

Systems Approach

CMSC183 – IT Project Management

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“Listening to both sides of a story will convince you that there is more to a story than both sides.”

• Frank Tyger

Repeatable successes for project managers, the meeting of project objectives, come from their ability to establish and utilize a standard project management life cycle (PMLC) in all their projects and across the organization and to manage the relationship between the PMLC to the different software development life cycles (SDLCs) used to create products. A project has a life cycle that is separate from but integrated with the product's SDLC. It's important for project managers to understand their individual project within the context of their entire environment, using the systems approach.

Chapter 1 Systems Approach

During the progression of your BS Computer Science journey, all students are taught to examine any proposed issue or opportunity by breaking it down into smaller and smaller parts to completely understand the total process and then offer a proposed solution. For example, say that a company's sales and marketing department has approached the IT department about adding a shopping cart feature to the company web site. It would allow customers to place orders online, adding and removing items until they are ready to process their order (check out).

The IT department (in a programmer's perspective) is excited because it would be a very cool technology to work with and put on the site. But someone, ideally senior management and the project manager, **needs to take a step back and ask:**

1. *Before we implement that feature, how will this affect and be affected by other projects already under way?*
2. *What are our competitors doing?*
3. *When should this be done in relation to other projects waiting to start or already executing?*

Someone, the project manager or the organization's decision makers, needs to understand that before the company decides to start a project, **it first needs to understand the whole picture**. It needs to understand where this project will fit into the group of projects already started or being proposed. What if another group of users had approached the IT department about upgrading the company's inventory control system, and management had decided it was a good idea and that project had already begun? These two systems would probably need to work together, but if no one knows about the other, problems will most certainly appear. In large IT departments, this scenario happens all too often.

The systems approach is a process that allows projects to be viewed in the context of the entire environment, including both inside and outside the organization. It is a process that can bring order and discipline to a large, chaotic, unorganized situation. It is the opposite of an analytical process, which takes the whole and breaks it into its component parts. Project managers, to be successful, must learn to use a systems approach.

The systems approach consists of three interrelated components:

1. Systems Theory
2. Systems Analysis
3. Systems Management

1.1. Systems Theory

Systems theory involves a philosophy of or a way of looking at the world—a language or set of principles and interventions for thinking and problem solving. A project doesn't occur in a vacuum; it exists within a system.

There are two broad categories of systems: open and closed. A closed system is completely self-contained; to understand it, you merely look on the inside, without regard to the external environment. A machine is a closed system; to understand how it works, you simply open it up and study the internal mechanisms. An open system is not self-defining; to understand it, you must also understand its environment. The human body and organizations are examples of open systems. They have the ability to affect and be affected by their environments and adapt. This concept of open systems is very important to project management because it is where projects take place.

The following are a few key terms you need to be familiar with in order to understand the systems approach:

- **Subsystem** - A system is made up of subsystems, smaller systems that are part of a larger system. For example, the human heart is a subsystem of the human body, and the accounts receivable subsystem is a part of the financial software system of an organization.
- **Element** - An element is the smallest part of a system. What is defined as an element varies depending on the level of understanding needed at a particular point in time. If you are investigating the detailed workings of an order processing software subsystem, you need to break it down into smaller pieces, such as entering new orders, checking inventory, and checking customer addresses. These pieces become the elements for the order processing software subsystem.
- **Attribute** - Attributes are individual characteristics that are part of systems and subsystems. In defining a new software system, you define attributes such as business requirements and database schemas. In project management, you define attributes such as budgets, schedules, and activities or tasks.
- **Boundary** - A boundary surrounds a system and separates it from its environment (see Figure 1). Most of what a project manager does exists on the boundary: How do you keep other projects from taking your key resources away, how do you foresee a new government regulation coming and its effect on your project, and how do you convince management not to cut your budget when there are cash flow issues?

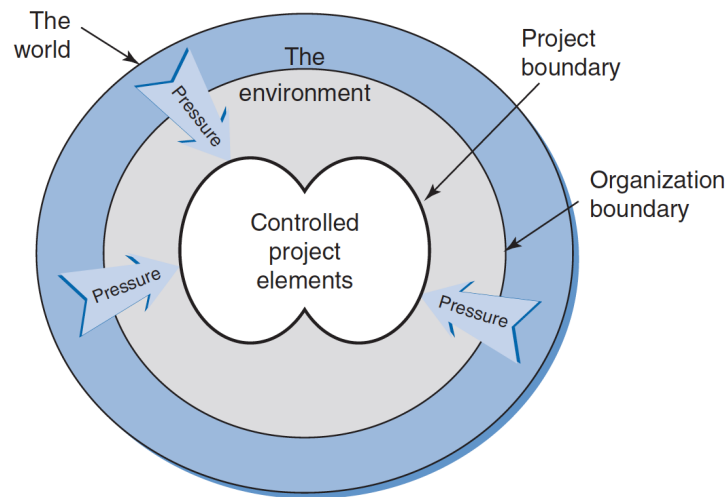


Fig. 1. Systems Boundary and Environment

- **Environment** - The environment is everything that exists outside the system or outside the control of the project manager (see Figure above). In this context, when we refer to the environment, we are speaking specifically about those factors in the environment that are relevant to the system being studied. The organization, governments, economies, foreign countries, and so on all have roles in the environment.
- **Objectives** - Open systems are designed to do something to change an input into an output via an internal process. The something that the system is designed to do is spelled out in the list of objectives. IT projects consist of customer-driven requirements or outputs needed from the system. Based on the desired outcomes and your knowledge of the inputs, you must build a project plan that describes the process of changing the inputs into outputs (meeting the objectives) and dealing with the changes the environment brings.
- **Constraints** - Every system has limitations forced on it from internal forces or external forces, and sometimes the limits are self-controlled. In previous study guides, we discussed the triple constraint of project management as limits in terms of scope, time, and cost.
- **Integration** - For a system to reach its objectives, all the subsystems and elements must work together effectively. In project management, we must make sure to manage the items both inside and outside the boundary.

Figure 1 is a depiction of the environment that project managers must understand and learn to work in. Using the systems approach will help project managers to identify and understand all the pressures that the external environment can create. Once identified, these pressures need to be dealt with or at least compensated for to prevent them from negatively affecting the project. Too many organizations and project managers in the past have tried to act as if they are isolated from their environment. Cleland and King (1972) state that managers must:

1. Appreciate the need to assess forces in the environment
2. Understand the forces that significantly affect their organization
3. Integrate these forces into the organization's goals, objectives, and operations

Although all projects are influenced by forces in the environment—such as new government regulations, withdrawal of funding, and technology obsolescence—these forces cannot be allowed, if at all possible, to control the outcome of the project. Project managers working on the boundary must strive to keep this from happening on a daily basis. Techniques such as risk analysis and SWOT analysis are two tools that project managers can use to keep environment forces in check.

1.2. Systems Analysis

Systems analysis is “a problem-solving technique that decomposes a system into its component pieces for the purpose of studying how well those component parts work and interact to accomplish their purpose”. In traditional systems development projects, a systems analyst studies the needs presented by users and attempts to understand them and have them understood by others by reducing a complex high-level set of requirements down into smaller and smaller elements.

The smaller elements can then be defined, estimated, and understood by all team participants. The smaller elements are then purchased or constructed and put together to form the whole. For example, a user comes to the IT department with a high-level list of requirements to build a web site that will represent the entire organization. As is common, this list isn’t very detailed or complete: “We want information on the web site that tells potential customers who we are, where we are located, our philosophy, and what products we offer at each site.” It’s not until the analyst begins breaking this down into its elements that a more complete list of needs can be ascertained (for example, the color schemes, technologies, back-end legacy systems to integrate with, search capabilities, menu styles).

1.3. Systems Management

The systems management component is responsible for the management of the whole system - objectives, environment (both internal and external), constraints, resources (both human and other), and the culture and social environment of the organization. This is what project management is all about.

When you, as a project manager, are handed a project to manage, one of the first things you need to do is put the project in context. Getting answers to the following questions as soon as possible will help your project get off to a great start:

1. Who is the project sponsor (key business decision maker)?
2. What other ongoing or pending projects might have an impact on this project?
3. What outside influences could have an impact on my project?
4. What early constraints, if any, have been placed on the project from scope, time, and cost perspectives?

Learning to take a systems approach is not easy, especially for those new to the working world, but it is possible if you are willing to put time and effort into it. The next study guide explains the processes associated with the PMLC and the SDLC. It also explains how the two must work together to achieve project success.

1.4. Looking Forward

Carefully understand the following conversation:

SETTING: Jeff (IT Person) and Reid (Management) are sitting in Reid's office, having a cup of coffee.

Reid Jeff, I have been meaning to tell you how pleased I am that you and Kevin are working with us on improving our information systems around here. We definitely need the help.

Jeff Thanks, Reid. That's our job, and believe me, you are not alone in needing help with your information technology projects. In fact, because information technology changes so often, it seems like a never-ending process. Businesses have become so dependent on computers and software to help manage and run their operation that any new software release that offers increased functionality or computer hardware that makes a process more efficient, leading to increased profits, must be addressed in order for the organization to be and/or remain competitive.

Reid That's definitely true, even in our business. We now have video games - the ones you play in arcades that connect to the Internet so the person playing can play against people playing the same game in other parts of the world. We consistently have to upgrade the game technology we offer to entice people to play and continue to play the games. If we don't, another operator will, and we'll lose business.

Jeff So you have a basic understanding of the environment we work in.

Reid I won't give myself that much credit, even though I have had some formal training in information systems development.

Jeff You have. That's good!

Reid Yes. When I became interested in computers and started messing around with programming, I foolishly envisioned doing all of our information systems work myself. So I enrolled in a couple courses, one being a systems course that taught me the systems development life cycle, or how to follow a process to build a system. "Piece of cake," I thought, until I tried to do it myself. Needless to say, I'm better off in the entertainment game industry.

Jeff Don't be too hard on yourself; I applaud you for starting out the right way - recognizing that to have the best chance to succeed, you must follow a tried-and-true process or methodology. Not understanding this is a mistake that most beginners make. It takes years of education, training, and experience to be good in this business that's what makes it so difficult. It's one thing to create a single-user application that only runs on a single computer, but to create a multiuser application that runs on multiple computers, interfaces with other computer systems, and contains complex business rules and logic is a totally different matter. It takes someone or most likely a group of people with a high level of skill and knowledge to do that.

Reid That's what is hard for me to comprehend. It seems that everything that we have to do in systems development is enormous in terms of scope and complexity. And we are not even a Fortune 500 company; I can't imagine the magnitude of their systems. How do you know where to begin? What do we do first? Can't it get out of control and overwhelming?

- Jeff It can if it's not managed properly. That's why we utilize a systems approach, along with sound project management processes and principles.
- Reid What do you mean by systems approach?
- Jeff It's the process of examining problems or opportunities in their environment or in the entire organization and then decomposing those problems into smaller components, thus making them easier to understand and then solve, and finally managing the resolution of those problems. *[Reid looks confused]* It's utilizing the systems development life cycle you mentioned earlier to plan, identify requirements, design the solution, and then implement it, all the while using a separate methodology to manage it all. The key is using the appropriate development life cycle or process, based on the characteristics of the project and team.
- Reid Do you mean there are different types of life cycles?
- Jeff Yes, there are, and the one you use depends on the type of product you are building and your project characteristics, such as team size, criticality of the application, purchased versus custom-made software solution, and so on. Using the right methodology gives you the best chance for a successful project. In addition, there is a life cycle for the management of building the product, which encompasses the product life cycle. This facilitates the building of multiple products in parallel or in sequence.
- Reid This is going to be an extreme learning experience for me!
- Jeff It will be for both of us - I will be learning about your business, and you will become more familiar with mine.
- Reid I can't wait. Say, let's go get a refill of coffee, and then you can tell me how we are going to get started.

Chapter 2 Ask Yourself

1. Describe Systems Approach.
2. What is the difference between open and closed systems?
3. What are the three components of Systems Approach?
4. Describe Systems Boundary and Environment.
5. What is Systems Analysis?
6. What is Systems Management?

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