Root Cause Analysis

Introduction

Applying the appropriate technology to meet an organization's challenges and opportunities distinguishes the best from the rest. The best organizations continuously strive for efficiency, effective management, and competitive advantage. Whether solving problems or identifying opportunities, the key is always to identify the root cause(s). To do this a root cause analysis process is followed.

More often than not, the cause of the problem or the opportunity is obscured by one or more symptoms. A **symptom** is a condition that is produced by the problem/opportunity, not the actual problem. It is critical to understand the difference between the actual problem or opportunity and the multiple symptoms the problem or opportunity is producing.

To get to the root cause, ask a series of questions to identify all the symptoms that will eventually uncover the root cause. This series of symptoms is called a **problem chain**.

At the end of the problem chain is the **root cause** of the problems faced by the organization or a key problem situation in the competitive environment that suggests an opportunity to increase revenue or improve service.

Description

A root cause analysis process involves asking probing questions that will distinguish symptoms from actual problems/opportunities.

After each symptom is identified, asking "Why?" will determine if there is another symptom to identify or if the root cause has been identified.

With the root cause identified, you and your team are ready to propose general objectives, measurable performance criteria, and constraints. Collaborating early and often with your team enables informed decision-making and sets reasonable expectations for the team including systems developers and users.
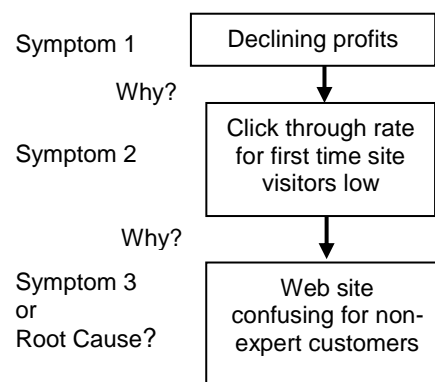
Purpose

Using the root cause analysis process clearly distinguishes symptoms from actual problems and opportunities. In so doing, information specialists are able to recognize if the root cause is an IT problem and if it is, begin solving it with the systems process approach.

For example, an on-line firm that sells nutritional supplements is concerned about declining profits. That's the first "point of pain" illustrated as a symptom in Figure 1 below. A marketing manager argues they are losing customers to a competitor who posts great savings opportunities on Groupon. In an attempt to learn the real problem, the marketing manager asks the web site hosting company to research web traffic for several days when she knows there has been a Groupon offering by a competitor. Web traffic metrics indicate that daily site usage this year is 20% higher than last year. The user traffic research also indicates that registered customers are buying about the same amount as they always have. The traffic metric that disturbs the marketing manager is that non-registered, first-time users rarely click all the way through to a purchase. (This is symptom 2 below.) The web traffic graphs for each page on the company web site indicate a couple places where first time users often leave the site. Both frequent exit spots are *before* the posted prices pages, so price sensitivity is *not* the root cause—web site confusion is the likely root cause.

Figure 1. Problem Chain Example

Symptom 1	Declining profits
Why?	↓
Symptom 2	Click through rate for first time site visitors low
Why?	↓
Symptom 3 or Root Cause?	Web site confusing for non-expert customers

Root Cause Analysis

Creating a Root Cause Analysis Process

Every problem/opportunity produces a set of symptoms. In the case of a problem, your team should try to describe in detail the points of pain. This includes but is not limited to: **who** is experiencing the difficulty, **what** the experience is, **when** it happens and **how** it impacts the rest of the organization or the entire firm. Your job is to organize all this information into a problem chain that leads to the root cause. Asking "why" after each symptom is described will enable you to logically create your problem chain.
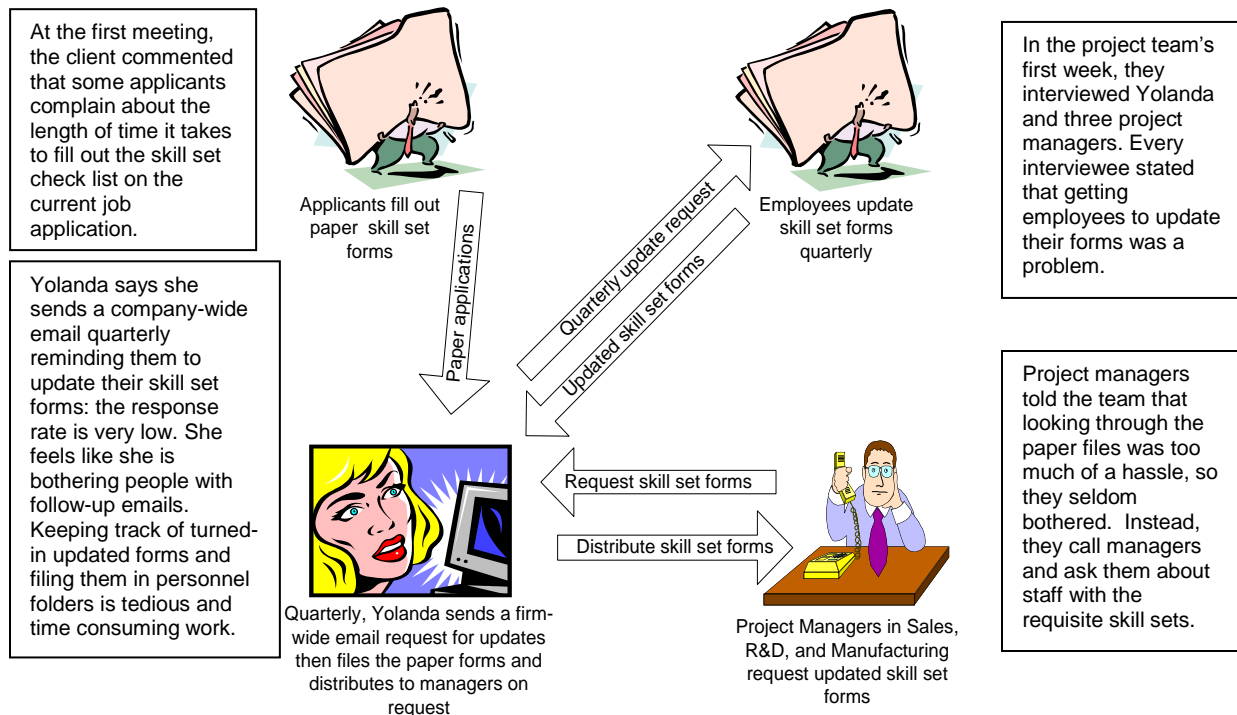
Root Cause Analysis for ASTA

Here is an example: Advanced System Technology Associates (ASTA) provides consulting services and software for factory automation. Their workforce consists mainly of engineers with a broad spectrum of technical expertise relating to their diverse factory automation systems that they manufacture and market around the world from offices in Austin and Dallas. The project request was to automate their paper-based "Skills Inventory System."

They wanted to be able to quickly identify employees possessing the required knowledge and skills demanded by business opportunities as they emerged. Like most industrial marketing organizations, they respond to requests for proposals (RFPs) submitted by other firms. To be competitive, they need to respond quickly with proposals that show their relevant expertise and experience.

Figure 2 shows a high level view of problems with the current skills set process. The consultants interviewed key stakeholders the first week into the project. The stakeholders included three project managers in different company areas and Yolanda, the HR director. The HR director was in charge of the manila folders that composed the current "skill set" data storage system.

The ASTA root Cause Analysis (Figure 4) shows how the team initially reported the results of their early interviews. Their recommendation was to create an automated Skills Inventory System, and they included two other recommendations based on their interviews with project managers. One was a market intelligence system to provide

Figure 2. System Overview Graphic of Existing Skills Inventory System for ASTA

At the first meeting, the client commented that some applicants complain about the length of time it takes to fill out the skill set check list on the current job application.

Yolanda says she sends a company-wide email quarterly reminding them to update their skill set forms: the response rate is very low. She feels like she is bothering people with follow-up emails. Keeping track of turned-in updated forms and filing them in personnel folders is tedious and time consuming work.

Applicants fill out paper skill set forms

Paper applications

Quarterly update request

Updated skill set forms

Employees update skill set forms quarterly

In the project team's first week, they interviewed Yolanda and three project managers. Every interviewee stated that getting employees to update their forms was a problem.

Quarterly, Yolanda sends a firm-wide email request for updates then files the paper forms and distributes to managers on request

Request skill set forms

Distribute skill set forms

Project Managers in Sales, R&D, and Manufacturing request updated skill set forms

Project managers told the team that looking through the paper files was too much of a hassle, so they seldom bothered. Instead, they call managers and ask them about staff with the requisite skill sets.

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information for project managers about market trends and competitor activities to improve ASTA's ability to predict demand. Another was a warning to upper management that some ASTA employees seldom updated their skill set folders. Even if the team created an easy-to-use, web-based Skills Inventory System the firm may need to create incentives or clearer rules about employees keeping their files updated.

Objectives, Performance Criteria, & Constraints

You and your team are now ready to discuss objectives, performance criteria and constraints. **System objectives** take into account: accuracy, timeliness, completeness and relevance. Using broad, general terms identify the new system's objectives. This is a first attempt at defining your project scope at a high level.

The next step is identifying the **performance criteria** of the new system. These are the stated, measurable goals the system must meet. Collaborating with your team, establish quantifiable performance criteria and document all measurements.

All the while, keep in mind that there will be **internal and external constraints** impacting your objectives and performance criteria and therefore your new system. What is the budget for the new system? How does it impact the hardware and software requirements? What is the personnel situation? Who can/will maintain the system after development ends and the system is in production? What are the system security risks and how does this impact the budget? How committed is the client? How committed are you, the developers?

System constraints are many and varied. Reality and honesty regarding scope, schedule and resources go a long way in distinguishing a successful system from an unsuccessful one. The triple constraints of scope, schedule and resources illustrate the inter-related nature of IT projects, as shown in the triangle in Figure 3. It is often possible to achieve two of these targets fairly easily, but adding the third can make or break project success.

Figure 3. Triple Constraint Triangle
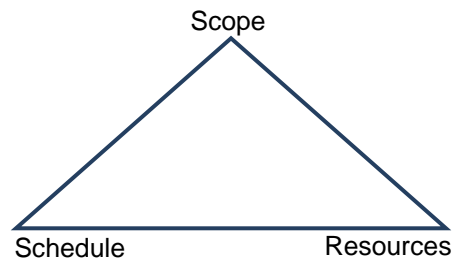
Benefits

Going through the logical process of identifying symptoms of the problem/opportunity and creating a problem chain leading to a root cause ensures that you are solving a problem and not wasting time treating a symptom that is a false lead—like the marketing manager in the example on the first page who thought advertising by competitors was the problem when poor web site navigation was the root cause. The final section of the root cause analysis is a recommendation for a project solution(s) with proposed objectives, measurable performance criteria, and constraints. Discussing these options with your team early in the development process builds trust between all interested parties and gives your team a chance to make an informed decision about the best solution.

Tips for Completeness

• Be careful not to jump too quickly to solutions. For example, a team was working on building a website for the display and sale of items for an artist who did original works, as well as cards and T-shirts. The team identified symptoms for the artist's web site as difficulties faced by Judy Paul, the artist, or her customers. It is tempting to list some of their underlying problems, like "lack of a shopping cart" as a symptom. But that's a possible solution, not a symptom. If you jump to design decisions—like "Judy.Paul.com needs a shopping cart"—your team might decide that a quick add-on for a shopping cart is all Judy Paul needs. When they considered all the points of pain in the list of symptoms, it was obvious there were more reasons for lower sales than just the lack of a shopping cart.

• Be aware that technology is not the answer to every problem. Sometimes organizational problems surface as part of a root cause analysis. So also be aware of how organizational issues can impact the technology solution you are providing. Non- IT issues can sabotage your technological success! Information technology specialists must always ask themselves, "Is this a problem I should try to solve?" If not, is it a problem that you need to bring to the attention of management? For example, some employees may be unwilling to follow perfectly good procedures correctly because they do not understand the system or there is too little time to perform the prescribed tasks or even some reason unrelated to technology. When technology is not the answer to a problem you discover, work with your clients to encourage an organizational solution. For example, the ASTA team identified what they called a Human Resource Problem and suggested a solution in their root cause analysis. The client's' project goal was a Skills Inventory System that employees had to update quarterly, but the employee response was poor to management requests for these updates. Along with the web-based Skills Inventory System the ASTA project team also recommended that ASTA HR provide a solution ensuring quarterly firm-wide updating of the Skills Inventory System, otherwise their system development work would have limited value to the managers relying on the system data.

Figure 4. Example Root Cause Analysis

Root Cause Analysis for ASTA's Paper-based "As Is" Skills Inventory System

Section 1. Symptoms
1. Difficulty in maintaining the skills inventory of employee knowledge and skills.
2. Slow access of the skills inventory system.
3. Errors in the skills inventory system.
4. Difficulty in responding promptly to with bids for RFPs (requests for proposals) and other market opportunities.
5. Lack of uniform support for the skills inventory system within the firm.
6. Inability to enforce quarterly updating of skills inventory information.

Section 2. Problem Chain

- **Symptoms 1, 2, 3:**
  o The manual nature of the paper-based skills inventory system

- **Symptom 4:**
  o Inability to quickly gather, process and disseminate information on market opportunities
  o Inability to promptly complete accurate bids for RFPs
  o Inability to quickly formulate a strategy for responding to market opportunities
- **Symptom 5:**
  o Functional attitude of organizational units
- **Symptom 6:**
  o Lack of motivation by employees to comply with skills updating procedure

Section 3. Root Causes of ASTAs slow, error-prone response to RFPs and other market opportunities

Root Cause 1: The manual nature of the paper-based skills inventory system.
Root Cause 2: The lack of a responsive business intelligence system.
Root Cause 3: Organizational units have functional (rather than company) attitudes.
Root Cause 4: Employees lack motivation to follow policies and procedures.

Root Cause Analysis

Section 4. Summary of Potential Solutions

1. **Skills Inventory System –** replace the manual ASTA skills inventory system with a fast, error-free, and easy-to-update system
2. **Market Intelligence System –** create a system to monitor market trends and competitor activities and predict emerging market opportunities.
3. **Human Resource Improvements –** develop strategies to change company culture to motivate employees to support company programs and procedures.

Section 5. System Solution Focus - Skills Inventory System

- **Objectives**
  - The skills inventory system should be computer based.
  - The skills inventory system should respond quickly to requests for information.
  - The skills inventory system should be accurate.
  - The skills inventory system should be easy to maintain

- **Performance Criteria**
  - Requests for information concerning employee skills are filled within <u>15 minutes</u>.
  - <u>All</u> employees update their skills records at least <u>quarterly</u>.
  - Employees can update their skills inventory in no more than <u>15 minutes</u>.
  - Employees update their skills inventory information from their <u>workstations</u>.
  - Employees update their skills inventory information by <u>changing only the data entries that need to be updated</u>.
  - The skills inventory system features a <u>user-friendly web-based front end</u>.

Section 6. Constraints

  - Schedule: Our MIS 374 team has only 12 weeks for this entire project.
  - Budget: ASTA management has not yet set a budget for the project..
  - Development tools: ASTA does not currently have the same .Net development tools that we have learned in past classes and have available as a development sandbox. A decision is needed soon about whether ASTA will acquire these tools or whether the team needs to research, install, and learn other development tools.

Note that Objectives and Performance Criteria have not been provided for two potential solutions: a Market Intelligence System and Human Resource Improvements. Our schedule constraint eliminates the Market Intelligence System for this semester. The Human Resource issues are best approached by ASTA management
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FAQs

Q1. What is the difference between a Problem Chain and Root Cause Analysis? **Answer:** MIS professionals use both terms to refer to a process of looking at complaints (or symptoms) and investigating what the real cause (root cause) is before recommending solutions. In MIS 374 we identify the "problem chain" as part of a Root Cause Analysis. Some organizations include the same sections of a Root Cause Analysis that we do and call it Problem Chain Analysis. Others have different sections and different names, e.g. "Investigation Summary" for a summary of the steps that led to eliminating possible underlying problems as the root cause of the complaints. MIS 374 exercises, exam questions, and project requirements will require all the parts discussed here and posted for the Root Cause examples.

Q2. Do we have to have three solutions like the ASTA Example? **Answer:** No. Your team may have a problem that you can manage within your schedule constraint and just suggest one solution, like the Root Cause Analysis for Judy.Paul.com on the Resources page.

Q3. What if we don't know the constraints? **Answer:** For the Latinitas case you have very little information, so guess what they might be for your Exercise 3 Root Cause Analysis. For Group Project 1, read the case for constraints. For your client project, ask your client about constraints.

High Quality Delivery Tips

- Each symptom should have at least one corresponding problem in the problem chain.
- Every solution's objective should address the problems in the problem chain.
- Performance criteria must be **measurable** and **quantifiable.**
- Symptoms, problems, objectives, and constraints should match the specific situation.

Template and Examples on **Resources Page**

- Root Cause Analysis Template
- Root Cause Analysis for ASTA
- Root Cause Analysis for JudyPaul.com
- Root Cause Analysis for Inter-Coop Council (ICC) – a non-profit organization

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