms into different words and find common ground, so the parties recognize that they really agree.
- **Unresolved conflict.** In some cases, participants do not agree and cannot understand how to determine what alternatives are better. You can help by structuring the issue. Ask for criteria by which the group will identify a good alternative (e.g., "Suppose this idea really did improve customer service. How would I recognize the improved customer service?"). Then once you have a list of criteria, ask the group to assess the alternatives using them.
- **True conflict.** Sometimes, despite every attempt, participants just cannot agree on an issue. The solution is to postpone the discussion and move on. Document the issue as an "open issue" and list it prominently on a flip chart. Have the group return to the issue hours later. Often the issue will resolve itself by then and you have not wasted time on it. If the issue cannot be resolved later, move it to the list of issues to be decided by the project sponsor or some other more senior member of management.
- **Use humor.** Humor is one of the most powerful tools a facilitator has and thus must be used judiciously. The best JAD humor is always in context; never tell jokes but take the opportunity to find the humor in the situation. *Alan Dennis*

	Interviews	Joint Application Design	Questionnaires	Document Analysis	Observation
Type of information	As-is, improvements, to-be	As-is, improvements, to-be	As-is, improvements	As-is	As-is
Depth of information	High	High	Medium	Low	Low
Breadth of information	Low	Medium	High	High	Low
Integration of information	Low	High	Low	Low	Low
User involvement	Medium	High	Low	Low	Low
Cost	Medium	Low–Medium	Low	Low	Low–Medium

FIGURE 3-12 Comparison of requirements elicitation techniques.

Requirements Analysis Strategies

You must include all the key stakeholders (the people who can affect the system or who will be affected by the system).

1. Problem Analysis	แก้ที่ปลายของปัญหา เช่น ยาแก้ปวด
2. Root Cause Analysis	แก้ที่ต้นตอของปัญหา เช่น ยารักษาโรค
3. Duration Analysis	ลดเวลาที่ใช้ในกระบวนการธุรกิจ เช่น กระบวนการทั้งหมดใช้เวลา 1 เดือน แต่กระบวนการย่อย ๆ ดูแล้วใช้เวลารวมกันไม่เกิน 1 วัน
4. Activity-Based Costing	เหมือน duration analysis แต่พิจารณาค่าใช้จ่าย
5. Informal Benchmarking	เปรียบเทียบกับธุรกิจในประเภทเดียวกัน
6. Outcome Analysis	ขยายขอบเขตของ outcome ออกไป ยกตัวอย่าง insurance company รถลูกค้าเกิดอุบัติเหตุ outcome หลักคือ insurance payment ขยายขอบเขตออกไปคือ performing the repairs or contracting with an authorized body shop
7. Technology Analysis	พิจารณาเทคโนโลยีใหม่ ว่าจะนำเทคโนโลยีใดมาใช้เพื่อปรับปรุงกระบวนการธุรกิจ
8. Activity Elimination	เอากระบวนการทางธุรกิจที่ไม่จำเป็นออก หรือทดแทนด้วยกระบวนการที่สั้นกว่า

รูปแบบรายงาน หลังจากทำ Requirements Determination

1. **Table of Contents**
2. **Executive Summary**

   A summary of all the essential information in the proposal so that a busy executive can read it quickly and decide what parts of the plan to read in more depth.
3. **System Request**

   The revised system request form. (See Chapter 1.)
4. **Work plan**

   The original work plan revised after having completed the analysis phase. (See Chapter 2.)
5. **Feasibility Analysis**

   A revised feasibility analysis, using the information from the analysis phase. (See Chapter 1.)
6. **Requirements Definition**

   A list of the functional and nonfunctional business requirements for the system (this chapter).
7. **Use Cases**

   A set of use cases that illustrate the basic processes that the system needs to support. (See Chapter 4.)
8. **Process Model**

   A set of process models and descriptions for the to-be system. (See Chapter 4.) This may include process models of the current as-is system that will be replaced.
9. **Data Model**

   A set of data models and descriptions for the to-be system. (See Chapter 5.) This may include data models of the as-is system that will be replaced.

Appendices

These contain additional material relevant to the proposal, often used to support the recommended system. This might include results of a questionnaire survey or interviews, industry reports and statistics, etc.

แบบฝึกหัด ให้เขียน functional/nonfunctional requirements ของระบบลงทะเบียนเรียน จุฬาฯ (to-be system) functional requirements ให้แบ่งเป็นระบบย่อย ๆ ลิสต์มาทั้งหมดว่ามีระบบย่อยอะไรบ้าง เอาแค่ส่วนของนิสิต nonfunctional requirements ให้เขียนทั้ง operational, performance, security, cultural and political

Functional Requirements

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1.1 The system will enable drone sales order creation.
1.2 The system will determine if the requested drone model is in stock.
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2.1 The system should provide response times of 3 seconds or less.
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3.1 Customer accounts should be maintained securely.
3.2 Only the customization shop supervisor may approve non-standard customizing options.
3.3 Use of each tablet device should be restricted to the salesperson to whom it is assigned.

4. Cultural and Political

4.1 Company policy says that all computer equipment is purchased from Dell.