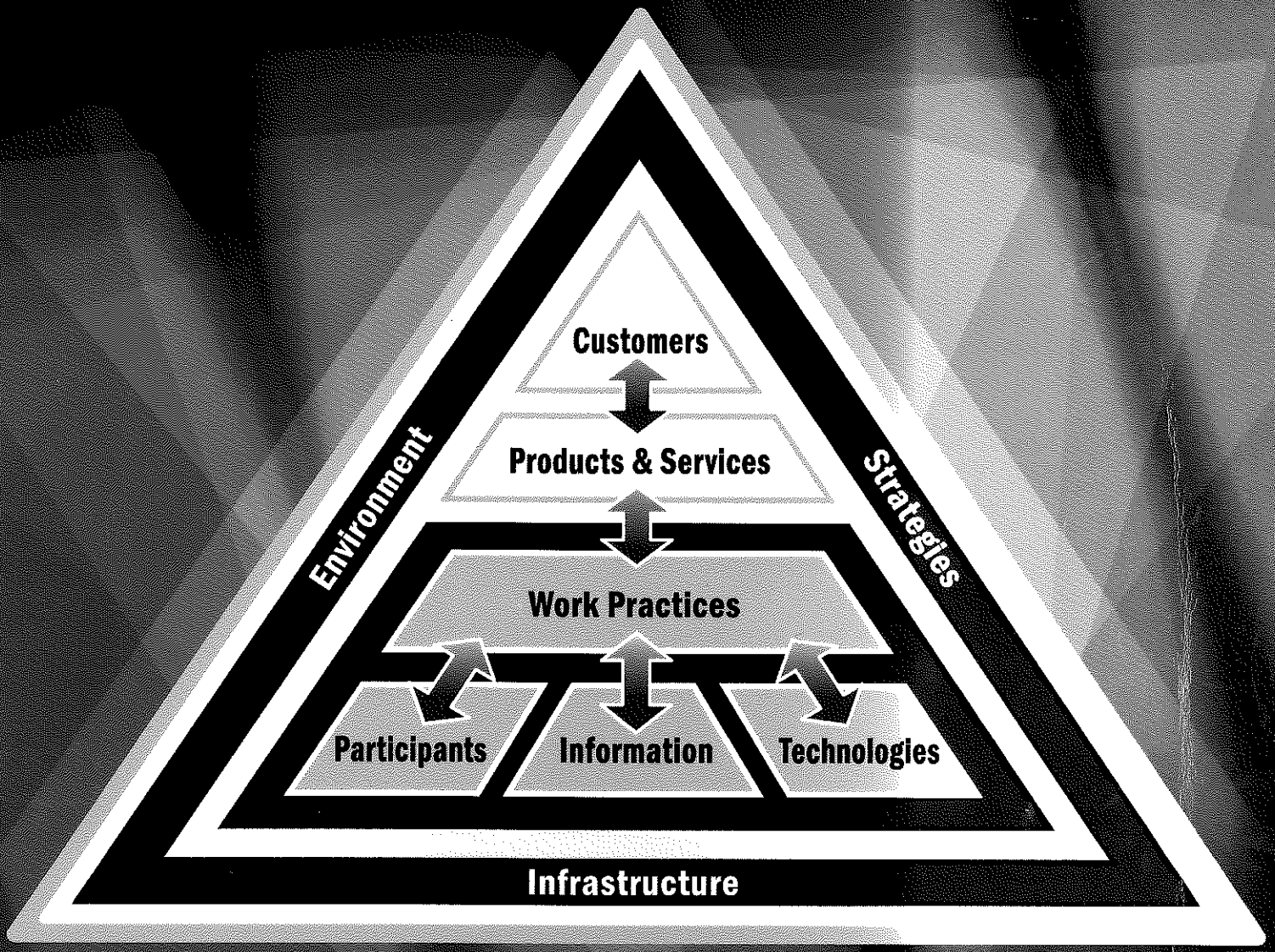

THE WORK SYSTEM METHOD

Connecting People, Processes, and IT for Business Results

Steven Alter

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Connecting People, Processes and IT for Business Results

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Preface

Current business organizations cannot operate without IT, but many IT initiatives fail to meet expectations and many IT-enabled systems satisfy neither employees nor customers. The following problems are disappointingly common:

- new systems that are supposed to improve performance but never meet expectations
- ineffective analysis and design projects that absorb time and effort but never produce consensus about what is to be done and why
- ineffective communication between business and IT professionals
- software implementation that proceeds despite disagreement about how the software is expected to improve work practices and provide benefits.

I wrote this book because I believe that many applications of IT would be more successful if business and IT professionals had an organized but non-technical approach for communicating about how current work systems operate and how they can be improved with or without changing technology. This book synthesizes ideas from many areas into a coherent, yet flexible approach that any business professional can use directly. I believe it is unique among the many current books that promise business and technical professionals insight about organizations, competition, technology, and system development. Although many of these books address important topics in compelling ways, most of them ignore this book's central issue for managers and business professionals:

> *How can I be more effective in evaluating systems and thinking about how to improve them, whether or not IT plays a major role, and whether or not the system is totally within my organization or links to other organizations?*

In other words, this book differs from the many books that explain how technology has made the world a better or worse place, how new technologies will shape competition in the future, how executives should allocate investment dollars, or how to thrive in the chaotic times ahead. Anyone who reads those books already knows that the pace of change is relentless and that technology is both a source of opportunity and a glutton for resources and attention. This book presents ideas that can help in making decisions for which IT may seem part of the solution, but may also become part of the problem.

Goal and audience. This book's primary goal is to provide a rigorous, but non-technical approach that any manager or business professional can apply for visualizing and analyzing system-related opportunities and problems. While this is not rocket science, just communicating more effectively about systems would help in seizing missed opportunities, minimizing wasted effort, and attaining business results.

Unfortunately, common tools and methods for IT professionals do not support this goal adequately. Graphical documentation tools are certainly useful for explaining the detailed structure of a proposed or actual system, but these tools omit many key topics related to work system characteristics, participants, customers, and the surrounding environment. Carefully scripted meetings facilitated by internal or external consultants have been used widely, but except in very complex situations, a meeting of the minds shouldn't require engaging a consultant. And regardless of how expertly IT professionals do their technical work, they too would often benefit from a better way to think and communicate from a business viewpoint.

This book is written for business professionals who want to participate more effectively in building, using,

and managing systems that apply IT, and who may wonder how to create practical meaning from the technology-related sales pitches, jargon, and speculation they often hear. Even if they have a coherent view of what to do about applying IT, they often find it difficult to explain that view to their business and IT colleagues. This book addresses these concerns by providing an organized approach for thinking and communicating realistically about how systems operate in organizations and how they can be improved.

The book's secondary audience is IT professionals who want to work more effectively with business professionals when building or maintaining systems. The mere fact that they are IT professionals often typecasts them as technology advocates even when they realize that a more balanced, business-oriented approach would lead to greater clarity, greater trust, and better results.

It is important to say what this book is not. First, it is not another book about reengineering and does not assume that you need to change your company to compete in the 21st century. Although it uses some ideas that are associated with total quality management, it is not another book about total quality, statistical process control, or Six Sigma. Rather, it is about establishing a basic understanding of a system. That type of understanding is required before a more detailed analysis is performed. Similarly, it is not about software or software development even though it uses some of the terms used in software development projects. Many established tools and procedures help software engineers generate the extensive documentation needed to produce high quality operational software. The ideas in this book address neither that type of work nor that level of detail, but they might help software engineers develop software that better reflects the needs of the business.

Basic Ideas. This book's central concept is the work system. All businesses and organizations consist of multiple work systems that perform essential functions such as hiring employees, producing products, finding customers, selling to customers, providing customer service, and planning for the future. Almost all important systems in today's organizations use IT extensively, but there is no reason to believe that IT will be the source of all improvements. Even if a particular system uses IT extensively, from a business viewpoint IT is not the headline. Rather, the headline is about how well the work is done and how it provides value for internal or external customers.

The work system method is organized around the Work System Framework™, which summarizes the components that should be considered in even a basic understanding of a work system. Using this framework to identify the elements of a particular system helps in establishing mutual understanding of the system's scope and operation. A deeper analysis examines these elements and their interactions. The work system method provides an organized, but flexible structure for analyzing a system from a business viewpoint, identifying possible changes, and then justifying a design recommendation.

Organization. This book is organized in layers. Some readers probably want just the first layer, a basic understanding of the approach. Other readers want to understand the work system method in enough depth to apply it when analyzing a work system.

With the exception of establishing a rigorous definition of work system, this book is written using familiar business terms. It chapters use a format that is designed for skimming. They contain tables, bullet lists, and bolded subheadings that should help in finding what you need.

Part I consists of seven chapters that introduce the work system approach and summarize how to analyze a work system from a business professional's viewpoint.

- Chapters 1 and 2 introduce basic ideas about work systems, including the definition of work system, the Work System Framework, and the work system snapshot that is used to summarize a work system on one page.
- Chapter 3 presents an overview of the work system method, which is designed to help business professionals clarify system-related issues, identify possible directions for change, and produce and justify a recommendation. This chapter emphasizes the logical flow and alternative paths for using the work system method.
- Chapters 4, 5, and 6 present clarifications and specific topics related to the three main steps in the work system method. Chapter 4 discusses issues related to deciding a work system's scope and resolving ambiguities about the work system's elements. Chapter 5 uses the Work System Framework to organize numerous topics that provide hints for identifying issues and possible improvements during the analysis process. Chapter 6 covers aspects of explaining and justifying a recommendation.
- Chapter 7 uses the work system life cycle model to explain how work systems evolve over time. This iterative model is quite different from the "system development life cycle" models that are often proposed for guiding software projects.

Part II looks at each element of the Work System Framework in more depth. The main purpose is to identify a range of issues that should be considered when analyzing a work system. All of these issues are important in a large number of work systems, although many of them may not be important in the particular one you need to think about. Accordingly, these chapters are organized to make it as easy as possible to find topics that are important in a particular situation.

- Chapter 8 uses an example to show how the top levels of the work system method can be applied to organize the analysis of a work system. The example concerns a regional bank's system for approving large commercial loans. It combines aspects of a number of real world situations, thereby illustrating the potential relevance of topics identified in tables in Chapter 5 and explained in Chapters 9 through 14. Many of those topics are relevant to a work system's operation and success but are downplayed or ignored in techno-centric analysis methods for IT professionals. The example is presented as a discussion document, including comments by a management reviewer.
- Chapters 9 through 14 explore concepts used for describing and evaluating each work system element in particular situations. Sections within the chapters cover performance indicators, strategies, tradeoffs, and related issues. These chapters include:

Chapter 9: Customers and Products & Services
Chapter 10: Work Practices
Chapter 11: Participants
Chapter 12: Information
Chapter 13: Technology and Infrastructure
Chapter 14: Environment and Strategies

- Chapter 15 closes the book by looking at work system ideas in a broader context. It shows how these ideas can be used to identify omissions in IT- and system-success stories, to interpret IT- and system-related jargon, and to understand information system categories that are changing continually.
- The Appendix completes the example that was introduced in Chapter 8 by showing how it might be described in a work system questionnaire. It includes checklists related to performance indicators, work system strategies, risk factors and stumbling blocks, work system principles, and possibilities for change. It also includes questions and templates for justifying the recommendation.

Background and Motivation. This book is based on a combination of experience as vice president of a software firm and as a business professor teaching MBA and EMBA students at the University of San Francisco. In both the business world and the academic world I found that people had difficulty explaining how systems work, how they should be improved, and why. Part of this was an unfortunate tendency to focus on what computers do and to de-emphasize what people do. Another part was the lack of an organized method and vocabulary for thinking and communicating about systems. The explosion of hype about ebusiness and the subsequent dot-com bust may have shifted the discussion a bit, but the underlying problem persists.

I first recognized the need for greater understanding of computerized systems thirty years ago during interviews of decision support system users as part of my Ph.D. research at MIT's Sloan School of Management. The need for greater understanding of systems shifted from an academic interest to a pocketbook issue when I served as vice-president of Consilium, a successful manufacturing software firm (acquired by Applied Materials in 1998). Working with customers in a variety of management roles

related to consulting, customer service, training, documentation, and product design convinced me that many business professionals need a simple, yet organized approach for thinking about systems without getting swamped in details. Such an approach would have helped our customers gain greater benefits from our software and consulting, and would have helped us serve them more effectively across our entire relationship.

This book is one of the results of a multi-year research effort aimed at developing a systems analysis method that business professionals can use for themselves without relying on consultants or IT professionals to help them get started. A number of articles based on this research were published in the last six years in the *Communications of AIS*, an online journal of the Association for Information Systems.

The effort started in 1992 with a series of presentations supporting a book tour for the first edition of my information systems textbook, whose four editions were used by several hundred thousand business students in universities around the world. The topics in the original presentations were the basis for a working paper that MBA and EMBA students used to analyze computerized systems in their own businesses.

Around 1997 I suddenly realized that I, the professor and textbook author, had been confused about what system the students should be analyzing. Unless they are focusing on software or hardware details, business professionals thinking about information systems should not start by describing or analyzing the information system or the technology it uses. Instead, they should start by identifying the work system and summarizing its performance gaps, opportunities, and goals for improvement. Their analysis should focus on improving work system performance, not on fixing information systems. The necessary changes in the information system would emerge from the analysis, as would other work system changes separate from the information system but necessary before information system improvements could have the desired impact.

With each succeeding semester and each succeeding cycle of papers by employed MBA and EMBA students, I tried to identify which confusions and omissions were the students' fault and which were mine because I had not expressed the ideas completely or clearly enough. The original working paper evolved into a workbook and then into an analysis outline that became more effective over many iterations of use in situations that these typical business people faced at work every day.

Acknowledgements. I would like to acknowledge the direct and indirect help of a large number of colleagues in the information system field. Many of the ideas in this book either describe or address issues revealed in their practical work, research, conference presentations, and discussions.

Among many colleagues who have contributed in a variety of ways, I want to thank two in particular. Around ten years ago John King pointed out the inconsistent use of the term *system* in a draft article I showed him. That single observation helped me recognize the need to develop a rigorous but useful way to talk about IT-enabled systems. Paul Gray, Founding Editor of the *Communications of AIS*, created a unique and innovative forum in which researchers could discuss and debate long-standing issues and new ideas. Publishing a series of articles in *CAIS* helped me reach interim closure on a number of topics that are integrated into the ideas in this book.

I also want to thank my wife Linda for her patience, encouragement, and willingness and ability to include systems among the many topics for our morning walks.

This book is dedicated to many hundreds of MBA and EMBA students whose successes and occasional confusions were essential in developing the ideas that are presented here. I greatly appreciate the many lessons they taught me.

Steven Alter
April 2006

Chapter 1: Why Are So Many Systems Such a Mess?

- A System Gone Awry
- Common Disappointments
- Seven Common Temptations
- Overcoming the Seven Temptations

Today's technology has had a huge impact on business and society. Current business practices would be impossible without IT. A seemingly endless stream of innovations brings images of boundless opportunity and change.

The progress of IT over the last five decades is an incredible accomplishment, yet IT is often under-utilized and misused. Its adoption has too many unanticipated consequences and sometimes causes many new problems. Unreliability and internal complexity often inhibit change instead of fostering it, converting a dream of flexibility into a maze of electronic concrete.

A System Gone Awry

Consider the following story[1] reported in *CIO Magazine* in 2005. "Global Giant," a global telecommunications company, installed a new "CRM system"[2] for customer-facing activities such as entering orders and providing customer service. From a purely IT viewpoint, the project went well. Even though the software vendor made significant modifications to its software package, the project was completed on time and within budget. However, the project was allowed to proceed without full agreement by Global Giant's sales, marketing, customer service, and channel management departments about how the new CRM system would affect their work practices. "They argued they couldn't realistically assess the business impact of a major system they'd never used before. They would work out their differences in the rollout."

"Unfortunately, no one—except IT—used the CRM the way it was supposed to be used, including the customers and the channels." Contrary to expectations, certain sales people figured out how to offer better prices and terms to their customers. Other customers complained and received rebates. The new system was supposed to help customer service representatives with cross-selling and up-selling, but it complicated their jobs so much that customer satisfaction suffered. Some customers would not use the new web-based order entry capabilities and phoned instead, causing inbound calls to surge. By the end of the story, a corporate innovation went down in flames, interdepartmental relationships turned sour, key customers complained, and the sales vice president was fired.

How could a seemingly successful project at a major company turn into an unmitigated disaster? According to the story's lead-in, "Getting people to use a new system correctly is much harder than getting it up and running." That partial explanation sounds reasonable, but it ignores a basic distinction about the nature of the system. Ask yourself which best describes the system in this story:

- The system is the software acquired from the software vendor, as modified and installed on the Global Giant's computers.

- The current system is the way Global Giant currently performs its customer-facing work, such as entering orders and providing customer service. The intended system is the new way Global Giant will do that work in the future.

- The system can be described in either of the two ways, depending on who happens to be talking and what they are talking about.

The people in the story acted as though they used the first definition. According to the story, the IT group acquired and installed the software; the sales, marketing, customer service, and channel management departments believed they would figure out how to use it once it was available. In other words, they believed system is a computerized tool that people use.

Things might have happened differently if the people in the story used the second definition and acted as though the system is the way Global Giant performs specific work. From that viewpoint, modification of the software was only part of a project that was never completed. The full project was not about acquiring and installing software. Rather, it was about changing the way work is performed. It may seem a bit crazy for an organization to make a major software investment based on the assumption it will figure out how to use the software. It seems even crazier for an organization to invest in major changes in work systems without knowing what the changes will be.

On the other hand, what would have happened if the people in the story chose the third possibility and believed that the system is either the software or the work system that uses the software, depending on who is talking and what they are saying? Accepting two different definitions for the same thing might seem crazy as well, except that it happens frequently. When you hear someone in your organization say, "we improved our sales system" how do you know whether they are referring to the software used in sales or the system of doing sales?

Part of a larger problem. The Global Giant story illustrates a larger problem, the lack of a practical, organized method that business professionals can use for thinking about business systems (not just software) from a business viewpoint. Viewing a system as an IT-based tool that people use is limited, techno-centric, and ultimately misleading. This view also puts business professionals at a disadvantage due to the many technical aspects of IT-based tools that they cannot appreciate fully because they lack the required technical background and interest.

This book provides a practical, but in-depth method for thinking about systems in organizations whether or not IT is involved. The method assumes that a system includes work practices, human participants, information, and technology, and that it exists to produce products and services for internal or external customers. Such a system is called a work system.[3] That idea is the basis of the work system method. The remainder of this chapter says more about issues that the work system method addresses. The second chapter begins the discussion of work system concepts.

Common Disappointments

The Global Giant story is a dramatic example of a widespread problem. Too many systems in organizations are disappointments or failures. Despite good intentions and hard work, the planned improvements and benefits are often elusive. Despite all the talk about process excellence, total quality, and agility, stories such as the following are commonplace in our personal lives:

- After switching to my local phone company's new service plan, it took three months and over four hours on the phone to correct the incorrect bills that we received.

- When I called a pharmacy to ask whether my prescription was ready, the pharmacist said that my insurance policy probably would not cover that medicine, but he couldn't be sure because the computer system linking the pharmacy to insurance companies had been down most of the day. The insurance company's call center agent gave the same answer. I was to leave on a trip the next morning and had to decide whether to pay the full price and try to obtain reimbursement later.

- My wife's former employer implemented ERP, a software package supporting business operations across multiple departments by means of an integrated database. Two weeks after the "go live" date, she was still unable to generate a simple invoice for an important client. Ironically, her employer was in the business of providing ERP training.

- After my wife's purse was stolen, her bank gave her a new account number and switched her account balance into the new account. When she deposited a check from my account into her account to pay bills, the bank put a hold on the funds until the check cleared because hers was a new account. She complained that she had been a customer for 14 years and that we had done this type of transfer before, but the teller said that the computer system would not let her remove that hold because it was a new account.

Similar stories from the everyday corporate world include:

- "Our customer service people are going crazy. They claim that the computer system is so complicated that they can't avoid making a lot of mistakes."

- "We installed great technology for sharing information but people are mostly using it as a personal tool and very little sharing is happening."

- "We installed a new enterprise system but almost everyone insists on receiving the same information they always had. What was the point?"

- "They called it sales force automation, but it doesn't help me and forces me to do clerical work so headquarters can monitor what I do."

- "The software sounded great, but after we bought it we realized we would have to make major changes in our processes."

Problems with IT-related projects and systems sometimes become visible to customers and stockholders despite typical efforts to avoid adverse publicity:

- Foxmeyer Drug Corporation, a successful wholesale pharmaceutical distributor, went bankrupt after a failed implementation of an enterprise software system that was supposed to save money and foster growth.[4]

- Cigna intended to create an integrated system for enrollment, eligibility, and claims processing. Ideally, the new system would improve customer service through an upgrade that would consolidate customer bills, process medical claims rapidly and efficiently, and provide customer service reps a single unified view of clients. Flawed implementation of the upgrade caused customer service problems that led to customer defections.[5]

- ChoicePoint, an information broker with an enormous database of personal information about almost every American adult, announced in 2005 that personal information about 145,000 people had been downloaded by identity thieves who could use the information for credit card fraud and other purposes. The impostors applied for access to the data by pretending to be legitimate business people.[6]

- Hershey's annual report for 1999 mentioned, "well-publicized problems associated with the implementation of the final phase of our enterprise-wide information system." Hershey's customers suffered order fulfillment delays and incomplete shipments, and Hershey lost some market share to major competitors during its key Halloween and December seasons.[7]

- Nike encountered difficulty implementing new supply chain software in 2001, resulting in an estimated $100 million in lost sales, a 20% drop in its stock price, and a flurry of class-action lawsuits. CEO Phil Knight was quoted as saying, "This is what we get for $400 million?"[8]

- Cisco Systems "wrote off $2.5 billion of inventory in 2001 when its forecasting systems

told it to keep pumping out switches and routers even as many of its customers were going belly-up. The company said the errors were largely due to customers grossly inflating orders, fearing they might get caught without supply."[9]

Widely publicized stories such as these are unusual because no company wants to publicize bad news, but smaller examples of similar problems are surprisingly common. Industry surveys and estimates by leading consulting companies typically describe appallingly high levels of disappointment in IT-related projects. For example, even with major improvements over the last 10 years, the Standish Group's 2004 report on its biennial survey of thousands of IT projects reported that 51% missed their schedule, went over budget, or did not produce the intended functionality. Another 15% were total failures.[10] Other researchers produce somewhat different numbers depending on the types of questions they ask and the samples they look at, but the preponderance of the evidence says that the batting average for IT success is far lower than it should be. Business and government organizations would dissolve into chaos if most of their activities encountered the level of ineffective effort and disappointment that is common with computerized systems.

Seven Common Temptations

Among the many reasons for IT-related disappointments is a set of powerful temptations that somehow beguile business and IT professionals. These temptations lead to unclear communication, unrealistic expectations, and disappointing results.

Most organizations need an effective way to recognize these temptations and avoid their consequences. This book shows how thinking of IT-reliant systems as work systems, rather than IT systems, addresses every one of these temptations and is an effective method for understanding and communicating about systems.

Temptation #1: Viewing technology as the system. Have you every wondered why systems that involve IT are often called IT systems? For example, the title of a brief case in *Harvard Business Review* was "The IT System that Couldn't Deliver," even though the issue in the case was that a new sales system had not been implemented.[11]

The tendency to see technology as the central element in systems, or even as the entire system, reflects a techno-centric view of systems. That type of view typically focuses on whether the technology operates to specification and typically downplays human and organizational aspects of the situation. It often seems to assume that technology is directly responsible for success and for mistakes and errors. A more balanced view recognizes that people and work practices are essential ingredients in IT success stories, and that supposed "computer glitches" often involve sloppy work practices and human error. A more balanced view is less concerned with the tools a system uses and more concerned with what a system does and what it produces. Thus, even though a system may not be able to operate without IT, the headline should emphasize what the system does and what it produces.

Systems in organizations are always much more than the software that is being used. Defining the system as the software is a diversion from business issues and often leads to vendor-driven discussions of software features and purported benefits. The software is part of a system, just as lungs are a part of a human being. We all need lungs and feel better if our lungs are operating well, but that doesn't mean that every discussion of human endeavors needs to focus on lungs.

Ask yourself whether these temptations affect systems in your organization.

Temptation #2: Assuming technology is a magic bullet. Technology is often discussed as though it were a magic bullet,[12] a "solution," in the parlance of the computer industry. Contrary to what is often implied and sometimes said explicitly, IT is not a magic bullet that can provide all the information you need, make people smarter, transform organizations, or provide competitive advantage. Despite its incredible speed and power, IT cannot solve

informational, personal, or organizational problems independent of larger systems that it supports. IT cannot supply all of your information unless your world operates like a totally predictable machine. IT cannot make you smarter even though it can provide access to information that may be useful. IT cannot transform anything other than data even though it can be used as one of the tools in a conscious organizational change effort. When the topic is a system in an organization, there is no such thing as a magical "IT solution," regardless of what the sales pitch said.

Unrealistic optimism about user enthusiasm for new technical capabilities is a common result of techno-centrism and techno-hype. Project teams indulging in this temptation pay little attention to the human and organizational aspects of systems. They may assume that since a particular technology was used successfully in one department it will probably be successful in another where the conditions are different. They may assume that procedures will capture all possible situations and that procedures will be followed. They may provide elaborate methods for sharing information despite the organization's culture of hoarding information. They may create elaborate computer security systems despite the organization's culture of supervising everything loosely.

Temptation #3: Abdicating responsibility for systems. Businesses operate through systems of doing work. That work might be manufacturing a product, finding potential customers, producing monthly accounting statements, or performing any other organized activity. The use of IT does not change the responsibility for organizing and managing the work. Too many managers and business professionals let their eyes glaze over when the discussion turns to IT and how it will be used. They know they need to be involved in IT-related projects to make sure the requirements are correct, but they still act as though systems are someone else's responsibility if IT is involved. IT professionals create computer-related tools and keep them running, but line managers are responsible for the work systems that define the organization's operation.

Managers sometimes abdicate their system-related responsibilities by confusing systems with IT, acting as though systems are someone else's work, and granting IT professionals excessive power to decide and define how systems will operate in business organizations. Sometimes they do this by allowing themselves to be misled through techno-hype and techno-centrism; sometimes they deceive themselves. In other cases, they are unwilling to get involved in detailed analysis, giving excuses such as "my eyes glaze over at those meetings about systems" or "as a manager I don't mess with that kind of stuff and I let the techies design the systems."

Abdication of system-related responsibilities creates problems. First, deep knowledge about IT and IT-related systems analysis techniques does not guarantee insight about how an organization should operate. IT experts provide essential help in developing IT-based tools, but they may not have much insight into personal and organizational issues that determine how things are really accomplished. Since computerized information systems often determine how work can or cannot be done, granting IT experts the freedom to define information systems increases the chances that these systems will miss the mark.

The other side of this question is technology hubris, the belief by some IT professionals that their knowledge of programming and systems analysis techniques qualifies them as experts in how work should be done in the organizations they support. Based on this belief they sometimes feel empowered to follow their own instincts and to ignore the concerns of the business professionals they are trying to support. Furthermore, since the IT staff typically has no authority over changing work practices in other departments, even a well conceived set of tools may not be used well unless managers in user departments are on board and committed.

Temptation #4: Avoiding performance measurement. A surprising avoidance of clear specifics about performance is one of the most striking phenomena I observed across many years of reading assignments written by part-time MBA and EMBA students about systems in their firms. After numerous repetitions of "performance is not good but would be better with these changes," I became increasingly explicit about asking students to

identify key performance indicators and provide actual values or estimates of metrics in these areas. Even with increasing attention to measures of performance in the course, I still found employed MBA and EMBA students reluctant to engage this topic.

Willingness to manage without using goals, baselines, or measures of performance makes it difficult to say how well a system is operating and how much improvement is needed. The most egregious form of measurement avoidance occurs when no measures of performance are identified or tracked. A lesser form occurs when managers focus on one or two performance indicators while ignoring many others that are pertinent. A typical example is factories and service operations that measure productivity carefully but do not measure the consistency of the work or quality of the product as perceived by the customer. The same phenomenon occurs in the management of information systems when the technical efficiency of information storage hardware is monitored carefully but the error rate of the information itself is not measured.

Measurement avoidance has an important effect on projects involving IT because it goes hand-in-hand with unclear project goals. Instead of identifying current and desired levels of work system performance, project leaders focus on providing particular software capabilities and achieving indirect benefits such as better information and better decision making. The new capabilities and indirect benefits may be quite important, but without measurement it will be difficult to decide whether the investment was worth the effort.

Temptation #5: Accepting superficial analysis. Superficial analysis often starts at the beginning of a project when managers are unwilling or unable to participate fully in defining the goals of the project and exploring how the proposed changes will really accomplish those goals. The most extreme cases of superficial analysis can be called "management by slogan." The manager identifies a broad goal, such as cutting response time or providing the best information possible, but never gets involved with what needs to happen in order to accomplish the goal. Even when managers are willing and able to be involved, a techno-centric emphasis sometimes focuses on changes related to IT applications and downplays changes related to work practices and people. In many cases, less IT-intensive but equally valid approaches are not fully considered, such as business process changes and better staffing, training, and on-going support.

When IT applications are involved, superficial analysis sometimes takes a bizarre turn by trying to attain closure on microscopic details before resolving big picture issues. The temptation to leap into details prematurely stems from two types of motives. The first is pressure to keep the project on schedule. The second is a reluctance to raise difficult political and practical issues about how work will be done, who will be in charge, and who will gain or lose power. A way to avoid these issues is to plunge into IT-related details that are essential for producing computer programs, whether or not those programs actually address the main problems. In combination, these two forces result in system development projects that ignore major business and organizational issues even though they tenaciously clarify the smallest details about anything a computer touches.

Another aspect of superficial analysis is confusion about the difference between documentation and analysis. Documentation of IT-based systems is an organized description of the system's structure and details. Documentation is essential for creating well-crafted technical systems, but by itself is not an analysis. In contrast, an analysis is about defining a problem carefully, gathering information, identifying alternatives, and deciding what to do. A look at the documentation of most IT-based systems would reveal substantial emphasis on what should happen in the computer and comparatively little emphasis on what should happen in the organization.

Temptation #6: Accepting one-dimensional thinking. Each of the following book titles (minus the subtitle) focuses on one dimension of a much more complex situation.

- Digital Enterprise
- IT Doesn't Matter
- IT Doesn't Matter, Business Processes Matter
- The Process Edge
- The Information Payoff
- People Come First
- Customers Come First
- Customers Come Second
- Customer Focused Organizations
- Designing Effective Organizations

The authors of these books unquestionably recognize that many other things matter, but the main title of each book puts one topic in the foreground and other parts of the puzzle in the distant background. Focusing on one main topic is an effective and frequently essential strategy for writing a business book, but one-dimensional thinking is totally inadequate for understanding systems in organizations. These systems consist of work practices AND people AND information AND technology. They exist to produce products and services for customers, and they do that within an environment and using available infrastructure. The analysis of a system in an organization needs to take all of those elements into account.

One-dimensional analysis of a system often assumes that the system exists in a vacuum and will operate according to the designer's wishes regardless of incentives, skills, culture, history, inventiveness, workarounds, changes in the environment, and other factors affecting the way work is done. These context-related issues make it risky to assume that better technology, better information, and better interfaces will result in better business results. To build computerized capabilities that are on the mark, designers and managers need to validate both the likely benefits of the proposed changes and the organization's commitment to implement them.

Temptation #7: Assuming desired changes will implement themselves. Innovations do not implement themselves. To the contrary, changes in significant systems require careful planning, extensive communication, and effective responses to problems that emerge. Even well designed systems may encounter implementation difficulties if the planning for the implementation process is inadequate and if implementation resources are unavailable. At minimum, the conversion from the previous way of doing work to the new way may involve a great deal of extra effort by the people doing the work. This extra burden should be recognized and planned in advance so that it does not undermine the new system.

Unrealistic assumptions about implementation sometimes leads to resistance and to a variety of interpretations of why resistance is or isn't legitimate. Project teams may believe that the software capabilities they have produced are a given and that the people who use those capabilities are guilty of resisting change if they have difficulty learning how to use the software or if they criticize it directly. They sometimes take an arrogant stance of assuming they are the bearers of the truth and that anyone who does not accept this truth is at best misinformed, and at worst, lazy or stupid. Many observers have noted this type of rhetoric in the early reengineering movement, whose proponents said things like "carry the wounded but shoot the stragglers."[13] More recently, the comic strip Dilbert has mined this topic endlessly by showing Dilbert's boss or an HR consultant ignoring sensible comments and squelching any motivation the employees might have. Resistance sometimes stems from little more than personal interest, but in many other cases resistance occurs because the resistors genuinely believe the intended changes reflect design flaws that need to be addressed.

Overcoming the Seven Temptations

As with many seductive forces, yielding to any of the seven temptations is far from fatal, but may have negative impacts. You can probably demonstrate their importance by looking at your own organization and asking whether these temptations affect the way systems operate. Think about the meetings you and your colleagues attended to discuss systems. Was there any difficulty in focusing on the real issues? Was there a tendency to become entangled in computer details instead of focusing on how the real work was done and how well that work was done? Was there a lot of frustration about incomplete understanding and communication? Was there a feeling that the business issues were not adequately expressed? Was there an urgency to define computer system features so that project schedules could be met regardless of whether there was genuine agreement about how those features would affect the organization's operations and results? Was there enough discussion of how the

changes would affect the people in the situation? These questions may hit a nerve because a surprisingly large percentage of the expense and effort devoted to using information technology fails to produce the expected benefits.

The ideas presented throughout this book will help you identify each temptation and respond to it. The next chapter shows how focusing on work systems automatically counteracts temptations to view technology as a system and to assume technology is a magic bullet. By making it easier for managers to understand systems, the work system approach reduces the temptation to abdicate responsibility for systems. Attention to performance indicators and metrics counteracts the temptation to avoid measurement. Antidotes to superficial analysis and unrealistic assumptions about system details and implementation start with an organized method for assuring that system changes are designed with a work system in mind.

The title of the next chapter summarizes the overall approach. Thinking of a system as a work system, not an IT system, is a step toward recognizing all seven temptations and reducing their impact. The next chapter uses brief examples to illustrate a work system approach for thinking about systems in organizations. The subsequent chapter summarizes the work system method.

Chapter 2: Work Systems - The Source of Business Results

- Examples of Work Systems
- Commonalities
- The Work System Framework
- Elements of a Work System
- Work System Snapshot
- One Lens Fits Almost All
- Themes Expressed by the Work System Framework
- Work Systems, Not IT

Most business and IT professionals could benefit from a practical, organized way to think and communicate about systems in organizations. With this type of approach they would be more likely to spot opportunities to exploit technology and more able to explain why poorly conceived system projects probably won't succeed. The work system method is based on the idea of "work system," which is introduced here through four disparate examples.

Examples of Work Systems

The following examples of work systems are in different industries, use different technologies, and face different problems or improvement opportunities. The tasks in these work systems include approval of commercial loans, identification and qualification of sales prospects, use of an ecommerce web site, and development of software. When these disparate situations are stripped down to the basics, they can be described in terms of identical categories that form the basis of the Work System Framework.

Work system #1: How a bank approves commercial loans. A large bank's executives believe that its current methods for approving commercial loans have resulted in a substandard loan portfolio. They are also under pressure to increase the bank's productivity and profitability. The work system for approving loan applications from new clients starts when a loan officer works with a new prospect to identify financing needs. The loan officer helps the client compile a loan application including financial history and projections. A credit analyst prepares a "loan write-up" summarizing the applicant's financial history, providing projections explaining sources of funds for loan payments, and discussing market conditions and the applicant's reputation. Each loan is ranked for riskiness based on history and projections. Senior credit officers approve or deny loans of less than $400,000; a loan committee or executive loan committee approves larger loans. The loan officer informs the loan applicant of the decision. A loan administration clerk produces loan documents for approved loans. (This example will be used in several places to illustrate the work system method.)

Work system #2: How a software vendor tries to find and qualify sales prospects. A software vendor sells human resources software to small and medium sized enterprises. It receives initial expressions of interest through inquiries from magazine ads, web advertising, and other sources. In addition to cold calling using industry phone lists, a specialized sales group contacts leads from other sources and asks questions to qualify them as potential clients who might be interested in buying or using the software. A separate outside sales force contacts qualified prospects, discusses what the software can do, and tries to negotiate a purchase or usage deal. The company's managers are concerned that the sales process is inefficient, that it misses many good leads, and that the prospect lists received by the outside sales group contain too many unqualified prospects.

Work system #3: How consumers buy gifts using an ecommerce web site. A manufacturer of informal clothing for teenagers and younger adults has a web site that has not produced the anticipated level of sales. Both surveys and logs of web site usage reveal that customers who know exactly what they want quickly find the product on the web site, put it in their electronic shopping cart, and make the purchase. On the other hand, customers who are not sure what they want, such as parents wishing to buy gifts for their children, often find it awkward to use the site, make a low percentage of purchases relative to the number of web site visits, and have a high rate of after purchase returns. The company's strategy calls for extension of existing sales channels. Its managers want to do something that will improve the level of sales on the web site and will improve the overall experience of customers who are not sure what they want.

Work system #4: How an IT group develops software. The IT group in a major manufacturing company buys commercial application software whenever possible, but also produces home-grown software when needs are not met by software from external vendors. Managers of the IT group are displeased with many of the IT group's software projects, which often miss schedule deadlines, go over budget, and fail to produce what their internal customers want. Software developers often complain that users can't say exactly what they want and often change their minds after a lot of work has been done. Users complain that the programmers tend to be arrogant and unresponsive. Several years ago the company bought computer aided software engineering (CASE) software, but its use has been uneven. Some enthusiasts think it is very helpful, but other programmers think it interferes with their creativity. The IT group's managers believe that failure to attain greater success within several years could result in outsourcing much of the group's work.

Commonalities

The four cases have many commonalities. In each system, people are doing work (approving loans, qualifying sales prospects, buying gifts, or developing software) in a somewhat systematic way to produce a result that is of importance to someone else. In each situation they are using information and technology. Each situation calls for multiple performance indicators related to the time and effort that goes into the work, the quality of the work, and the quality of the results. In each situation, aspects of the surrounding environment have an important impact on the possibilities for change. The following commonalities apply to all four cases and are at the core of the work system method:

Focusing on work, not just IT. Each of these systems uses IT, but exists to perform a particular type of work. The concept of work has nothing to do with paying people to be present at a particular place during a particular part of the day. Work is the application of resources such as people, equipment, time, effort, and money to generate products and services for internal or external customers.

A closer examination of the work within each system would reveal one or more business processes that are followed, at least to some extent. However, the work practices in each case also involve more than an idealized set of business process steps. The loan approval system depends on the loan officer's ability to communicate and persuade. The prospect qualification system relies on the communication ability of phone agents. Different users of the ecommerce web site might use it in different ways and in different sequences for several different purposes. The software development system seems

to have several different sets of work practices depending on who is doing the work.

Work systems. From a business viewpoint, systems in organizations are best understood as work systems, regardless of whether they use IT extensively. A work system is a system in which human participants and/or machines perform work using information, technology, and other resources to produce products and/or services for internal or external customers.

Problems or opportunities. Each story is about a work system that has problems or opportunities. Because life is very busy, it is unlikely that anyone would go to the trouble of thinking about a work system in depth without being motivated by a problem or opportunity.

Identification of the system. The precise scope of each work system is not obvious in advance and is determined based on the problem or opportunity that is being explored. In each of these situations, the analysis should start with more clarification about the work system's boundaries. For example, does the work system for selling through the web site involve anything other than the mechanics of the web site? Does it involve larger questions such as how the company organizes and presents its product lines to the market in general? Similarly, is the work system for producing qualified prospects mostly about what happens when the internal sales force receives the initial leads, or does it start with the way the initial leads are generated? Thus, work system is a mental construct rather than a physical thing. Different people looking at the same situation usually define the relevant work system somewhat differently.

The basis of the work system method is apparent in commonalities shared by four seemingly disparate systems.

Participants and customers. It is useful to think separately about the people who are participants in the work system and the people who are the work system's customers. In three of the examples, the participants are employees or contractors for the company that owns the work system. In the ecommerce example, however, the customer is a work system participant who performs self-service activities. Although participants in all four work systems are users of computers or software, being a participant in the work system is much more important to them than being a user of technology. In all four examples, the efficiency of the work and the quality of the outcome depends on the participants. Appropriate technology and well-designed processes certainly help, but uninterested or unwilling participants will not produce good results. In the software development example, the attitude that CASE software restricts creativity was one of several obstacles to successful implementation.

Information. Each work system involves computerized databases and other information not stored in databases. For example, transaction-related information in the ecommerce web site is stored in a highly structured database, but other relevant information is from advertisements, personal preferences, or other sources. The loan approval example uses information from the applicant's financial statements and from publicly available databases. Other important information includes the content of loan documents and the reputations of the loan officer and loan applicants.

Technologies. Each work system uses technology extensively. Those technologies range from telephones and personal computers through web sites and complex decision support software. The loan approval example includes a use of software that helps work system participants make the decision. In the ecommerce example, the work of deciding what to purchase and then making the purchase occurs through a web site. In the software development example, the programming and documentation work uses computers and software tools extensively, but important aspects of the requirements analysis and user collaboration may not involve technology at all.

Products and services produced for customers. Each work system produces things for internal or external customers. The loan approval system produces an approval decision for the loan applicant,

but the loan officer, whose bonus depends on the decision, is also a customer. The sales person who will try to make the sale is an internal customer of the prospect qualification system. The ecommerce system helps external customers decide what to buy and executes the purchase transaction. The customers of the IT group are the people within the company for whom the software is being built. To some extent the IT group is also a customer of the software development system because it will have to maintain the software over time.

Environment. Each work system operates within an environment that affects its operation. The managers of the loan approval system, prospect qualification system, and software development system are all under pressure to improve their operational results. The environment surrounding the ecommerce web site includes an industry-wide expectation that web sites will be attractive and effective.

Infrastructure. Although shared infrastructure was not mentioned directly in the brief descriptions of the examples, each work system relies on human, technical, and information infrastructures. For instance, the software development system relies on the firm's human infrastructure to maintain the work environment, on its technical infrastructure to provide computers and networks, and on its information infrastructure to provide internal company information that may be relevant.

Strategies. Each work system has an operational strategy. These strategies include making loan approval decisions by committee, using several different channels for finding sales prospects, selling using a web site that assumes the customer knows what to buy, and allowing individual programmers to decide on their own programming methods. Whether or not articulated as a strategy with a capital S, each of these represents a strategy because the main activities might have been performed in fundamentally different ways. In addition, each work system is to be improved within a corporation that also has strategies. An attempted improvement that conflicts with the corporation's strategies is unlikely to succeed.

Relationships with other systems. Systems in organizations never exist in a vacuum. Most work systems receive inputs from other systems and produce products and services that are used by other work systems. For example, the work system for finding qualified sales prospects produces lists of qualified leads that are used by a separate sales force that actually tries to sell the software. Similarly, the customer's use of the ecommerce web site produces sales transactions fulfilled by other work systems that find, package, and ship the merchandise. Additional impacts on other systems are less direct. For example, the resources and attention devoted to one work system might have been devoted to other work systems.

Work system architecture and performance. The analysis of each of these systems requires attention to both architecture and performance. A work system's architecture is a description of how it is organized and how it operates. Architecture can be described at various degrees of detail under the headings of work practices, participants, information, and technology. Architecture is assumed to be relatively constant until it is changed. A work system's performance is a description of how well the work system operates during a particular time interval. Work system performance has many facets and can be measured using a variety of performance indicators and related metrics. In many situations, improving a work system's performance requires changing its architecture.

The Work System Framework

A work system is a system in which human participants and/or machines perform work using information, technology, and other resources to produce products and/or services for internal or external customers. Businesses operate through work systems. Typical business organizations contain work systems that procure materials from suppliers, produce products, deliver products to customers, find customers, create financial reports, hire employees, coordinate work across departments, and perform many other functions.

The work system method is organized around the Work System Framework™ (Figure 2.1), a graphical representation of the elements that are included in even a basic understanding of a work system's scope and operation. Just agreeing on the identity and scope of these 9 elements can eliminate fundamental confusions in many situations.

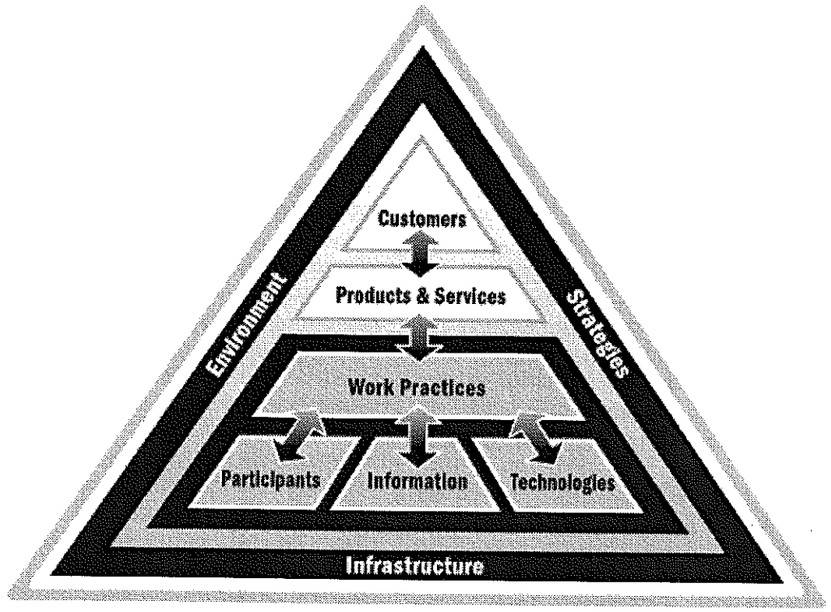
The Work System Framework provides an outline for describing the system being studied, identifying problems and opportunities, describing possible changes, and tracing how those changes might affect other parts of the work system. The arrows within the framework indicate that the various elements of a work system should be in balance. The first four elements are the basic components that actually perform the work. These include work practices, participants, information, and technologies.

The other five elements are included in even a basic understanding of a work system:

- Products and services the work system produces
- Customers for those products and services
- Environment that surrounds the work system
- Infrastructure shared with other work systems
- Strategies used by the work system and the organization.

Products & services and customers are not part of a work system, but are included in the framework because systems exist in organizations in order to produce products and services for internal or external customers. Environment and infrastructure are included because a work system's success often

Figure 2.1. The Work System Framework™



depends on its fit with the surrounding environment and on its use of available infrastructure that is shared with other work systems. Strategies are included in the framework as a reminder that work systems have strategies and that those strategies should be aligned with the organization's strategies.

The Work System Framework makes no assumptions about whether or not IT is used. It simply reserves a location for whatever technology is used. This is appropriate because any particular work system might not use IT, or might use IT only in a minor way. Furthermore, the framework does not create an artificial separation between the work system that produces products and services for the customer and the information system that often overlaps with the work system.

The Work System Framework also says nothing about how long a system will exist. Some work systems exist and produce their outputs over extended time spans. Others are projects, temporary systems designed to produce a particular output and then dissolve. In other words, the same framework can be used to summarize work systems in general, information systems, and projects. The concept of work system therefore provides a consistent starting point for thinking about work systems in general, about information systems that support work systems, and about projects that build or modify work systems.

The Work System Framework is easy to understand as an abstraction and has many uses in practice. At the beginning of an analysis it can help people agree about the scope of the system, and hence, what the analysis should include or exclude. Later, it is a useful reference point for keeping the analysis on target and recognizing whether the initial definition of the system and problem proves inadequate in relation to the realities that are uncovered.

The individual ideas underlying the Work System Framework are not revolutionary,[14] but the framework combines these ideas to provide an organizing perspective that is quite different from the way people in many organizations talk and think about computerized systems. You can verify this in your organization by listening to informal conversations or formal presentations about these systems, or by looking at written system proposals or documentation. You will probably find the informal conversations focusing on isolated details and frustrations related to information system use and maintenance. The formal conversations, proposals, and documentation will probably say a great deal about how the computerized parts of a system should operate. Aside from diagrams representing idealized work flows, however, rather little will typically be said about how people produce the work system's products with the help of technology, how well the various components of the work system are expected to operate, and how infrastructure and surrounding environment affect the work system.

Elements of a Work System

The nine elements of the Work System Framework were identified, and will now be defined. Chapter 4 will identify additional distinctions that have proven useful in applying the Work System Framework to understand systems in organizations.

Customers are the people who receive, use, or benefit directly from products and services that a work system produces. In most cases they can experience or perceive the quality of those products and services. Customers include external customers and internal customers. External customers receive and use the economic products and/or services that a firm produces. Firms exist to produce those products and services. Internal customers are employees or contractors who receive and use a work system's products and/or services while performing work in other parts of the same firm's value chain. A basic premise of quality management is that a system's customers are typically best able to evaluate the products and services it produces. Customer satisfaction is often linked to the entire customer experience, starting from determining requirements and acquiring the products or services. In many work systems, different groups of customers may receive different products and may have different criteria for evaluating those products.

Products & services are the combination of physical things, information, and services that the work system produces for its various customers. A work system's products and services may take various

forms, including physical products, information products, services, intangibles such as enjoyment and peace of mind, and social products such as arrangements, agreements, and organizations.

Work practices include all of the activities within the work system. These activities may combine information processing, communication, decision making, coordination, thinking, and physical actions. In some work systems, work practices can be defined tightly as highly structured business processes; in other work systems, some or all of the activities may be relatively unstructured. The Work System Framework uses the term *work practices* instead of the more familiar term *business process* for two reasons. First, in many work systems some of the activities are unstructured, and coordination occurs through improvisation rather than pre-specified rules. In these situations, the term business process is misleading because it implies a set of steps that are highly structured and are related in a predictable way. Second, there is no reason to assume that business process is always the primary perspective for thinking about work practices. Other useful perspectives include decision making, communication, coordination, control, and information processing.

Participants are people who perform the work. Some participants may use computers and IT extensively, whereas others may use little or no technology. When analyzing a work system, the more encompassing role of work system participant is more important than the more limited role of technology user,[15] whether or not particular participants happen to be technology users.

Being a work system participant is more important than being a computer user.

Information includes codified and non-codified information used and created as participants perform their work. Typical codified information is the pre-defined information used in tracking packages, entering orders, and performing repetitive financial transactions. In each case, each data item must be defined precisely, and the information is usually processed using explicit rules. Typical uncodified information includes computerized or handwritten documents, verbal agreements, and formal or informal conversations. Information may or may not be computerized. Information not related to the work system is not directly relevant, making the common distinction between data and information secondary when describing or analyzing a work system.

Knowledge can be viewed as a special case of information. Explicit knowledge is recorded in documents, images, rules, and other forms. Tacit knowledge exists in people's heads and is not explicit. Maintenance of both explicit and tacit knowledge is an important management challenge.

Technologies are tools that help people work more efficiently. Some technologies, such as search engines, cell phones, spreadsheet software, and automobiles, are general-purpose because they can be applied in a wide range of business situations. Other technologies are tailored to specific situations. Examples include a spreadsheet model for calculating mortgage interest and a software package for designing kitchens. Technologies tailored to specific business situations usually involve a combination of general-purpose tools and specialized techniques, such as mortgage calculation formulas. The separation between tools and techniques is worth considering because it is often possible to use a different general-purpose tool (e.g., a better laptop) without changing the technique. Similarly, it is possible to change the technique (e.g., moving to a better mortgage calculation method) while using the same laptop or other tool. In other situations, different techniques require more powerful general-purpose tools (e.g., early PCs were too slow to support voice recognition software).

Environment includes the organizational, cultural, competitive, technical, and regulatory environment within which the work system operates. Factors in the environment affect system performance even though the system does not rely on them directly in order to operate. The organization's general norms of behavior are part of the culture in the environment that surrounds the work system, whereas behavioral norms and expectations about specific activities within the work system are considered part of its work practices.

Infrastructure includes human, information, and technical resources that the work system relies on even though these resources are managed outside of it and are shared with other work systems. Human infrastructure is the people and organizations that supply services shared by different work systems. For example, training organizations, internal consultants, and human resources departments are typically considered part of human infrastructure. Information infrastructure is information shared across various work systems, such as mutually accessible databases and other enterprise-wide information. Technical infrastructure includes the Internet, corporate computer networks, database management software, and other technologies shared by multiple work systems and often hidden or invisible to work system participants.

Strategies consist of the guiding rationale and high-level choices within which a work system, organization, or firm is designed and operates. Strategies at the department and enterprise level may help in explaining why the work system operates as it does and whether it is operating properly. Although sometimes not articulated clearly, high-level choices about a system can often be inferred by considering plausible alternatives that were not chosen. For example, a system designed based on an assembly line rationale is not using a case manager rationale, in which one individual performs multiple steps, usually with the help of computerized information and models.[16] Similarly, a system designed to produce based on mass customization is not using a commodity-like, "one size fits all" strategy. A work system's strategy should be aligned with the strategy of the organization and firm that it serves. For example, a work system designed to produce the highest quality products might not fit in an organization operating under a cost minimization strategy.

Work System Snapshot

The Work System Framework can help in summarizing virtually any system in an organization. It can be applied to produce a tabular one-page summary called a **work system snapshot**. This is a highly summarized but balanced view of a work system that a business professional can produce quickly or can understand quickly when it is presented. A work system snapshot uses six central elements to summarize what a system is and what it produces. At this level of summarization, distinctions between technology and technical infrastructure are unimportant.

The sample work system snapshot in Figure 2.2, summarizes the loan approval system mentioned earlier. Any summary of this type is a simplification of reality that attempts to identify the main features of the system and ignores many distinctions that are important when analyzing the system in depth. Even with no additional explanation, Figure 2.2 gives a general impression of what work system is being discussed. This type of summary could also be used effectively in an initial discussion with colleagues, especially since it would help in recognizing inconsistencies between different views of system content and operation. A glance at Figure 2.2 might reveal areas that seem unclear or questionable. Someone familiar with the situation might find details that are no longer correct or were never totally correct. Use of a work system snapshot makes it more likely that everyone in a conversation will be thinking about the same system and not just imagining that everyone else shares the same view of the system's scope.

A work system snapshot can help people verify that they agree on a work system's scope and purpose.

The identification of work system elements in the work system snapshot might lead to a variety of discussion points. Part of the discussion would be about defining the scope of the system that was being analyzed:

- What else does the loan approval system produce? For example, does it produce any management information for tracking the bank's current and future revenues and evaluating the quality of its current and future loan portfolio?
- Do we really want to talk about how the loan officer finds prospects, or is it better to think of the loan approval system as starting with a known prospect?
- Can we treat the production of loan documents as part of a separate system so that we can focus on how to make the approval/denial decisions more effectively?

Another part of the discussion would be about how well the loan approval system operates and what are some of the possibilities for improvement:

- How appropriate are the approval or denial decisions that have been made? What is the frequency of mistakes?
- Which of the delays in the system are due to the clerical work of assembling the loan applications, and which are due to loan committee schedules?

Figure 2.2. Work system snapshot for a loan approval system for loans to new clients

Customers	Products & Services
• Loan applicant • Loan officer • Bank's Risk Management Department and top management • Federal Deposit Insurance Corporation (FDIC) (a secondary customer)	• Loan application • Loan write-up • Approval or denial of the loan application • Explanation of the decision • Loan documents
Work Practices (Major Activities or Processes)	
• Loan officer identifies businesses that might need a commercial loan. • Loan officer and client discuss the client's financing needs and discuss possible terms of the proposed loan. • Loan officer helps client compile a loan application including financial history and projections. • Loan officer and senior credit officer meet to verify that the loan application has no glaring flaws. • Credit analyst prepares a "loan write-up" summarizing the applicant's financial history, providing projections explaining sources of funds for loan payments, and discussing market conditions and applicant's reputation. Each loan is ranked for riskiness based on history and projections. Real estate loans all require an appraisal by a licensed appraiser. (This task is outsourced to an appraisal company.) • Loan officer presents the loan write-up to a senior credit officer or loan committee. • Senior credit officers approve or deny loans of less than $400,000; a loan committee or executive loan committee approves larger loans. • Loan officers may appeal a loan denial or an approval with extremely stringent loan covenants. Depending on the size of the loan, the appeal may go to a committee of senior credit officers, or to a loan committee other than the one that made the original decision. • Loan officer informs loan applicant of the decision. • Loan administration clerk produces loan documents for an approved loan that the client accepts.	
Participants	**Information**	**Technologies**
• Loan officer • Loan applicant • Credit analyst • Senior credit officer • Loan committee and executive loan committee • Loan administration clerk • Real estate appraiser	• Applicant's financial statements for last three years • Applicant's financial and market projections • Loan application • Loan write-up • Explanation of decision • Loan documents	• Spreadsheet for consolidating information • Loan evaluation model • MS Word template • Internet • Telephones

- Could some type of preliminary screening by a person other than the loan officer save time and effort for everyone?
- What types of biases are introduced by the fact that the loan officer is both a participant and a customer (whose bonus is affected)?
- Does the information about the applicant provide an adequate picture of the risk of the proposed loan?
- How effective is the loan evaluation model? How often does it mislead the decision makers?
- Could the loan officers use the loan evaluation model directly to help them analyze the loan application, thereby reducing the number of situations in which a senior credit officer or loan committee rejects an application that should not have been submitted?

Although analysis of these questions would probably involve a detailed examination of different aspects of the situation, the work system snapshot would always be available to maintain the big picture. And the snapshot itself might change if the analysis revealed that the initial scope of the system was wrong, or that the system should really be subdivided into several separate systems.

The work system snapshot is a deceptively simple tool. For example, one team of Executive MBA students analyzing a system in one of their organizations complained that the team had argued for four hours about the scope of the system they were trying to analyze. This was much more effort than they had expected in the first step of the project, but their experience helped them realize why it is so important to define both the work system and the problem or opportunity before launching into technical details. They had seen expensive system projects that generated disappointing results because the technical work occurred without genuine agreement about how the new work system should operate. A comparatively small work system analysis early in the project might have dispelled big picture confusions that led to unnecessary technical features that were never used.

One Lens Fits Almost All

The work system concept is like a common denominator for many of the types of systems discussed in information system practice and research. Operational information systems, projects, supply chains, and ecommerce web sites can all be viewed as special cases of work systems.

- An **information system** is a work system whose work practices are devoted to processing information, i.e., capturing, transmitting, storing, retrieving, manipulating, and displaying information. Some information systems exist to produce information products for internal or external customers. Others exist to support work systems that produce physical products and services for internal or external customers. Increasing reliance on computerized information systems has led to greater overlap between work systems and the information systems that support them. This increasing degree of overlap makes it even more important to avoid confusion about the problem or opportunity that an analysis addresses, about which system has that problem, and about what is to remain constant.
- A **project** is a work system designed to produce a product and then go out of existence. Each major project phase or subproject might also be viewed as a separate work system with its own work practices, participants, and products.
- A **value chain** can be viewed as a large work system that crosses several functional areas of business and whose participants typically reside in different departments. Similarly, each major step in a value chain can be viewed as a work system.
- A **supply chain** is an interorganizational work system devoted to procuring materials and other inputs required to produce a firm's economic products and services. The firm and specific suppliers are participants in work practices that use specific information and technology to create, monitor, and fulfill orders.
- An **ecommerce web site** can be viewed as a self-service work system in which a customer uses the seller's web site in a process of matching requirements to product offerings and then making the purchase. By focusing attention on the customer's work practices and desired outcome, a work system view helps in recognizing why an attractive interface does not assure a web site's success.

The fact that all of these systems can be viewed as work systems implies that the same basic concepts and analysis ideas apply for all of these cases. For example, it is possible to use work system elements to summarize any work system, including any information system, project, supply chain, or ecommerce web site. Being able to start from the same big picture ideas and models makes it easier to think about a broad range of situations even though each special case may have its own specialized terminology for specific topics.

The work system method exploits these commonalities in many ways. For example, it uses a set of commonsense principles (presented in Chapter 5) that apply for every work system. These principles are part of a straightforward, organized approach for evaluating how well each aspect of a system is operating now and whether any particular change in the system would have beneficial or adverse effects in other parts of the system. The work system method also provides lists of common performance indicators, strategies, stumbling blocks, and possibilities for change that apply across most work systems.

Themes Expressed by the Work System Framework

The content and form of the Work System Framework express a number of themes that motivate the work system method.

Work system, not IT system. Systems in organizations involve much more than IT. Even a cursory understanding of a system in an organization starts by summarizing the work system itself, and its work practices, participants, information, and technologies. Recognition of five other elements (products and services, customers, environment, infrastructure, and strategies) is required for a meaningful discussion of whether the work system is producing what customers want and of the consequences of any particular change.

Work system, not just business process. Some people describe the work system approach as a "process approach" to systems in contrast to a technical approach. This characterization is partly correct. Yes, the work system approach focuses more on the work than on the technology that is used, but the Work System Framework is designed to show that a pure process view is also inadequate.

The framework contains *work practices* rather than business process because work involves much more than just the steps in an idealized business process. The steps in a business process can be described independent of the participants, information, and technology. However, different participants with different skills or motivation might perform the same business process steps differently. People performing the work also may invent workarounds for their own convenience or to adjust for exceptions or conditions not anticipated when the process was designed. The business process results might also be affected by variability related to information or technology. The discussion of the work system method will explain that business process is one of several different perspectives for looking at work practices, just as an organization chart and personal impacts on participants are different perspectives for attending to the people who participate in a work system.

Alignment between the elements. The Work System Framework's double-headed arrows express the need for internal alignment. They also convey the path through which a change in one element might affect another. For example, the arrows linking the work practices to participants, information, and technology say that a change in the work practices might call for a change in any of these elements and vice versa. Thus, changes in work practices may affect the participants by changing the quality of their work life. Conversely, the replacement of work system participants by people with different skills and motivation might affect how well the work is done and, hence, the results.

Participants, not users. The framework refers to *participants* rather than *users* because it focuses on

how a work system operates rather than on how people use computers while doing work. The use of computers is certainly important, but it usually shouldn't be the headline when trying to understand a work system in an organization. Part of the common confusion about systems in organizations involves an under-emphasis on how system participants do their work and an over-emphasis on how they use computers and on what the computers do.

Products and services, not outputs. The terms products and services are used instead of "outputs" because that term brings too many mechanistic and computer-related connotations, especially when services and intangibles are involved. Computer programs produce outputs; work systems produce products and services for their internal and external customers.

Better information may not matter. Better information leads to better work system results only if the new information helps participants perform work more efficiently or effectively. In other words, access to a huge amount of seemingly relevant information may have no impact whatsoever.

Better technology may not matter. As with better information, better technology leads to better work system results only if the new technology helps participants perform work more efficiently or effectively. For example, writing a book using the very latest desktop computer instead of a two-year old computer would have little or no impact on the quality of the result.

Internal versus external performance. The managers of the work system want to promote both internal work system efficiency and customer satisfaction. The customers are primarily concerned with whether the products and services they receive meet their goals and expectations related to cost, quality, responsiveness, and other facets of product performance. Thus, evaluation of any work system should consider both internal and external views.

Work Systems, Not IT

This overview of four examples and the main ideas in the Work System Framework demonstrates that a work system approach provides an organized way to think about how systems in organizations operate, and how well they operate. The ideas are logical and straightforward. Other than the term work system, most of the ideas are familiar in the everyday work environment.

Applying a work system approach for understanding or analyzing an IT-reliant system helps in focusing on the quality of work and the satisfaction of customers. Technology assumes its rightful place as an essential part of the work system, but certainly not the headline. Seeing IT from this vantage point leads to a number of simple conclusions:

- IT success is about how IT is used in work systems. IT success is really about work system success.
- IT has a significant impact only when it is used in a work system.
- IT success is not the sole responsibility of IT professionals. They have to make sure that IT is set up properly and works technically, but IT success is largely the responsibility of line managers and work system participants.
- Reducing confusion and uninformed expectations about what IT can and cannot do is a powerful way to boost the likelihood of IT success.

A useful analysis of a system should produce recommendations that are practical to implement as part of a work system's evolution over time. For explanatory purposes it is easier to continue discussing the analysis of a work system. Chapter 7 will return to implementation issues by explaining how work systems change over time.

Chapter 3: Overview of the Work System Method

- Three Levels for Using the Work System Method
- Level One
- Level Two
- Level Three
- Different Uses of the Work System Method
- Conclusion - the Whole, the Parts, and the Specifics

The work system method (WSM) is designed to help business professionals understand systems in their organizations. It is especially valuable early in a system-related project when people identify the problem, think about alternative courses of action, and decide how to proceed. As a project unfolds, it is also useful for keeping the project on track by reinforcing the goal of improving the work system rather than just producing software on time and within budget. Unlike some methods that require specific steps performed in a specific order, the work system method is designed to be quite flexible. It provides usable guidelines and analysis concepts while at the same time permitting the analysis to occur in whatever order and at whatever level of detail is appropriate for the task at hand.

WSM outlines steps a business professional can use to clarify a system-related issue, identify possible directions for change, and produce and justify a recommendation. The goal is to create an organized, rigorous problem solving approach with enough freedom to encourage focusing on important issues and downplaying minor ones. To avoid becoming a straightjacket it encourages examination of a work system in as much depth as is warranted by a particular situation. Instead of emphasizing the kinds of rigorously consistent details required for creating a debugged, maintainable computer system, it focuses on business issues leading to a recommendation about desired work system changes.

WSM is organized around a typical problem solving process of defining a problem, gathering and analyzing relevant data, identifying alternatives, and selecting a preferred alternative. WSM is divided into three major steps that apply general problem solving to typical systems in organizations:

- SP - Identify the System and Problem: Identify the work system that has the problems or opportunities that launched the analysis. The size and scope of the work system depends on the purpose of the analysis.
- AP - Analyze the system and identify Possibilities: Understand current issues and find possibilities for improving the work system.
- RJ - Recommend and Justify changes: Specify proposed changes and sanity-check the recommendation.

The abbreviations SP, AP, and RJ minimize repetitive verbiage when referring to these steps.

An idealized problem solving process might call for a prescribed sequence of steps such as completing analysis of the current situation before trying to define possibilities for improvement. However, in reality people often redefine the problem and think about possibilities while they do the analysis. They may even start with a recommendation and work backward to see whether an analysis could support it. WSM's goal is to help people understand systems and recognize the completeness of their understanding, regardless of the order they use for thinking about the situation.

Awareness of the three steps is valuable because many problems result from inadequacies in each step. In too many cases, organizations purchase software without a clear understanding of which work systems have the problems or opportunities that are being addressed. The common result is a "solution" that doesn't fit the situation or that causes many new problems. In too many cases, little or no real analysis is done and managers simply assume that software designed for a specific type of problem, such as tracking sales calls, will be effective. Too often, the recommendation focuses on the software that will be built or acquired, but not on how the work system will operate after the software is available. Finally, too many system improvement efforts are not adequately evaluated and justified. Too many projects plunge ahead before creating a shared understanding of the extent and value of the intended changes, the new problems that might arise, and the feasibility of implementing changes whose rationale and impacts are unclear.

Before proceeding it is worth noting that other methods and techniques address some of these issues. For example the "rich pictures" produced by soft systems methodology[17] can be used in establishing the scope of the system that is being analyzed. Influence diagrams[18] can be used to map beliefs about important relationships. A wide range of techniques under the general heading of Six Sigma are used to gather and analyze statistical data about process performance and causes of problems. Our goal is to explain the work system method rather than to compare it to many other methods and techniques that address some of the same issues, but in different ways and with different goals.

Three Levels for Using the Work System Method

WSM is based on the assumption that a single, totally structured analysis method is not appropriate for all situations because the specifics of a situation determine the nature of the understanding and analysis that is required. In some situations, a manager simply wants to ask questions to make sure someone else has done a thoughtful analysis. At other times, a manager may want to establish a personal understanding of a situation before discussing it with someone else. When collaborating with IT professionals, managers can use WSM to clarify and communicate their own understanding of the work system and to make sure that the IT professionals are fully aware of business issues and goals that software improvements should address. From the other side, IT professionals can use WSM at various levels of detail to confirm that they understand the business professionals who are the customers for their work.

Recognizing the varied goals of WSM applications, WSM can be used at three levels of detail and depth. The user's goals and the need to communicate and negotiate with others determine the level to use in any particular situation.

- Level One: Be sure to remember the three main steps when thinking about a system in an organization: SP (system and problem), AP (analysis and possibilities), and RJ (recommendation and justification).
- Level Two: Within each main step, answer specific questions that are typically important.
- Level Three: Use checklists, templates, and diagrams to identify and consider issues that are easy to overlook.

Table 3.1 illustrates WSM's structure by showing how the three steps in Level One expand into specific questions in Level Two and use checklists, templates, and diagrams in Level Three.

Table 3.1. Three levels of the work system method

	First step in WSM	*Second step in WSM*	*Third step in WSM*
Headings in Level One	**SP**: Identification of the work system that has the problems or opportunities.	**AP**: Analysis of current issues and identification of possibilities for improvement.	**RJ**: Recommendation and its justification.
Questions in Level Two	**SP1** through **SP5**: Five questions about the system and problem.	**AP1** through **AP10**: Ten questions related to analysis and possibilities.	**RJ1** through **RJ10**: Ten questions related to the recommendation and its justification.
Topics and guidelines in Level Three	Checklists, Templates, & Diagrams	Checklists, Templates, & Diagrams	Checklists, Templates, & Diagrams

This chapter summarizes the three steps at Level One, identifies the 25 questions at Level Two, and describes a few of the issues that are introduced in the checklists in Level Three. It also explains some of the different ways you can use WSM. Subsequent chapters fill in guidelines and ideas needed for an in-depth analysis. Chapter 4 focuses on defining the system and the problem (the SP step). Chapter 5 introduces many ideas in the Level Three checklists in the AP step. Chapter 6 provides brief explanations of the RJ questions. Chapter 8 and the Appendix provide an example designed to illustrate how the levels can be used independently or in combination.

Level One

The most basic application of WSM encourages the user to think about the situation in work system terms, but provides minimal guidance other than saying that each of the three main steps (SP, AP, and RJ) should be included. For example, assume that several people are speaking in general about whether a particular CRM (customer relationship management) software package might be beneficial. Using WSM at Level One, they would not focus initially on the features and purported benefits of the CRM software. Instead, they would discuss:

- SP: What work system(s) are we talking about? From a business viewpoint, what are the problems and opportunities related to the work system(s)?
- AP: What are the shortcomings of each part of the work system(s) and what are the possibilities for eliminating or minimizing these shortcomings? Adopting CRM software might be one possible change, but there are probably others.
- RJ: What changes in the work system(s) do we recommend and how could we justify those changes?

Merely using these questions to stay focused on the work system(s) instead of plunging into software details and features would probably make the initial discussion more productive. The discussion would treat the CRM software as part of something larger. It would be clearer that addressing the business problems or opportunities requires many changes beyond just adopting CRM software.

Level One can be used in other ways as well. An individual can use it as a simple discipline for organizing a quick personal summary of a familiar situation. A manager can use it to organize a ten-minute summary of a proposed system change, thereby increasing the likelihood that colleagues

would understand the purpose and scope of the proposed change. From the other side, someone reading a proposal or listening to a presentation can use the three headings in Level One to attain clarity about what system and problem are being discussed, whether any real analysis has occurred, and whether the recommendation is justified.

Level One is a minimal first cut that highlights three headings (SP, AP, and RJ) but provides no other guidance. For example, the headings provide no help in identifying topics that should be considered and concepts that are effective in exploring those topics. A seemingly reasonable proposal created and presented at Level One is likely to overlook many foreseeable difficulties that would emerge from a deeper, more detailed business analysis.

Level Two

As illustrated in Table 3.1, Level Two provides a set of important questions for each of the three steps in the Level One analysis. Because the steps in Level One are abbreviated SP, AP, and RJ, specific questions in Level Two are identified using abbreviations such as SP3 and AP8.

Every question in Level Two is relevant to almost any analysis of a system in an organization, whether or not IT plays a major role. Level Two can be used as a checklist to organize one's own analysis or to review someone else's analysis to make sure that major aspects of a current and proposed system are being considered. Level Two can be used to make sure that an analysis has not over-emphasized one aspect of a work system while ignoring other important aspects. If any of the Level Two questions has been ignored, the analysis is probably incomplete and may overlook important issues that are easily identified.

System and Problems in Level Two. The WSM step of identifying the work system that has the problems or opportunities is subdivided into five questions that provide a starting point for analyzing a work system in an organized way.

- SP1: Identify the work system that is being analyzed.
- SP2: Identify the problems or opportunities related to this work system.
- SP3: Identify factors that contribute to the problems or opportunities.
- SP4: Identify constraints that limit the feasible range of recommendations.
- SP5: Summarize the work system using a work system snapshot.

Taken together, SP1 and SP2 imply that the scope of the work system is not known in advance, but rather, depends on the problems or opportunities that are being pursued. To expedite the analysis effort and focus the recommendations, the work system should be the smallest work system that has the problems or opportunities that are being analyzed. The initial identification of the work system should be viewed as no more than a starting point that is definitely not cast in concrete. Insights as the analysis unfolds often reveal that the initial definition is inadequate and that a better definition would encompass unanticipated problems, opportunities, or issues.

Questions SP3 and SP4 are included because initial beliefs about contributing factors and constraints help in framing the analysis. They also may help in surfacing assumptions that may not be shared and in recognizing additional opportunities and issues that emerge during the analysis. For purposes of analyzing a system, contributing factors are relevant issues that might provide insight and might affect the analysis or recommendation even though they are not part of the system. For example, contributing factors might include recent turnover in key personnel, recent changes elsewhere in the organization, the frequent absence of a key decision maker due to other responsibilities, or month-end spurts in output from another work system that cause overtime in this work system.

Constraints are limitations that are assumed to be unchangeable within the time period covered by the analysis. It is worthwhile to identify constraints at the beginning of an analysis to avoid making recommendations that are impractical. For example, there are many times when it would be nice to replace some of the work system participants with people who are more skilled or motivated. If there is no possibility of doing that, the retention of the current participants should be treated as a constraint that precludes recommendations that would remove those individuals. Other typical constraints include budgets, capacity limitations, technology limitations, union rules, employment regulations, privacy regulations, and customer requirements for documentation of processes.

Question SP5 calls for clarifying the scope of the work system using a work system snapshot such as the one presented in Figure 2.2. A work system snapshot is a single page that identifies:

- the work system's customers, products and services, and participants
- the major steps or activities
- the most important information and technologies in the work system.

Even when there is initial agreement about the work system snapshot, looking at the situation in more depth as the analysis unfolds often results in revising the initial view of the work system's scope. The initial work system snapshot may reveal that several different work systems are involved and that it will be simpler to analyze each work system separately. Figure 4.3 in Chapter 4 provides guidelines for work system snapshots. Figures 4.4 through 4.9 provide additional examples of work system snapshots for a diverse set of situations.

Steps and Levels keep the analysis organized while it goes as deep as is needed.

Analysis and Possibilities in Level Two. Understanding current issues and finding possibilities for improvement is subdivided into ten questions, one for each element in the Work System Framework and one for the work system as a whole:

- AP1: Who are the customers and what are their concerns related to the work system?
- AP2: How good are the products and services produced by the work system?
- AP3: How good are the work practices inside the work system?
- AP4: How well are the roles, knowledge, and interests of work system participants matched to the work system's design and goals?
- AP5: How might better information or knowledge help?
- AP6: How might better technology help?
- AP7: How well does the work system fit the surrounding environment?
- AP8: How well does the work system use the available infrastructure?
- AP9: How appropriate is the work system's strategy?
- AP10: How well does the work system operate as a whole and in relation to other work systems?

Although some of these AP questions are inevitably more important in than others in specific situations, inclusion of questions about all nine elements of the Work System Framework increases the likelihood that analysis and design efforts will start with a reasonably balanced view of the work system and the range of possible improvements. In particular, this approach should avoid the common error of assuming that the system consists of little more than the software and computerized information.

Recommendation and Justification in Level Two. The goal of performing the analysis and identifying possibilities is to provide the basis for a recommendation for action. In addition to making sure the recommendation is stated clearly, the RJ questions at Level Two probe whether the recommendation and justification are coherent and compelling enough to explain to others:

- RJ1: What are the recommended changes to the work system?
- RJ2: How does the preferred alternative compare to other alternatives?
- RJ3: How does the recommended system compare to an ideal system in this area?
- RJ4: How well do the recommended changes address the original problems and opportunities?
- RJ5: What new problems or costs might be caused by the recommended changes?
- RJ6: How well does the proposed work system conform to work system principles?
- RJ7: How can the recommendations be implemented?
- RJ8: How might perspectives or interests of different stakeholders influence the project's success?
- RJ9: Are the recommended changes justified in terms of costs, benefits, and risks?
- RJ10: Which important assumptions within the analysis and justification are most questionable?

The RJ questions at Level Two serve several purposes. First, they identify issues that should be considered before pursuing a recommendation. Second, they make sure the recommendation is justified from a variety of economic, organizational, and practical perspectives, not just financial estimates such as internal return on investment or net present value. Third, they can help in recognizing topics that need a deeper discussion and/or additional expertise. Although none of these questions are intrinsically technical, several require input from IT professionals. For example, it is rarely feasible to produce a cost-benefit justification (RJ9) without help from someone who understands the technical issues and technical resources required.

WSM's justification questions help in explaining the rationale and completeness of a proposal, but they are not designed for comparison of disparate proposals competing for limited investment funds. WSM is used to analyze a current work system, describe a proposed work system, and justify a proposal. WSM assumes that budget allocation decisions occur at a different time. Its main contribution to a budget allocation process is in supporting the analysis of the systems that are being considered.

Level Three

The 25 questions in Level Two provide an organized approach for pursuing each of the three major WSM steps. Level Three identifies specific topics that are often worth considering when answering Level Two questions. Although each question in Level Two is almost always relevant, some of the Level Three topics for the Level Two questions may not be relevant to a particular situation.

As an example, consider the Level Two question AP3, "How good are the work practices inside the work system?" In a particular situation, it might be easy to produce a quick answer that the work is being done inefficiently, that it takes too long, and that the error rate is too high. That type of statement mimics question SP2 (identify the problems or opportunities), but does not go into enough specifics to determine whether any particular set of proposed changes would actually generate better results. A genuine understanding of the quality of the work practices would look more deeply at how the work is done and how well it is done. It would include consideration of a variety of possibilities for improvement.

The major topics and concerns identified in Level Three are basically hints about topics that are frequently important but that might not be important in any particular situation. Using Level Three involves deciding which topics are important and which can be ignored in the particular situation. Examples of Level Three topics related to AP3 include, among others:

- Roles and division of labor
- Relevant functions not performed by the work system

- Problems built into the current business process or functions
- Effect of strategies built into work practices
- Evaluation criteria for work practices
- Problems involving phases of decision making
- Problems involving communication.

Each of these topics provides a direction for looking at work practices. Each direction brings a set of everyday concepts, images, and examples that may be useful. For instance, problems built into current work practices might include any of the following:

- Unnecessary hand-offs or authorizations
- Steps that don't add value
- Unnecessary constraints
- Low value variations
- Responsibility without authority
- Inadequate scheduling of work
- Large fluctuations in workload
- Inadequate or excess capacity.

This type of list might help in identifying or categorizing problems that otherwise might be overlooked. At minimum, a glance at such a list provides greater assurance that widely applicable issues have been considered.

As you can imagine, lists of topics for each of 25 questions can be unwieldy to use. Experimentation with various alternatives led to an approach of using checklists, templates, and diagrams to make Level Three efficient for the user. The checklists and templates organize concepts and knowledge in an easily accessible form that allows a user to identify topics that are relevant and ignore other topics without devoting effort to them.

Checklists within themes. Chapter 5 presents five themes that can be used for identifying issues and possible improvements. The topics within these themes are presented in Figures 5.1 through 5.5. The extended example in the Appendix shows how those topics can be included in checklists organized around the themes:

- Work system principles
- Work system performance indicators (the work system scorecard)
- Strategic issues for a work system
- Possibilities for improvement
- Work system risk factors and stumbling blocks.

The principles checklist may trigger realizations that the original problem statement ignored important issues, or that certain possible changes would cause other problems. The scorecard encourages consideration of a range of performance indicators. The strategies checklist encourages consideration of big picture strategies that go beyond fixing details and local symptoms. The possibilities checklist helps in remembering that changes in one part of a work system often must be accompanied by related changes in other parts of the system. The risk factors and stumbling blocks checklist provides reminders of things that often go wrong.

Each of these checklists contains topics related to all of the work system elements. For example, the work system scorecard lists common performance indicators for each work system element. It also provides space for entering current and desired values of specific metrics for the performance indicators that are relevant to a specific work system.

Checklists for specific work system elements. The same topics can be organized in a different direction by using a separate checklist for each work system element, thereby drilling down within each element instead of following a theme across all of the elements. To illustrate this type of checklist, the last section of Chapter 5 presents a separate table of topics for each work system element. These tables serve as reminders of frequently relevant topics for each of the AP questions in Level Two. For example, a glance at the table for question AP3 (about work practices) identifies relevant work system principles, performance indicators, strategies, stumbling blocks, and possibilities for change.

Templates. The work system snapshot is an example of a template. It is an organized, tabular format for displaying information that is useful in answering a specific question, in this case, SP5. The Appendix presents a number of other templates that are useful for answering other questions.

Diagrams. A range of diagrams and visual display methods from various disciplines may be useful in analyzing a work system. For example, Chapter 10 (Work Practices) shows three types of diagrams that can be used in analyzing work practices. These include flow charts, swimlane diagrams, and data flow diagrams. The tables at the end of Chapter 5 mention some of the common types of diagrams that can be used to think about other work system elements. Many websites and books on data analysis and Six Sigma methods explain other types of diagrams that are not covered in this book but are useful for analyzing work systems when appropriate data is available. Examples include histograms, scatter plots, control charts, Pareto charts, and fishbone diagrams.

All of Level Three is designed to help in identifying issues and topics that might be overlooked. The analyst can decide whether or not to use any or all of the checklists, templates, and diagrams. Typically it is unnecessary to use all of the checklists because topics on one are often reminders of topics on other checklists.

WSM is designed based on the assumption that providing an organized structure with considerable depth is an effective way to help managers and business professionals pursue whatever amount of detail they want to pursue in a particular situation. Because WSM is designed to support a business professional's analysis, even Level Three does not approach the amount of detail or technical content that programmers and other IT professionals must analyze and document while producing computerized information systems. In addition, although Level Three might seem quite thorough, it focuses on a single work system and therefore skims over some of the details and complexities of interactions between work systems. In some cases it is worthwhile to address those issues by viewing several interacting work systems as a single, larger work system.

Different Uses of the Work System Method

After seeing all 25 questions in Level Two, you might wonder whether it is important for business professionals to look at systems in so much depth. The answer is a resounding *maybe*. If a particular situation calls for nothing more than a quick once-over, even the questions in Level Two may not be necessary. But when it is important to understand a significant situation, it is unlikely that any of the Level Two questions about the analysis and possibilities can be skipped with impunity. And if it is important to participate in decisions about a system-related project, all of the questions about the recommendation and its justification are important.

The organization of WSM into Level One steps, Level Two questions for each step, and Level Three checklists and templates is basically a device to help in recognizing different depths of analysis and deciding how to apply work system ideas in practical situations. The goal is to combine guidance with freedom in using a set of ideas that apply to any real world system but often are not applied in a complete or organized way.

In a well-managed organization, analyzing situations and justifying recommendations should be totally familiar even if the idea of focusing on work systems is unfamiliar. In such an organization, something similar to Level One should be part of the culture, even if different terms are used. Level Two fills in reminders about typical questions under each of the three steps in Level One. For individuals with substantial systems analysis experience, just the list of Level Two questions could suffice because that experience provides personal checklists and rules of thumb.

Most business professionals do not have substantial systems analysis experience, however. If it is important to understand or discuss a system in some depth before making or agreeing to a proposal, most business professionals would probably benefit from the Level Three reminders about typical issues and topics related to the Level Two questions. Experience to date implies that the questions at Level Two provide an organized way to go beyond the superficial, and that the checklists, templates, and diagrams at Level Three make it easier to consider each question in reasonable depth.

Shown next are some of the ways the work system method can be used at different levels of depth for different purposes. The first six types of use are posed as an individual's analysis, although teams can use the same approaches. The seventh and eighth invite analysts and IT professionals to customize parts of WSM when performing interviews or creating questionnaires to gather diverse viewpoints about a proposed project.

1. Ask several basic questions.

Level 1	SP	AP	RJ
Level 2	SP1 - SP5	AP1 - AP10	RJ1 - RJ10
Level 3	Checklists Templates Diagrams	Checklists Templates Diagrams	Checklists Templates Diagrams

Assume that someone has proposed that software should be developed or that an existing system should be improved. The most basic review of the situation simply asks several basic questions to check whether all three Level One steps have been considered. Just looking these three steps provides three important reminders:

- ***SP reminder***: The work system, not the software or IT, is the primary unit of analysis from a business viewpoint.
- ***AP reminder:*** Before deciding what to do, it is a good idea to analyze the situation and consider different possibilities related to the work system, not just the technology.
- ***RJ reminder:*** Recommendations should be justified.

Unfortunately, the three general headings of Level One provide very little guidance about how to define the system, analyze it, or justify a recommendation.

WSM's structure provides reminders about questions and issues that should be considered when a system improvement project begins.

2. Show care in defining the work system and problem.

Level 1	SP	AP	RJ
Level 2	SP1 - SP5	AP1 - AP10	RJ1 - RJ10
Level 3	Checklists Templates Diagrams	Checklists Templates Diagrams	Checklists Templates Diagrams

In many cases of system-related disappointments, merely defining the work system clearly probably would have helped firms minimize confusions and unrealistic expectations that led to costly project delays and rework. The term *system* often takes on different meanings in the same conversation. For example, "our manufacturing system isn't working properly" might refer to the way manufacturing is being performed, and later might refer to software that is being used. Defining the work system and problem using questions SP1 through SP5 adds clarity when distinguishing between the desired work system improvements and the information system changes that are necessary in order to realize those improvements.

3. Make sure the analysis is balanced and considers each element of the work system.

Level 1	SP	AP	RJ
Level 2	SP1 - SP5	AP1 - AP10	RJ1 - RJ10
Level 3	Checklists Templates Diagrams	Checklists Templates Diagrams	Checklists Templates Diagrams

The ten questions AP1 through AP10 look at each work system element and at the work system as a whole. Considering each question makes it less likely that information and technology will be over-emphasized and that customers and participants will be under-emphasized.

4. Use checklists to identify topics and issues for the analysis.

Level 1	SP	AP	RJ
Level 2	SP1 - SP5	AP1 - AP10	RJ1 - RJ10
Level 3	Checklists Templates Diagrams	Checklists Templates Diagrams	Checklists Templates Diagrams

Checklists and templates in Level Three provide a convenient way to identify topics and issues that should be considered when answering the Level Two analysis questions. As mentioned earlier, some checklists organize Level Three topics within themes such as work system principles, performance indicators, strategies, possibilities for change, and stumbling blocks. Other checklists are organized by work system element. WSM templates provide organized, tabular formats for displaying information that is useful in answering specific Level Two questions. Various diagrams can also be used, some of which are introduced in Chapters 10 and 12.

5. Examine the recommendation and make sure it is justified from a number of viewpoints.

Level 1	SP	AP	RJ
Level 2	SP1 - SP5	AP1 - AP10	RJ1 - RJ10
Level 3	Checklists Templates Diagrams	Checklists Templates Diagrams	Checklists Templates Diagrams

The ten questions about the recommendation and justification look at the recommendation from a variety of viewpoints, all of which are frequently useful. Attention to different facets of the recommendation may highlight issues that would not be identified with a less thorough approach. For example, these questions might help in realizing that a recommendation will cause new problems, that it may not solve the original problem, or that it may be very far from the ideal approach to the current problem. It is much better to recognize these situations than to pretend they don't exist.

The work system method is designed for flexibility. It organizes ideas that should be applied in whatever way makes sense in the user's situation.

6. Use recommendation checklists and templates to sanity-check whether the recommendation is justified.

Level 1	SP	AP	RJ
Level 2	SP1 - SP5	AP1 - AP10	RJ1 - RJ10
Level 3	Checklists Templates Diagrams	Checklists Templates Diagrams	Checklists Templates Diagrams

As illustrated in the example in the Appendix, checklists and templates for the RJ questions organize a large number of topics in a form that makes them readily accessible. For example, for question RJ7, "How can the recommendations be implemented?" the templates cover project ownership and management, a tentative project plan, and resource requirements. Many organizations have more complex templates for these topics, but these basic templates are at least a reminder of topics should that be considered in any well-justified recommendation.

7. Select questions and topics to use in an outline for interviewing work system participants and stakeholders.

Level 1	SP	AP	RJ
Level 2	SP1 - SP5	AP1 - AP10	RJ1 - RJ10
Level 3	Checklists Templates Diagrams	Checklists Templates Diagrams	Checklists Templates Diagrams

Analysts and IT professionals may find it useful to select particular questions and topics as the basis for interviews. For example, a newly hired IT professional had a mandate to improve software methods in a product engineering group. He created an interview questionnaire to help him learn about his new firm's product engineering system. The questionnaire started with "describe your role in the system" and included questions such as AP5 and AP6, "Would better information (or better technology) help?" He was intrigued that everyone seemed to have views about many topics but no one had strong suggestions for question RJ3, "What would be an ideal system?"

Effective use of WSM requires conscious decisions about what to consider and what to omit.

8. Create a questionnaire to gather information for a project.

Level 1	SP	AP	RJ
Level 2	SP1 - SP5	AP1 - AP10	RJ1 - RJ10
Level 3	Checklists Templates Diagrams	Checklists Templates Diagrams	Checklists Templates Diagrams

Another way to use WSM is to select and adapt questions and topics while creating a questionnaire for a project that requires ideas and comments from individuals in different locations. The Level Two questions and Level Three checklists and templates provide a possible starting point for creating the questionnaire. The advantage of using these questions is their emphasis on the business goal of work system improvement.

Conclusion - the Whole, the Parts, and the Specifics

This chapter provided a summary of the work system method. WSM is designed to help you and your colleagues think and communicate about any system in your organization. Approaching systems effectively requires that you maintain a big picture view of the whole while also recognizing the parts and digging into some of the specifics that must be handled in order for the system to perform well.

Level One is nothing more than a reminder to define the system and the problem, do some kind of analysis, and produce a justified recommendation. The SP questions in Level Two help you see the whole and establish the big picture. Identification of the parts using a work system snapshot (SP5) leads to the AP questions in Level Two, which ask about problems related to the nine work system elements and the work system as a whole. These AP questions also motivate the search for improvement possibilities. The RJ questions in Level Two ask for specifics about the recommendation and its justification from different viewpoints. The Level Three checklists, templates, and diagrams help you look at the work system in more depth and help in identifying issues that a broad overview would never catch. Whether or not you need a Level Three understanding of a particular work system, anyone responsible for system effectiveness needs that level of understanding.

Well designed IT support for the work system requires delving further into details of work practices, information, and technology. WSM can help in these situations because it addresses a troublesome gap between general, but often unfocused requests for system improvements, and the technical work that IT professionals are uniquely qualified to perform. The frequent result of this gap is production of software that addresses part of the problem but ignores issues that ultimately turn a potential success into a disappointment or a failure. Because this book is directed at business professionals, it only hints at the types of documentation, analysis, and design details that IT professionals must understand. Fortunately, many books and web sites cover that material quite well.[19]

The next three chapters look at each of the three WSM steps in more detail. Chapter 4 says more about deciding a work system's scope, defining its elements, and producing effective work system snapshots. Chapter 5 focuses on five groups of concepts for looking at a work system with greater depth and clarity. Chapter 6 provides additional explanation of the various questions about the recommendation and its justification.

Chapter 4: Defining a Work System

- Deciding the Work System's Scope
- Clarifications about Work System Elements
- Effective Work System Snapshots
- Examples of Work System Snapshots

The previous chapter introduced the work system method and explained how this method helps in organizing thinking about a work system. Awareness of an analysis approach is important, but it is also important to have useful ideas that can be applied in the analysis. This chapter and the chapters that follow fill in many of those ideas.

Identifying the right work system to analyze is the first order of business in the work system method because the work system's scope is not a given. In general, the work system should take whatever shape the WSM user believes is most effective for the analysis task at hand. Several people discussing the same work system often find that their initial views of the work system differ in scope and in the specifics of the work system elements. The Work System Framework provides a general model, but each individual's initial view of the specifics in any particular situation is based on personal experience, interests, beliefs, and imagination.

The clarifications in this chapter address distinctions that arise when people try to use WSM to gain insight about a situation. The first section mentions key issues for deciding a work system's scope. Next come distinctions that may be important in defining the work system's elements. The last section discusses characteristics of effective work system snapshots, one page summaries produced before launching the Analysis and Possibilities step in WSM.

Deciding the Work System's Scope

The surface simplicity of the concept of work system sometimes obscures the need to be careful when deciding a work system's scope. Work systems do not exist in nature. Work system is a mental construct used to understand real world situations. The scope of the work system is a decision, not a given. The initial decision about a work system's scope often changes as the analysis unfolds.

The smallest work system in which the problems or opportunities occur. When using WSM to analyze problems or opportunities, the work system should be the smallest work system in which the problems and opportunities occur. If the work system is too small, some of those problems and opportunities will be beyond the scope of the analysis and will not be addressed. If the work system is too large, unnecessary topics will expand the time and effort required for the analysis.

For example, assume that a firm has identified problems related to an ineffective hiring system. Managers who need to hire employees complain that

hiring takes too long, and that many qualified applicants have already taken other positions by the time they receive offers. For purposes of the analysis, the work system of hiring people might extend from the approval of a new job opening to the point when the new employee starts work. Alternatively, it might focus on the activities that transpire from the time when the human resources department receives the application until the time when the hiring manager receives a list of qualified candidates. The decision about the scope of the work system would depend on the initial view of the problem. Perhaps the problem is mostly about slow processing of resumes within the human resources department; perhaps it is related to a broader scope of activities, including negotiations about job openings, creation of job postings, and interviews. As the analysis proceeds, it may become apparent that the problem is broader or narrower than was initially imagined. In either case, the person doing the analysis should always be aware that the scope of the system is a decision that can change as the analysis process generates a better understanding of the situation.

Attention to the work system's size and location. Even a basic description of a work system should indicate something about its size. For example, although the steps in the sales process may sound similar, a sales work system that involves three sales people in a single local office is quite different from one involving 50 sales people working from 12 offices on three continents.

Relationship to other work systems. Trying to understand a work system in isolation from other work systems is usually insufficient.[20] Most work systems receive and use things provided by other work systems; most produce products and services that are received and used by other work systems; most can be viewed as subsystems of other work systems.

Relationships between systems are often expressed as "inputs" received from other systems and "outputs" directed toward other systems. Computer programs always have inputs and outputs, and can be modeled in the form of "input -- processing -- output." The physical and biological sciences often focus on inputs and outputs across a system boundary. Accountants and economists perform various types of input/output analysis. The spirit of the work system approach is based on a less mechanical, more humanistic viewpoint than any of these types of analysis. Instead of including slots for inputs and outputs in the Work System Framework, inputs and outputs are handled based on general guidelines for summarizing a work system's scope and relationship to other work systems:

- As noted above, the work system being analyzed should be defined as the smallest work system that has the problems or opportunities that launched the analysis.
- The work system's outputs are the products and services it produces for its customers. Those customers are often participants in other work systems that use the products and services.
- The work system's inputs are information and other resources it receives from other work systems and from other sources. Some of the inputs a work system receives are not important enough to list on a one-page summary. Those that are important enough to include should be mentioned explicitly in the activities listed under work practices. For example, a sales system might start with a prospect list produced by a different work system. In that case, the first activity listed under work practices would be something like "salesperson contacts prospect on prospect list."

Dividing a work system into smaller work systems. It is often possible to divide a work system into several smaller work systems. The desirability of doing so depends on the purpose of the analysis and on the degree of overlap between the two smaller work systems. For instance, assume that a manufacturing firm's customers complain about late deliveries of custom-built products. The work system's scope could start with taking orders, and could extend through manufacturing, packaging, and delivery. Alternatively, it might be more meaningful to analyze four separate work systems: taking orders, manufacturing, packaging, and delivery. If it seems likely that much of the problem involves coordination between the separate subsystems, it might be worthwhile to analyze the larger work system and consider the subsystems as single steps in a business process within that work system. If it seems likely that the problem exists within each of the smaller work systems and that coordination is not an important issue, it makes more sense to consider the smaller work systems individually.

Defining a work system in terms of work, not technology. Defining a work system in terms of the technology it uses is often counterproductive. Doing this focuses attention on the technology rather than on the work that is being done and the results that are being produced for customers. In particular, it is important to avoid organizing the analysis around the features and benefits touted by a software vendor. Doing so frames the analysis in terms of the software vendor's selling points. From a business viewpoint it makes more sense to focus on business issues related to the work system's work practices, products and services, and customers.

From a business viewpoint, the work defines the system, not the technology that is used to do the work.

An organization as a group of work systems. It is possible to view an entire organization as a single work system. In most situations, however, is better to view an organization as a combination of many smaller work systems. Viewing an entire firm as a single work system tends to produce a bloated analysis that covers too many groups of people performing too many different types of roles and activities. For example, a firm that builds and sells automobiles contains hundreds or even thousands of work systems. Viewing it as a single work system would include so many different roles and activities that it would be difficult to see the relationships between work practices, participants, information, technologies, products and services, and customers.

On the other hand, it is often worthwhile to view a small company's entire value chain as a single work system. For example, a small company that produces real estate appraisals for lenders wants to improve customer satisfaction. For that purpose, the work system could easily include the firm's primary value chain activities, such as taking orders, assigning appraisals to appraisers, performing appraisal work, producing final appraisal documents, and conveying appraisals to customers. Treating the firm's primary activities as a single work system makes sense in this case because its activities are tightly linked and are performed through a small number of work roles.

Information Systems that Support Work Systems

Chapter 2 noted that an information system is a work system whose work practices are devoted to processing information, which includes capturing, transmitting, storing, retrieving, manipulating, and displaying information. Some information systems exist to produce information products and services for internal or external customers. Others exist to support work systems that produce physical products and services for customers.

Increasing reliance on computerized information systems has led to greater overlap between work systems and the information systems that support them. Information systems and the work systems they support were often rather separate decades ago when most business computing stored information on punched cards[21] and tapes, and recorded transactions in periodic batches rather than in real time.

Today, many information systems are inextricably connected to the work systems they support. For example, the package delivery firms FedEx and UPS have extensive information systems that track each package as it moves from pick-up point to delivery point. These firms exist to deliver physical packages, and their information systems support those activities. Remove the information system and their primary work systems can't operate efficiently. Ignore the work system and the information system is meaningless. In extreme cases such as highly automated manufacturing, the information system and work system overlap so much that the manufacturing is largely controlled by the

information system. Turn off the information system and this type of manufacturing grinds to a halt.

The overlap between work systems and information systems is apparent in the activities performed by work system participants. For example, the activities required to track and move FedEx and UPS packages combine data collection activities that are part of their information systems and physical activities that move the packages. The data collection activities can be treated as part of a separate information system, but they also can be treated as part of the work system of tracking and moving packages.

In most situations, it is helpful to start the analysis by focusing on the work system and assuming that the information system is an integral part of the work system. Analyzing the work system without separating out the information system provides a balanced starting point for understanding how the work system operates and how it might be improved through changes that might or might not involve IT.

Figure 4.1 illustrates some of the different forms of overlap between work systems (WS) and related information systems (IS). A set of sales-related examples illustrate each type of overlap:

- (A) A comparatively small IS provides information for a WS but is not part of it. Example: A web based IS develops a prospect list by extracting information from web sites. The WS for direct sales uses the prospect list.

- (B) A comparatively small IS is a dedicated component of a WS. Example: Salespeople travel to customer sites. During interviews and negotiations with customers they use a model to compare alternatives for the customer.

- (C) The WS is primarily devoted to processing information and the IS and WS are almost identical. Example: An ecommerce web site that customers use in self-service mode to identify possible purchases, find product descriptions, and enters orders.

- (D) One IS overlaps with several separate WSs. Example: The sales force uses an IS for sales call tracking. The IS contains models that generate projections of sales based on the stage in the sales process and historical sales cycle data. Those models are used by the sales force, but are also used by the finance department for estimating sales revenues in future quarters.

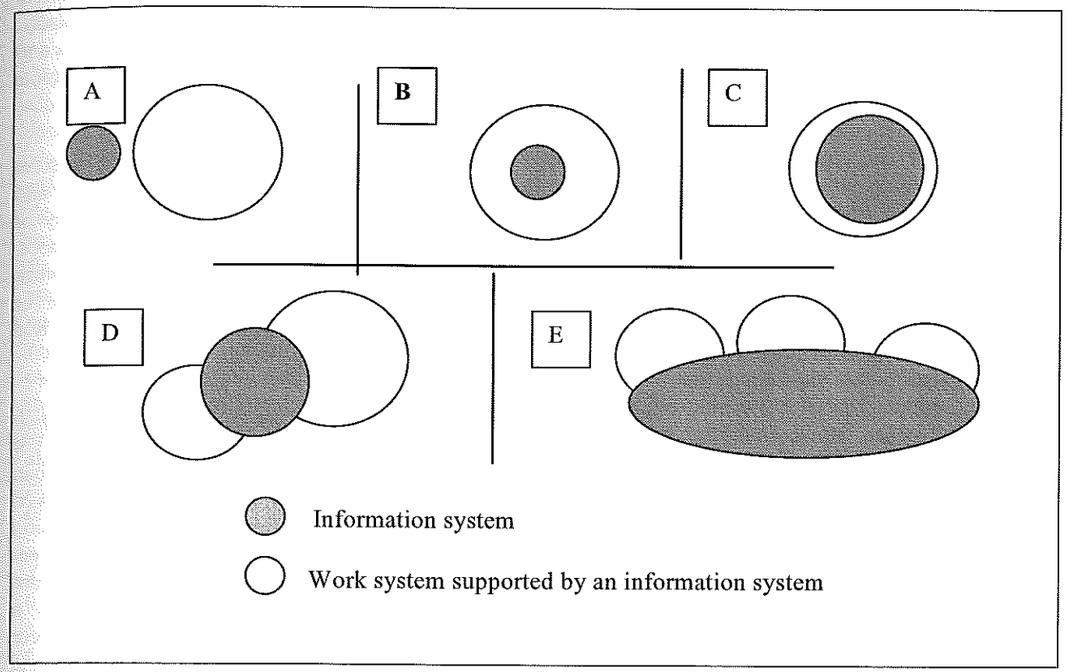
- (E) A large IS supports a number of different WSs and might be larger than any of them. Example: A firm purchases a CRM (customer relationship management) software package that provides integrated database capabilities for tracking customers, sales cycles, customer orders, and customer services. Separate WSs in each of those areas use different parts of the CRM software in their operations.

Information system success. Given the overlap between information systems and work systems they support, it is difficult to evaluate an information system's success in isolation. The entire system effort may be deemed unsuccessful if the work system disappoints or fails for reasons unrelated to the information system. For example, consider a well designed planning information system that worked effectively for years. A new CEO comes on the scene with a new agenda and changes corporate planning from a bottom-up work system to a top-down work system. The previously successful information system processes the same information, but has no impact on decisions. From a business viewpoint, evaluating this information system separately from the work system is not useful.

Clarifications about Work System Elements

The elements of the Work System Framework are broad categories that are sometimes interpreted differently by different people thinking about the same system. The brief definitions of the elements in Chapter 2 are a starting point for understanding the work system approach, but experience has shown that clarifications about how to interpret each work system element help make the analysis more insightful and useful. The following clarifications start from previous definitions and add distinctions emphasizing choices and interpretations that are necessary to use the work system method effectively.

Figure 4.1. Different types of overlap between work systems and related information systems



Customers

Customers are the people who receive, use, or benefit directly from products and services that a work system produces. In most cases, a work system's customers can experience or perceive the quality of products and services. Accordingly, they are in the best position to evaluate products and services.

Effective analysis of a work system avoids going overboard in identifying customers. The following distinctions and special cases clarify the way the term *customer* should be used in WSM.

Stakeholders in general. A work system's stakeholders are people affected by its products and services and by its operation. Stakeholders include:

- customers, who receive and use products and services that the work system produces
- participants, whose livelihood depends partly on work done within the work system
- managers, who are responsible for the efficiency of work and the quality of the work system's products and services
- anyone else who is affected directly or indirectly by the work system's products and services.

When analyzing a work system, it is counter-productive to treat all imaginable stakeholders as customers. Doing that diverts attention from the customers whose direct concerns and satisfaction related to the work system's products and services should be an important part of the analysis.

Internal and external customers. External customers receive and use the products and/or services that a firm produces. Internal customers are employees or contractors who receive and use a work system's products and/or services while working inside the organization. Many work systems have both internal customers and external customers. For example, the customers of a manufacturer's production system include the external customers who will receive and use the product and the (internal) packaging department that will receive finished goods from production, package those goods, and forward them to a shipper.

Some observers think that the whole idea of internal customers doesn't make sense because a company exists to produce things for its external customers. Although that viewpoint might make sense in a speech about the need for greater customer focus and less focus on internal politics, it is not helpful when analyzing specific systems in organizations. All systems in organizations exist to produce something for someone, and some of those systems are truly directed inward, such as payroll or hiring systems. In a few rare cases those systems might affect the business's external customers in a noticeable way, but trying to include external customers in the analysis of inward-facing systems usually adds little and diverts attention from more pertinent topics.

Downstream work systems. If a work system produces products and services that are used by another work system, the second work system's participants can be considered the first work system's customers. The packaging department mentioned above is an internal customer. In turn, a third party delivery service might be considered the customer of the packaging department. These internal customer relationships might be important if variability of production rates causes coordination problems, delays, and overtime in the downstream work systems. On the other hand, if a work system encompasses four sequential steps, it is not useful to list steps 2, 3, and 4 as customers because they are all inside the work system.

Customers as participants. Self-service work systems are designed to treat customers as work system participants, thereby increasing convenience for customers and/or reducing production costs within the work system. For example, an ATM user is both a customer and participant in a work system of making bank deposits and withdrawals. Similarly, the user of an ecommerce web site is a customer and participant in a work system for purchasing items online.

Participants as customers. Most work system participants are paid for the work they do, and therefore have an economic stake in the quality of the products and services the work system produces. However, most should not be considered the work system's customers because they do not use or obtain direct benefits from those products and services.

On the other hand, there are some cases in which participants should be viewed as customers. For example, both the loan applicants and the loan officer in a loan approval system should be viewed as customers because the approval or denial decision produced by the work system will have direct impacts on both of them. The loan applicant participates by providing information, and is a customer of the approval or denial. The loan officer participates by negotiating with the applicant and helping the applicant produce the loan application, but should also be considered a customer because loan approvals affect the loan officer's bonus.

Customers are participants in self-service systems.

A complete analysis of the loan approval system should treat the loan officer as a customer because the prospect of a higher bonus may motivate the loan officer to sugarcoat the applicant's situation in order to influence the approval decision. In a rather different example of participant as customer, the programmers in a software development group might be viewed as customers of their own software development work system if they will have to maintain that software over time. The potential users of that software are the most direct customers, but the programmers will feel direct effects of the quality of their own work when they fix or improve the software in the future. In contrast, programmers who produce software that they will not have to maintain usually should not be considered customers for that software.

Regulators and tax authorities as customers. Consider a work system that determines how much federal and state tax a firm should pay. Parts of that work system involve mechanical compilation of information, but other parts involve accounting decisions about how to treat specific transactions or assets. The work system's product is a set of financial statements that are submitted to tax authorities that will evaluate the statements for accuracy and completeness. In this case the regulators and tax authorities should be treated as customers because they will use and evaluate the product even though they do not benefit from it directly. In this case the company's top management should also be considered customers because their legal and economic stake in the results is quite direct.

Top management and stockholders. It is pointless to treat top management and stockholders as customers of every work system in a firm even though they can be viewed as stakeholders. A central challenge in analyzing work systems is to focus on topics and issues that are genuinely useful for understanding those systems, and to downplay topics that provide little or no insight. With the exception of work systems whose products they see and use, top managers and stockholders are usually quite distant from the situations that are being analyzed. For example, consider a work system of cleaning equipment in a factory. Top managers and stockholders may benefit very indirectly from equipment cleanliness produced by that work system, but with rare exceptions they will have no personal experience of equipment cleanliness and they will contribute nothing to the evaluation or improvement of that system. Listing them as customers of most work systems rarely adds new understanding or contributes to the analysis or recommendations.

Products and Services

Work systems exist in order to produce products and services for their customers. The term *products and services* is used instead of *outputs* because output sounds mechanical and is often associated with computers and software, which are not the central focus even though they are essential for most work systems. In addition, the term output seems inappropriate as a way to describe services that many work systems produce.

Combination of physical things, information, and services. Many work systems produce a combination of physical things, information, and services. Physical products derive most of their value from their physical form and operation, whereas information products derive most of their value from information they contain. Few products are purely physical things or purely information. For example, a DVD of a movie is a physical thing that stores the movie in the form of coded information. Most of its value resides in the information it stores, but some of its value comes from the convenient physical form of the DVD, which is smaller and easier to use than the videotapes in the previous generation of technology. For companies such as Netflix and Blockbuster, the complete offering includes the DVD and the services related to acquiring it. A future generation of technology may replace the DVD with some type of download or broadcast that shifts the balance even further in the direction of information.

Products of the work system, not products of the company. When thinking about a work system it is important to be specific about the particular products and services it produces and to exclude other products and services that other work systems produce. For example, a work system of selling medical insurance policies produces an analysis of each client's needs, the sale of insurance policies, and possibly documentation of the client's policy. On the other hand, it doesn't produce medical care and doesn't produce reimbursements for medical costs. Those products and services are produced by other work systems.

Outputs, not measurements of outputs. In the Work System Framework and WSM, products and services are the outputs that a work system produces, not the measurement of those outputs or the attainment of goals. For example, consider a work system of selling medical insurance and assume its goal is the sale of 4.8 insurance policies per week per

salesperson. The products and services produced by the work system include the sale of insurance policies, the client information and analyses that are produced, and the documents that are created. Attainment of the goal is not the product of the system, but rather, confirmation that a particular level of a key metric was achieved during a particular time period. Notice also that the goal itself is not part of the work system.[22] Next month, a new manager may establish a different goal without changing the work system or the products and services it produces. For clarity about what is being analyzed, it is always important to think of the products and services as what is being produced rather than management goals that may or may not be achieved.

Intermediate products and by-products. Most work systems include a number of sequential activities in which the output of one step is the input to another step. In some cases, those intermediate outputs should be considered products produced by the entire work system. For example, the insurance sales system mentioned previously exists to produce insurance sales, but the process of producing those sales generates client profiles, contract offers, and other intermediate products that may be worth treating as products of the work system. The number and quality of client profiles produced may be an indicator of whether the sales people are generating client interest or using selling tools effectively. Similarly, highly automated manufacturing usually produces not only physical products, but also records of exactly how those products were produced. In examples such as the semiconductor chips that are used in anti-lock brakes, the manufacturing history may be a very important by-product. If an auto manufacturer discovers brake failures related to defective chips, it would much rather recall only the cars whose anti-lock chips came from the lot with the flawed chips, rather than recalling all of the cars that used any of the chips.

Intangible products and services. Some valued products and services are not described well as information or physical things or services. Examples include enjoyment, peace of mind, and social products such as arrangements, agreements, and organizations. Relatively few work systems focus on producing intangibles, but it is necessary to mention the possibility, especially since important intangibles may not conform to a general rule (explained later), that each product or service should be the output of at least one activity included in the work practices.

Work Practices

Work practices include all of the activities within a work system. These activities may combine information processing, communication, decision making, coordination, thinking, and physical actions. In some work systems, work practices can be defined tightly as highly structured business processes; in other work systems, some or all of the activities may be relatively unstructured.

Work practices versus business process. The Work System Framework uses the term *work practices* instead of *business process* because *business process* implies the existence of a structured set of steps performed in a particular order. Although many work systems operate through a well-articulated business process, in many other work systems a clear business process does not exist. A famous example is the activities that occur in an airport's control room. Air traffic controllers make frequent decisions, coordinate their actions, and communicate with airplanes. These activities are basically about minute-to-minute coordination rather than a pre-defined sequence of steps.[23] Calling these activities a business process would be a stretch.

Actual work practices versus idealized work practices. As workplace researchers point out repeatedly, the work that actually occurs often deviates from the idealized work practices that were originally designed or imagined. In many situations, different work system participants perform the same business process steps differently based on differences in skills, training, and incentives. In some situations, participants bypass or modify the idealized business process because it is too difficult or time consuming, and sometimes because it seems an obstacle to getting work done. In some labor disputes workers try to pressure management by resorting to **working by the book**, scrupulously following all rules and procedures and refusing to perform the small workarounds that allow them to get their work done. The result is often gridlock. The official rules may have made sense once, but now create unnecessary documentation, coordination, sign-offs, and delays.

Multiple perspectives for discussing work practices. The work system method views business process as only one of a number of perspectives for discussing the activities within the work system. Other perspectives include communication, decision making, coordination, control, information processing, and thinking. Each perspective has its own vocabulary and primary issues.

.... ***business process.*** From this perspective, work practices are viewed as a set of steps, each of which:

- has a beginning and end,
- is triggered by specific events such as the completion of prior steps
- triggers other steps within the work system or generates part of the work system's products and services.

Business processes are often represented graphically using diagrams such as flow charts, swimlane diagrams, and data flow diagrams, which will be illustrated in Chapter 10.

.... ***communication.*** Regardless of how beautifully the idealized business process seems to be designed, focusing on sequences of steps often omits important aspects of communication between work system participants, suppliers, and customers. A communication perspective focuses on issues such as the types of communication that are used, the clarity of messages, the extent to which messages are understood, the amount of effort devoted to communication, and opportunities to improve communication. For example, consider work practices related to developing information systems. Regardless of how clearly the idealized business process is defined, communication difficulties between business and IT professionals often have negative impacts on project success.

.... ***decision making.*** In many situations, the details of steps in a business process are less important to analyze than a few specific decisions within the process. For example, consider the process by which a prestigious university accepts students. The details of receiving and handling applications certainly matter, but the main question is about decision making: Which criteria should be used and how effectively are those criteria applied in practice? Decision making is the central issue in many other situations including hiring decisions, strategy decisions, medical decisions, and design decisions.

.... ***coordination.*** In other situations, coordination is a key issue. At its heart, coordination is about managing dependencies between activities.[24] Typical dependencies are related to:

- shared resources -- who gets what and when do they get it
- task assignments -- who does what, and when do they do it
- producer/consumer relationships, such as the treatment of notification, sequencing, and tracking
- standardization of communication
- scheduling and synchronization, both in a planning mode and in a recovery mode when reality diverges from the plan.

When coordination is a key issue, focusing on the business process or communication may not be as effective as asking whether the main facets of coordination in the work system can be improved.

Business process is but one of several perspectives for understanding the activities in a work system.

.... ***control.*** Efficient and effective operation of work systems requires control methods that use past and current operational information to create plans and make sure plans are satisfied to the extent possible. Although control is an essential part of a work system, many work systems have inadequate methods for planning work and for using operational

information to stay on plan or respond to circumstances that require new plans.

.... ***processing information.*** When analyzing a work system it is often useful to look at the processing of information. At the work system level this is not about computers. Rather, it is about whether and how relevant information is captured, transmitted, stored, retrieved, manipulated, and displayed. Each of these six information processing tasks may be the source of problems or may be an opportunity to improve the work system.

.... ***performing physical activities.*** Even in highly computerized systems it is often important to include physical activities in the analysis. For example, delays may be caused by confusion or lack of information, but they may also be caused by the inefficient layout of the workplace.

.... ***thinking***. Work practices also involve thinking, which is sometimes viewed as being so far in the background that it cannot be analyzed. At minimum, it is often possible to ask whether specific types of thinking are important, and if so, whether they are being performed effectively. For example, research on methods for supporting group deliberations have developed a number of tools to support common patterns of thinking such as divergent thinking, convergent thinking, consensus building, and organization, elaboration, abstraction, and evaluation of concepts.[25]

Participants

Participants are the people who do the work in a work system. The inclusion of human participants as part of a work system often generates much more variability than might be implied by a flow chart.

Participants, not just users. IT professionals often focus on how technology is used, and therefore speak of "users" instead of work system participants. Unfortunately, focusing on the use of technology may downplay or omit essential aspects of a work system that are not related to technology use. WSM recognizes that work system participants use technology, but views them primarily as work system participants rather than technology users.

Usually not developers of software that is used. Work system participants are usually not the people who created the software that is used in the work system. For example, a work system for hiring people may use software that was produced previously, but the software producers are not considered part of the work system unless they participate directly in its typical operation.

There are a few common situations in which software developers should be considered participants in a work system. The most common situation is when the work system itself is devoted to software development. In some other cases, a software developer plays a role in a work system because the database and/or software that is used in the work system is too awkward for non-programmers to use directly. An example involves a company whose sales and marketing information is archived in a poorly documented database. In this company, a software developer is part of the work system of analyzing marketing information because the marketing specialists need help retrieving and manipulating archived information.

Participants are people who do the work, not just people who use technology.

May or may not include work system managers. Similarly, the managers of the people doing the work may or may not be considered work system participants. They should be considered work system participants if they perform some of the activities that contribute directly to generating the work system's products and services. On the other hand, if they serve only as managers of others who perform those activities, it may be unnecessary or even confusing to view them as work system participants.

Information

Information in today's work systems involves much more than computerized databases.

Computerized vs. non-computerized information. Despite the importance of computers in most work systems, much of the information in most work systems is never computerized, and some of the computerized information does not fit into standard databases. For example, computerized information in a work system for producing a company's long-range plan includes the plan itself and the supporting spreadsheets and written explanations. Important non-computerized information exists in the negotiations and commitments between various managers. Focusing solely on computerized information misses some of the most important information in the planning process.

Types of information. Information includes:

- ***pre-formatted data items***, such as the product numbers, customer addresses, and prices on sales invoices. In databases, each of these has a specific definition and format.
- ***text***, such as email messages, memos, and other documents consisting of words rather than pre-defined data items.
- ***images***, such as X-rays, design drawings, and pictures of the damage in an automobile accident
- ***sounds***, such as the conversations that occur between call center employees and customers
- ***video***, such as a recording of a videoconference or training presentation.

Most systems analysis methods for IT professionals assume that the information will be stored in a computerized database.

Databases and documents. These larger units of information may include information of any type.

- ***Database.*** An organized collection of data. Although a database may include data of any type, the term database is usually associated with structured tables of pre-defined data items related to uniquely identified entities such as customers, products, orders, or invoices.[26] Each data item, such as a customer address or invoice number, has a definition and a pre-specified format. Some may have a range of possible values (e.g., 50 two-letter state codes or a range of valid ages for employees) or a pre-defined coding scheme (e.g., a rating from 1 to 7).
- ***Document.*** Defined in the past as "a writing conveying information." Today, electronic documents are computer files that may contain any type of information. The most familiar electronic documents are word processing documents, spreadsheets, email messages, and PDFs. Documents are usually indexed by date, author, purpose, and intended recipient(s). According to a Chief Technology Officer of Xerox, "documents have nothing to do with paper anymore." [The focus is on] "finding information and structuring it inside the document, whether it's paper or electronic, and it's about connecting the document to a workflow."[27]

Spoken communication: It is sometimes easy to forget that information in the form of spoken communication is an essential part of most work systems. In some cases, attempts to increase efficiency by computerizing record keeping have led to social isolation and have inhibited spoken communication that is essential for doing work well.

Data vs. information vs. knowledge. The common distinction between data, information, and knowledge sometimes helps in visualizing whether better information would have any effect on a work system's performance. Data includes facts, images, or sounds that may or may not be pertinent or useful for a particular task. We receive so much data every minute that our conscious minds can't possibly pay attention to all of it.

Information is data whose form and content are appropriate for a particular use. Information systems often convert data into information by formatting, filtering, and summarization. The distinction between data and information is cited frequently in explaining why vast operational databases often fail to satisfy managerial information needs. Data in these databases is information for people performing day-to-day operational tasks such as processing orders, but it is not information for managers because it is too detailed to help directly with managerial work.

Knowledge is a third basic concept for understanding the role and use of information in work systems. Knowledge is a combination of instincts, ideas, rules, and procedures that guide actions and decisions. People actually need more knowledge in many situations where they say they need more information.

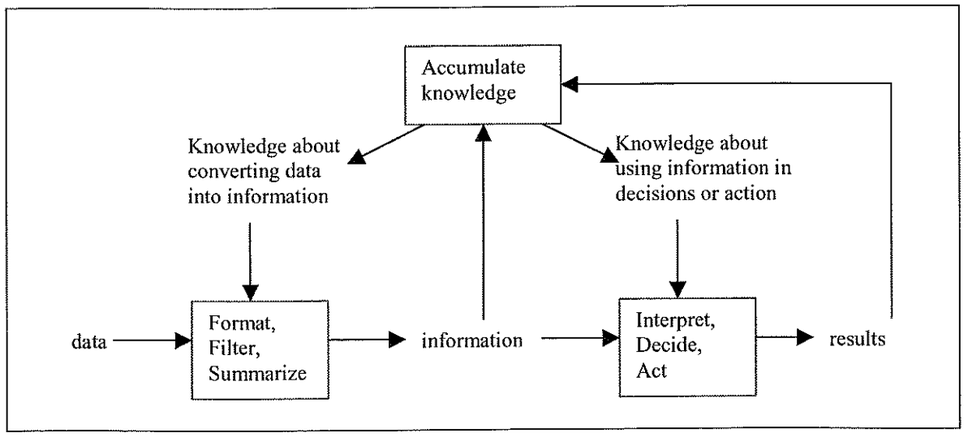
Figure 4.2 shows that people use knowledge about how to format, filter, and summarize data as part of the process of converting data into information useful in a situation. They interpret that information, make decisions, and take actions. The results of these decisions and actions help in accumulating knowledge for use in later decisions. Knowledge is necessary for using information effectively regardless of how brilliantly the information is gathered and combined. Unless a work system is totally structured, system participants need enough knowledge to use the available information effectively.

Knowledge may be tacit or explicit. **Tacit knowledge** is unrecorded and is understood and applied unconsciously. **Explicit knowledge** is articulated and often codified in documents or databases. Effective knowledge management is still difficult to attain even though a great deal has been written about knowledge management. Software vendors in knowledge management tend to view it as the development and use of electronic repositories for capturing, cleansing, and retrieving information. Another important area of knowledge management involves formal and informal work practices for finding employees who have specialized knowledge that someone else in the firm needs.

The distinction between knowledge and information hints at a number of areas for potential improvement related to knowledge per se:[28]

- ***Better ability to retrieve usable knowledge from databases***. Repositories of knowledge generate no value if people don't know how to use them to find knowledge required in a current situation.
- ***Better ability to find experts***. One method is broadcasting questions and requests using email or electronic bulletin boards. Another method is using employee databases to find people who are likely to have the required knowledge.

Figure 4.2. Relationship between data, information, and knowledge



The fundamental limitation is often knowledge, not just information.

- ***Better incentives for sharing knowledge***. The mere fact that knowledge exists in a firm does not mean that the firm's employees will be inclined to share it, especially in organizational cultures that are competitive. For example, in consulting companies in which only a small percentage of associates are promoted to partner, there is little natural incentive to share information that could help someone else get promoted. To minimize this effect, some consulting firms treat evidence of knowledge sharing as a significant factor in employee reviews.[29]
- ***Retention of knowledge.*** Ideally, knowledge about company's culture, methods, procedures, history, and politics should stay with a company even when people leave. Unfortunately, downsizing and employee turnover often lead to a loss of these types of knowledge.
- ***Knowledge in work systems***. It is often said that employee knowledge is the primary corporate asset in companies that do knowledge work. The design of a work system may encourage development or codification of knowledge, or may simplify work so that less knowledge is needed.
- ***Lack of codified knowledge.*** In many situations, important knowledge exists in people's heads but is never written or formalized so that it can be shared effectively. For example, this is why Xerox developed a database of insights and tips from service representatives who fix copy machines in the field. Ideas submitted by representatives are added to the database only after review by peers. Xerox says that database saved it up to $100 million per year in service costs.[30]
- ***Better knowledge about customers***. Work systems that interact with customers can produce knowledge by-products related to "knowing the customer better." Sometimes these efforts are called customer relationship management (CRM), although the specifics often are less focused on anything resembling a relationship and more focused on storage of information about customer interactions and transactions.

Technology and Infrastructure

The technologies of interest when analyzing a work system include both information technologies (IT) and non-IT technologies. Even when substantially computerized, specific tools (such as cars) and techniques (such as use of checklists) may or may not be associated with IT.

In the context of a work system, things that are considered technologies when viewed in isolation are viewed as either technology within the work system or as external technical infrastructure that the work system uses. Tools and techniques that are viewed as technologies are integral parts of a work system. Their surface details, interfaces, and affordances (such as mobility afforded by cell phones) are visible to work system participants. In contrast, technical infrastructure is used by the work system but is largely invisible to work system participants. For example, technical infrastructure often includes computer networks, database management software, and other, largely hidden technologies shared by other work systems. Thus, an ecommerce web site would be considered technology because it is visible to the shopper, whereas the Internet would be viewed as technical infrastructure that the work system uses.

Much as electricity, trash removal, and roads are taken for granted, technical infrastructure is often taken for granted except by the people who build and maintain it. The work system method mentions both technology and infrastructure because taking infrastructure for granted is often a mistake, such as when a work system cannot operate because of infrastructure problems.

In practice, the choice between treating something as technology inside the work system or as technical infrastructure should depend on what is most useful for performing a specific analysis. For example,

when analyzing an order entry system, the enterprise software package SAP might be viewed as part of a firm's infrastructure and the SAP order entry software might be viewed part of the technology within the order entry work system.

Similar distinctions apply to human and information infrastructure. In each of those cases, the choice of whether to view a shared resource (people or information) as an integral part of a work system or as part of the infrastructure depends on the situation and the goals of the analysis.

Types of technologies. WSM recognizes that improving technology is often essential for improving work system performance. On the other hand, WSM does not go into depth about technology because most business professionals lack the technical background needed to understand many technology nuances that are invisible to technology users. Even though they lack that background, nothing should stop them from recognizing basic types of technology that are used in a work system, including, among others:

- ***Application software***, such as software for transaction processing, management reporting, data analysis, and specialized business functions or activities, such as designing electronic devices or selecting stocks to purchase. Concepts such as invoice or supplier that are related to specific business activities are built into application software.
- ***Non-application software***, such as operating systems, database management systems, software for data warehouses, and middleware that links applications. Non-application software contains programming and computer concepts such as query or subroutine, but does not contain concepts related to specific business activities.
- ***Computing technology,*** such as personal computers, laptops, and PDAs
- ***Communication technology***, such as email, instant messaging, voice messaging, and software supporting video conferencing
- ***Data capture technology***, such as scanners, bar code readers, and RFID readers
- ***Display technology***, such as CRT monitors, flat screen monitors, and loudspeakers
- ***Data networks*** for moving data between computerized devices
- ***Intranets*** for providing employees with Web-like interfaces to internal company information
- ***Extranets*** for providing customers or suppliers with Web-like interfaces to internal company information that they should be able to access
- ***Web sites*** for providing information that anyone can access.

Components of infrastructure. Around 55% of total IT investment is devoted to infrastructure.[31] In large companies, infrastructure services include telecommunication network services, provision and management of large scale computing (such as servers or mainframes), management of shared customer databases, and an enterprisewide intranet. (discussed further in Chapters 13 and 14)

Environment

Every work system is surrounded by many layers of environment-related issues. When analyzing a work system, it is important to identify aspects of the surrounding environment that have significant impacts on the situation. For example, organizational culture may have little bearing on a work system for generating paychecks according to highly structured rules, but may be the prime determinant of the success of a new information system for knowledge sharing. An organizational culture that includes strong expectations of cooperation and knowledge sharing tends to support initiatives that make it easier to fulfill those expectations. To the contrary, an aggressively individualistic organizational culture tends to undermine knowledge sharing initiatives that are not linked directly to personal incentives (discussed further in Chapter 14).

Strategies

Strategies can be discussed at many different levels. Ideally a work system's strategy should support the firm's strategy, but in many cases the firm's strategy is not articulated fully or is not communicated to people involved in specific work systems. Even if a firm's strategy is not articulated, it is usually possible to discuss aspects of a work system's strategy as a way of discussing big picture issues about the work system itself. For example, before plunging into details of work practices, it may be useful to discuss how structured the work should be, how many different people should be involved, how integrated the effort should be, and how complex the work system should be. Chapter 5 will present a strategy checklist that can be used in WSM. Subsequent chapters about specific work system elements will discuss strategy choices related to those elements.

Effective Work System Snapshots

A work system snapshot (question SP5) is a one-page summary designed to identify what is included within the work system that being analyzed. As the analysis proceeds, the work system snapshot remains available as an expression of the big picture within which the analysis is taking place. The work system snapshot will change if the analysis reveals that the initial scope was inappropriate, or that the work system should be viewed as several separate systems.

Figure 4.3 provides guidelines for the content of a work system snapshot. These guidelines include brief definitions of each term along with guidance about relationships between various elements of a carefully crafted work system snapshot. For example, Figure 4.3 says that products and services are produced by the activities and processes listed as work practices. This guideline is included because past users of the work system snapshot have occasionally confused the products and services produced by the work system with the products and services produced by the firm. For example, a work system snapshot attempting to describe a retail shoe store's cash management system incorrectly listed shoes among the products and services produced by the work system. Shoes were the products sold by the store, but they were not the products and services produced by the store's cash management system.

The form of the activities or processes listed under work practices is another area where past work system snapshots might have been clearer. When summarizing work practices as steps in a business process, it is important to say what is done and who does it. Thus instead of making a list of work practices such as "identify prospect, compile available information, contact prospect, and explain product," it is clearer to include both the work system participant and the action, such as:

- Phone agent identifies prospect.
- Sales assistant compiles available information
- Salesperson contacts prospect
- Salesperson explains product.

Consistency guidelines. The italicized statements in Figure 4.3 identify guidelines that make it more likely that a work system snapshot is internally consistent. These guidelines include:

- Each product or service should be the output of at least one activity or step mentioned under work practices.
- Each product or service should be received and used by at least one customer group.
- Each customer group should receive and use at least one of the products and services mentioned.
- Each participant should be involved in at least one activity or step listed under work practices.
- Each item of information should be used or produced by at least one activity or step listed under work practices.
- Each technology should be used in at least one activity or step listed under work practices.

Figure 4.3. Guidelines for the content of a work system snapshot

Note: The italicized guidelines are designed to promote internal consistency within the six parts of the work system snapshot.

Customers	Products & Services
• These are the people who make most direct use of the products & services. • Exception: In some cases it is useful to include non-customer stakeholders who have a direct and perceptible stake in the products and services produced. • Usually top managers and stockholders should not be mentioned because their stake is extremely indirect. • Customers may also be participants. Example: a self-service work system whose participants make direct use of its products & services • ***Each customer group should receive and use at least one of the products and services mentioned.***	• These are the products and services produced by activities and process steps listed as work practices. • These are not the end products of the firm unless the work system itself produces those end products. • ***Each product or service should be the output of at least one activity or step mentioned under work practices.*** • ***Each product or service should be received and used by at least one customer group.***

Work Practices (Major Activities or Processes)

- These are the activities and processes through which the work system produces its products and services.
- The list is more understandable if the activities or processes are listed in sequential order. In some cases, however, the activities are not performed sequentially.
- To make this summary as understandable as possible, try to summarize the activities or processes as no more than 10 steps that can be explained in more detail elsewhere.
- Each step should be a complete sentence identifying a relevant role and a step or activity performed by someone in that role. Examples: "Credit analyst prepares loan write-up" or "Loan officer negotiates loan terms."

Participants	Information	Technologies
• These are the people who perform the work. • ***Each participant should be involved in at least one activity or step listed under work practices.***	• These phrases identify the information that is used or produced by the work system. • Use phrases such as "employee database" or "details of project schedules" • ***Each item should be used or produced by at least one activity or step listed under work practices***	• These are the technologies used to perform the work. • ***Each technology should be used in at least one activity or step listed under work practices.***

Adherence to the guidelines in Figure 4.3 would have improved many work system snapshots that were produced in the past. However, there are some circumstances under which it makes sense to violate a guideline. For example, when a service or an intangible product such as an agreement is being produced, the product or service may not be the output of any specific activity.

Examples of Work System Snapshots

Figures 4.4 through 4.9 are six examples of one-page work system snapshots related to specific problems or opportunities summarized in the table below. Each example starts with one or two sentences identifying problems or opportunities in the situation. The work system snapshot of the existing or proposed work system is brief, but provides enough information to help people agree about the problems and opportunities they want to address and the boundaries of the relevant work system. In all of these cases, it is likely that the preliminary discussion would lead to some modification of the work system snapshot and possibly a modification of the problem statement. As the analysis unfolds in any of these cases, the people doing the analysis might find additional issues that will lead to further revision of the work system snapshot. In some cases the original work system snapshot might be divided into separate work system snapshots summarizing different, separable parts of the situation.

Examples of work systems	***Examples of problems or opportunities for these work systems***
Company A's work system for hiring new employees starts with submitting a requisition for a new hire and ends with a hiring decision and a formal offer letter or rejection letter.	Company A is concerned that it takes so long to hire new employees that many promising recruits go to other companies.
Company B's fulfillment system for ecommerce orders starts with verification of availability of the customer's component options. It includes internal production operations, packaging of the product, and third party shipping.	Company B is concerned that its ecommerce sales are lagging behind those of its major competitor.
Company C's system for creating a regional marketing budget begins when local marketing managers propose allocations of the marketing budget across various media. These requests are analyzed, combined, reviewed, and revised.	Company C's management wants to move from an intuition-based approach to a fact-based approach that produces a clear rationale for regional marketing plans, including a way of measuring how well the marketing plan succeeded.
Company D is an insurance broker that helps corporate clients obtain group health insurance for employees. Company D's services include consolidating the corporation's health claims for the previous years, obtaining bids for the renewal from various insurance companies, and helping the client negotiate rates and terms.	Company D has received increasing complaints about inadequate customer service. It wants to understand those complaints and wants to improve its customer service system.
Company E's process of producing a new release of its commercial software starts with obtaining wish lists for new software capabilities. Management decides on primary goals for the new release. The software development organization produces and tests the software in the new release.	Company E's customers are concerned that their requests are not adequately reflected in the new releases they receive.
Company F's process for implementing new software releases for internal departments starts with identification of possibilities for improving existing work systems. After the new software release is configured and tested based on those requirements, potential users are trained and the software is implemented in the organization as part of improvements in various work systems.	Company F plans to implement a software package it purchased from Company E. Company F is concerned that its last two software implementation projects went far over their schedules and encountered a lot of resistance.

Figure 4.4. Hiring a new employee in a large company

Company A is concerned that it takes so long to hire new employees that many promising recruits go to other companies.

Customers	Products & Services
• Hiring manager • Applicants • Human Resources (HR) Department	• Hiring of a new employee • Complete information for employee database • Offer or rejection letters

Work Practices (Major Activities or Processes)

- Hiring manager submits requisition for new hire (within pre-approved budget).
- Staffing coordinator in Human Resources (HR) department publicizes the position on the company intranet, on several Internet job sites, and in newspapers.
- Applicants submit resumes by email.
- Staffing coordinator transfers resume information into a database, and sends the best resumes to hiring managers once a week.
- Hiring manager identifies applicants to interview.
- Staffing assistant contacts applicants, performs additional screening, and sets up initial interviews.
- Hiring manager performs initial interviews and provide feedback to HR.
- Staffing coordinator or staffing assistant contacts applicants who pass the first interview and schedules additional interviews with manager, co-workers, or others.
- Hiring manager makes the hiring decision.
- Staffing assistant sends a formal offer letter or a rejection letter.

Participants	Information	Technologies
• Applicants • Staffing coordinator • Staffing assistant • Hiring manager • Other interviewers	• Job requisition, including job description • Resumes from all candidates • Information from interviews • Offer or rejection letters	• Email • Database software • Corporate network

Figure 4.5. Entry and fulfillment of ecommerce orders

Company B is concerned that its ecommerce sales are lagging behind those of its major competitor.

Customers	Products & Services
• Customer who submits the order • Customer(s) who receive and use whatever is ordered. • Finance Department	• Made-to-order product received by the customer • Information about the order and the shipment

Work Practices (Major Activities or Processes)

- Customer uses website to enter order.
- Computer verifies availability of component options selected by the customer.
- Computer verifies credit card information, accepts order, and transmits it to the Manufacturing Department.
- Manufacturing Department assembles and tests the made-to-order product.
- Shipping Department packages the product for shipment.
- Third party shipper ships the product to the address designated on the order.

Participants	Information	Technologies
• Customer who submits the order • Manufacturing Department • Shipping Department • Third party shipper	• Order details • Customer credit card and verification number • Inventory on hand, plus planned availability • Manufacturing status of the order • Shipping status of the order	• Customer's PC and the Internet • Ecommerce web site • Corporate database system and network

Figure 4.6. Creating a regional marketing budget for a beverage company

Company C is a major beverage company whose regional marketing plans are developed mostly based on intuition. Company C's management wants to move to more of a fact-based approach that would produce a clear rationale for the marketing plan and would have a way of measuring how well the marketing plan succeeded.

Customers	Products & Services
• Local and regional marketing managers • Upper management within the region • Regional sales force	• Regional marketing plan for the upcoming 6 months, including an approximate weekly schedule of media purchases for different media (radio, television, newspaper, billboards) and special incentives for retailers

Work Practices (Major Activities or Processes)

- Local and regional marketing managers receive a summary of the national marketing plan for the upcoming year.
- Local marketing managers use introspection and intuition to propose an allocation of the local marketing budget across various media.
- Marketing specialists compare requests, obtain approximate pricing from media providers, and produce a combined request after reviewing the history of units sold by product and area.
- Regional marketing manager reviews combined request and approves it or suggests revisions.
- Local marketing managers revise requests if necessary. The regional marketing manager reviews the revisions and may negotiate further.

Participants	Information	Technologies
• Local marketing managers • Marketing specialists • Regional marketing manager	• National marketing plan for upcoming year • Regional budget allocation for marketing • History of units sold by product and local area • Requests from local marketing managers	• Spreadsheets • Email • Personal computers • Corporate network and database

Figure 4.7. Renewing a group health insurance policy through an insurance broker

Company D is an insurance broker that has received increasing complaints about inadequate customer service.

Customers	Products & Services
• Corporate customers wanting to renew their group health policies at the best terms possible.	• Signed contract for group insurance renewal • Bids from insurance companies • Summary of the customer's claims experience for recent years.

Work Practices (Major Activities or Processes)

- Corporate customer asks insurance broker to find a group insurance renewal policy.
- Insurance broker produces consolidated summary of corporation's health insurance claims for recent years.
- Insurance broker contacts various insurance companies and requests their bids, which include policy coverage and price.
- Insurance companies submit their bids.
- Broker analyzes the bids and makes a recommendation.
- Corporate customer selects a bid to accept or negotiates further.

Participants	Information	Technologies
• Corporate customer desiring a group health policy • Insurance broker • Insurance companies	• Corporate customer's insurance claims for recent years • Summarized version of the claims experience • Bids by insurance companies • Broker's recommendation and client's decision	• Email • Word processing • Spreadsheets

Figure 4.8. Developing a new release of commercial software

Company E is a software firm. Its customers are concerned that their requests are not adequately reflected in the new releases they receive.

Customers	Products & Services
• Current customers who have purchased Company E's software • Future customers • Software development group (which must use this release as the starting point for the next release)	• New software release, including software and documentation • Original goals for the release, plus revisions of those goals

Work Practices (Major Activities or Processes)

- Marketing and Product Management Departments obtain feedback and wish-lists from customers.
- Top management identifies major goals of the new release. Product Management Department converts the major goals into more detailed requirements.
- Management in Software Development divides the planned changes into separate projects with priorities, and then assigns the projects to project teams.
- Project teams execute the projects.
- Management in Software Development monitors progress and trims the plans if necessary.
- Project teams test the entire software product and convert the software to a form for release.

Participants	Information	Technologies
• Marketing Department • Product Management Department • Top management • Management in Software Development • Project teams • Customers	• Customer feedback and wish-lists • Goals of the new release • Detailed requirements • Planned scope of projects • Progress information for projects • Plan revisions	• Computer workstations • Software for programming and testing • Documentation software

Figure 4.9. Implementing a software package in a large company

Company F plans to implement a software package it purchased from Company E. Company F is concerned that its last two software implementation projects went far over their schedules and encountered a lot of resistance.

Customers	Products & Services
• Current and future users of the software • Managers of those employees • IT group that will maintain the software over time	• An improved work system that uses the software package. • Configuration of the software package to suit the situation

Work Practices (Major Activities or Processes)

- IT analysts, user representatives, and consultants analyze the current work system to identify opportunities for improvement.
- IT analysts, user representatives, and consultants identify ways in which the software package might support better work practices.
- Programmers configure the software package consistent with the company's requirements.
- Programmers test the configured software.
- Trainers train intended users of the software.
- Users convert to the new way of doing the work using the software (with help of consultants and IT analysts).

Participants	Information	Technologies
• IT analysts • User representatives • Consultants from the software vendor • Programmers • Trainers • Users	• Operation and opportunities of the current work system • Capabilities of the software • Configuration choices • Information about implementation progress and problems	• Software being implemented in the organization • Computers and networks that run the software • Terminals or PCs used by the software users.

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Chapter 5: Identifying Issues and Possible Improvements

- Possibilities for Change
- Work System Performance Indicators
- Work System Strategies
- Work System Risk Factors and Stumbling Blocks
- Work System Principles
- Checklists of Useful Ideas

This chapter focuses on five themes that provide concepts and topics for identifying issues and possible improvements in a work system. The themes include possibilities for change, performance indicators (organized as a work system scorecard), work system strategies, risk factors and stumbling blocks, and work system principles. These themes are the basis of the checklists mentioned in the introduction to the work system method in Chapter 3. This Chapter's discussion of each theme uses the template for a work system snapshot to organize on one or two pages numerous topics associated with that theme. (See Figures 5.1 through 5.5.)

Many of the topics in Figures 5.1 through 5.4 are explained in subsequent chapters that focus on specific work system elements, such as customers, work practices, and information. In contrast, the complete discussion of work system principles appears in this Chapter. The section on work system principles identifies 24 principles (Figure 5.5) that can be used in two ways:

- to identify current issues that might need action
- to identify possible problems that might be caused by a recommendation.

This Chapter's last section reorganizes the concepts in Figures 5.1 through 5.5 in the form of ten checklists of concepts and topics that are directly related to the ten AP (analysis and possibilities) questions in WSM's Level Two.

Possibilities for Change

The purpose of analyzing a work system is to evaluate it and decide whether and how to improve it. Improving a work system is clearly not a board game like chess, but the idea of "moves" is useful in thinking about the range of possibilities for change. The moves in the system improvement game combine procedural, organizational, and technical changes that address problems and opportunities.

Figure 5.1 lists different types of changes related to each of the work system elements. Many of these possibilities will be discussed in subsequent chapters devoted to individual work system elements. As is clear from looking at Figure 5.1, work system improvements may involve some types of moves that are related to information or technology, but also may involve many other types of moves that are related to other work system elements. The range of possibilities illustrates the fallacy of assuming that the analysis of a system should focus on improving software or hardware. A much more effective initial assumption is that anything can change except whatever is explicitly identified as a constraint for purposes of the analysis.

A glance at Figure 5.1 will reveal that some of the moves overlap. For example, eliminating built-in obstacles or delays (under work practices) usually involves improving a business process by changing its steps and/or their sequence. Overlaps of this type are expected because the goal of Figure 5.1 is to make it easy to identify a large number of possible changes. With this goal, converging on the same possible change from several different starting points is much less of a problem than overlooking some of the possible changes that should have been considered.

Figure 5.1. Typical possibilities for change

Customers	Products & Services
• Add or eliminate customer groups. • Change customer expectations. • Change the nature of the customer relationship. • Change the customer experience. •	• Change information content. • Change physical content. • Change service content. • Increase or decrease customization. • Change controllability or adaptability by the customer. • Change the relationship between work system participants and customers. • Provide different intangibles. • Change by-products.
Work Practices (Major Activities or Processes)	
• Change roles and division of labor. • Improve the business process by adding, combining, or eliminating steps, changing the sequence of steps, or changing methods used within steps. • Change business rules and policies that govern work practices • Eliminate built-in obstacles and delays. • Add new functions that are not currently performed.	• Improve coordination between steps. • Improve decision making practices. • Improve communication practices. • Improve the processing of information, including capture, transmission, retrieval, storage, manipulation, and display. • Change practices related to physical things (creation, movement, storage, modification, usage, protection)

Participants	Information	Technologies
• Change the participants. • Provide training. • Provide resources needed for doing work. • Change incentives. • Change organizational structure. • Change the social relations within the work system. • Change the degree of interdependence in doing work. • Change the amount of pressure felt by participants. • Assure understanding of details of tasks and use of appropriate information and knowledge in doing work. • Assure that participants understand the meaning and significance of their work.	• Provide different information or codified knowledge. • Use different rules for coding information. • Codify currently uncodified information. • Eliminate some information. • Organize information so it can be used more effectively. • Improve information quality • Make it easier to manipulate information. • Make it easier to display information effectively. • Protect information more effectively. • Provide access to knowledgeable people.	• Upgrade software and/or hardware to a newer version. • Incorporate a new type of technology. • Reconfigure existing software and/or hardware. • Make technology easier to use. • Improve maintenance of software and/or hardware. • Improve uptime of software and/or hardware. • Reduce the cost of ownership of technology.

Infrastructure	• Make better use of human infrastructure. • Make better use of information infrastructure. • Make better use of technical infrastructure.
Environment	• Change fit with organizational policies and procedures (related to confidentiality, privacy, working conditions, worker's rights, use of company resources, etc.). • Change fit with organizational culture. • Respond to expectations and support from executives. • Change fit with organizational politics. • Respond to competitive pressures. • Improve conformance to regulatory requirements and industry standards.
Strategies	• Improve alignment with the organization's strategy. • Change the work system's overall strategy. • Improve strategies related to specific work system elements (See strategies checklist).
Work System as a Whole	• Reduce imbalances between elements. • Improve problematic relationships with other work systems. • Conform to work system principles.

Work System Performance Indicators

The balanced scorecard[32] is a commonly used management tool. The underlying idea is that a firm's performance should be evaluated based on factors other than just financial performance. At the corporate level, a balanced scorecard often contains performance indicators related to four perspectives: finance, customers, internal business processes, and learning and growth. According to the logic of the balanced scorecard, management should identify objectives, measures of performance, targets, and initiatives in each area.

Figure 5.2 provides a starting point for a balanced scorecard for a work system rather than an entire firm. At this level, application of a balanced scorecard approach starts with identifying relevant areas of performance related to work system elements. In any particular situation at least several areas of performance for at least several elements probably will be relevant.

Performance indicators and metrics. Common terminology related to performance measurement is frequently inconsistent. Terms such as measure, measure of performance, metric, and performance indicator are not defined carefully and sometimes are used interchangeably. WSM uses the following conventions:

- ***Performance indicators*** are general areas of performance, such as speed and consistency.
- ***Metrics*** are calculated or estimated numbers that summarize specific aspects of performance during a particular instant or time interval.

For example, the performance indicators speed and consistency might be important in a particular manufacturing work system. Two distinct metrics for speed might be (1) the weekly average time from start to completion for manufacturing an important product and (2) the monthly average time to recover when an important machine goes out of calibration. Similarly, two metrics for consistency might be (1) weekly average variation in tolerances at a key step and (2) monthly percentage of rework for an important step. Metrics for qualitative performance indicators such as customer satisfaction are often based on estimates rather than physical measurements. For example, two metrics for the satisfaction of the factory's customers might be (1) the average customer rating of the product and (2) the average customer rating of the factory's responsiveness, both on a scale from 1 to 7.

Ideally, WSM users should evaluate whether the work system is achieving targets for all significant metrics. They should also estimate the extent of

improvement that is likely to occur after the recommendations are implemented. In many situations they cannot do a thorough job in either area. First, many analysis efforts quickly find that important metrics have not been tracked. In other words, whether or not targets have been established, no one knows whether those targets are being met. Under those circumstances, estimates of the likely performance impact of recommended changes are no more than guesses. Anyone using WSM under those circumstances is left with a quandary about how to describe current performance and how to estimate the impacts of recommended changes. In many cases it is impractical to accept lengthy delays to set up performance tracking. If action is required regardless of whether desired information is available, the WSM user needs to proceed cautiously based on estimates that may not be supported by facts. Unlike quality management methods that require tracking of metrics over time, WSM is designed to allow the analysis to proceed whether or not complete information is available. Obviously, the analysis is much more solid and convincing if performance information is available and is used effectively.

Figure 5.2. Performance indicators that might be included in a work system scorecard

Customers	Products & Services
• Customer satisfaction • Customer retention	• Cost to the customer • Quality perceived by the customer • Responsiveness to customer needs • Reliability • Conformance to standards or regulations • Satisfaction with intangibles

Work Practices (Major Activities or Processes)

For business processes and work practices in general:

- Activity rate
- Output rate
- Consistency
- Speed
- Efficiency
- Error rate
- Rework rate
- Value added
- Uptime
- Vulnerability

For communication:

- Clarity of message
- Absorption of message
- Completeness of understanding
- Signal to noise ratio

For decision making:

- Quality of decisions
- Degree of consensus attained
- Range of viewpoints considered
- Satisfaction of different legitimate interests
- Justifiability of decisions

Participants	Information	Technologies
• Individual or group output rate • Individual or group error rate • Training time to achieve proficiency • Job satisfaction • Turnover rate • Amount of management attention required	• Accuracy • Precision • Age • Believability • Traceability • Ease of access • Access time • Controllability of selection and presentation • Relevance • Timeliness • Completeness • Appropriateness • Conciseness • Ease of understanding • Vulnerability to inappropriate access or use	• Functional capabilities • Ease of use • Uptime • Reliability • Compatibility with related technologies • Maintainability • Price/performance • Training time to achieve proficiency • Setup and maintenance time

Work System Strategies

Strategies express big picture choices about how resources are deployed to meet goals. A work system's strategies are conscious rationales under which it operates. Thinking about work system strategies focuses on why a work system operates one way or another, not just the details of how it happens to operate. For example, each of the following strategies, or a version of its opposite, might be appropriate for a particular work system:

- Automate work to the extent possible. (Opposite: Do everything manually.)
- Structure work and minimize application of judgment to the extent possible. (Opposite: Rely on judgment and avoid structuring work.)
- Automate information processing, but assure that system participants can use judgment in making decisions. (Alternatives: process information manually; enforce decision rules.)
- Use an assembly line approach to separate the work into discrete steps that can be performed by different people. (Opposite: Use a case manager approach to consolidate the work into steps that can be done by a single individual.[33])
- Do everything as cheaply as possible. (Opposite: Do everything possible to help work system participants do their work effectively.)
- Use segregation of duties to reduce the likelihood that people will be able to collude in fraudulent activities. (Opposite: Assume fraud won't happen and minimize the number of people who are involved.)
- Minimize costs by outsourcing parts of the work. (Opposite: Do all of the work in-house.)
- Maximize control by monitoring work closely. (Opposite: Maximize employee autonomy and assume they will coordinate voluntarily.)
- Use templates to reduce costs while allowing some degree of customization. (Alternatives: Do everything from scratch; no customization.)
- Substitute telecommunications for transportation to reduce costs and effort. (Opposite: Do as much work as possible in a single location.)

Strategies vs. goals. These examples illustrate that strategies differ from goals. Strategies are stated in terms of how things will be done. Goals are about what will be achieved. For example, a manager may decide that a work system's goal is production of 75 units per hour. The work system's strategies should guide the deployment of people and other resources to achieve its goals.

Many work systems do not have a clear strategy. For example, today's work practices may have evolved gradually from practices set up ten years ago by a group of people who are no longer with the organization. Under those circumstances, work system participants may be able to describe work practices but unable to explain why those work practices should or should not continue.

The idea of work system strategies can help WSM users visualize alternatives that may not be obvious. Experience with WSM has shown that it is comparatively easy to recommend small, incremental changes in work systems, such as eliminating an unnecessary step or computerizing information that is currently stored on paper. For most people it is much more difficult to imagine and describe changes in a work system's rationale.

Figure 5.3 uses the template of the work system snapshot to organize various strategy decisions that are relevant to many work systems. Many of the strategies in Figure 5.3 that are listed under specific work system elements will be discussed in subsequent chapters about those specific elements. The strategies that apply to a work system as a whole will be discussed next because those topics fit here better than elsewhere in the book.

Figure 5.3. Work system strategy decisions

Customers	Products & Services
• Customer segmentation • Treatment of customer priority • Nature of the customer experience • Style of interaction with the customer	• Mix of product and service • Product/service variability • Mix of information and physical things • Mix of commodity and customization • Controllability and adaptability by customer • Treatment of by-products

Work Practices (Major Activities or Processes)	
• Amount of structure • Range of involvement • Level of integration • Complexity • Variety of work • Amount of automation	• Rhythm • Time pressure • Amount of interruption • Form of feedback and control • Error-proneness • Formality of exception handling

Participants	Information	Technologies
• Reliance on personal knowledge and skills • Personal autonomy • Personal challenge • Personal growth	• Quality assurance • Quality awareness • Ease of use • Security	• Functionality • Ease of use • Technical support • Maintenance

Infrastructure	• Reliance on human infrastructure • Reliance on information infrastructure • Reliance on technical infrastructure
Environment	• Alignment with culture • Alignment with policies and procedures
Strategies	• Fit with the organization's strategy • Fit with the strategy of related work systems
Work System as a Whole	• Centralization/ decentralization • Capacity • Leanness • Scalability • Resilience • Agility • Transparency

Strategies for a Work System as a Whole

Strategies that apply at the level of an entire work system involve a rationale that encompasses work practices and other work system elements. Six strategy variables that apply to a work system as a whole will be mentioned briefly.

Centralization/ decentralization. Organizations can be centralized or decentralized, and the same distinction applies for work systems. As a strategy issue, centralization/ decentralization is reflected in how and where work is controlled and in the distribution of responsibility and authority. Much of the current attention to virtual teams and networked organizations is part of a trend toward using IT-enabled communication capabilities to support decentralized work systems.

Capacity. A work system's capacity is the amount of work it can do in a given amount of time. Capacity is related to a combination of work practices and human and technical resources. For example, it is often possible to increase or decrease production rates by making changes related to people without changing work practices. Conversely, changing work practices may increase capacity without changing headcount or workload. Strategy issues related to a work system's capacity often involve the amount of slack designed into the work system. Almost no one touts the advantages of having excess capacity because excess capacity uses capital and human resources inefficiently and often hides sloppy planning and execution.

Leanness. Many organizations try to use "lean" approaches, meaning that they try to operate near full capacity and with minimal reserves of human or technical resources. Lean approaches are often associated with **just-in-time** (JIT). Work systems using a JIT approach avoid performing any work step unless the next downstream step needs its output in order to satisfy customer demand. Thus, work systems using a JIT approach avoid doing work to keep people and machines busy or to build inventory buffers. In addition to reducing capital costs of work-in-process, minimizing inventory buffers between steps helps in identifying production problems, which become apparent quickly because they cannot hide behind excess inventory. Another advantage of minimizing the amount of the idle inventory sitting in warehouses or on factory floors is that non-existent inventory cannot become obsolete and cannot be broken, lost, or stolen.

Lean strategies can lead to high efficiency, but they are vulnerable in a number of ways. They may be less able to respond quickly to unanticipated problems or sudden increases in demand. Lean strategies are difficult to maintain in work systems that experience peak loads, such restaurant kitchens, which have busy periods and slack periods throughout the day. When taken to an extreme, lean strategies increase vulnerability to accidents and surprises. For example, in 1997 a fire destroyed the Kariya Number 1 plant of Aisin Seiki, a large Japanese auto parts manufacturer. That plant supplied 99% of Toyota's requirements for an essential brake component. Toyota, a world leader in lean manufacturing, had less than a day's inventory on hand. It faced the possibility of a shutdown that could have lasted for months. Toyota's other suppliers volunteered to help. Aisin Seiki and Toyota engineers helped set up temporary production lines in 62 locations. Within two weeks, the entire supply chain was back in full production.[34]

Scalability. A mismatch between customer demand and work system capacity calls for adjusting capacity or adjusting demand. Scalability is the ability to increase (or decrease) capacity without major disruption or excessive costs. The most scalable work systems are those that easily incorporate incremental resources to provide more capacity, or that easily shrink to lower capacities. Unfortunately, work systems that depend on knowledgeable participants are relatively difficult to scale up because of the amount of time needed to bring new participants up to speed. These systems are also difficult to scale down because of employee concerns and loss of knowledge.

Resilience. The Toyota example is about resilience, the ability to adjust to unexpected events or problems. A work system's resilience is related to the combined characteristics of its work practices, technologies, and participants. Work systems that rely heavily on highly structured business processes controlled by IT may lack resilience if there is no practical way to work around problems related to IT. For example, reservation systems that rely on IT are

Work System Principles

The idea of defining work system principles and incorporating them within the work system method came from observing difficulties encountered by users of earlier versions of WSM. The work system elements provided a useful outline for identifying and describing a work system, but many teams had difficulty searching for improvements other than relatively obvious changes such as recording data that wasn't being recorded or sharing data that wasn't being shared. They seemed to need guidelines for evaluating both the current system's operation and the likely impacts of any proposed improvements. Providing a set of work system principles seemed a plausible way to support their analyses, but it wasn't clear what those principles should be.

Applicable to Any Work System

Work system principles are general statements about desired work system characteristics or results that should apply to almost any work system, not just specific tasks such as hiring employees or building software. These principles take one of two forms:

- Systems that are operating well *should* exhibit a particular characteristic.

or

- Systems that are operating well *should* accomplish a particular goal.

Work system principles can help in evaluating the current status and possible modifications of any particular work system. For the sake of brevity, they are all stated as imperatives such as "please the customer" or "do the work efficiently."

A combination of trial and error and a literature search led to a list of 24 principles. The first step was an attempt to propose a single principle for each of the 9 elements of the Work System Framework. A literature search led to additional principles that are based on ideas from sociotechnical theory,[36] general systems theory, total quality management, and general management.

All of the work system principles shown in Figure 5.5 apply to almost any work system, and therefore apply to special types of work systems, such as information systems, projects, supply chains, and ecommerce web sites. It is ironic that many authors have proposed principles for special cases (such as principles for managing projects, doing research, or selling consumer goods), but relatively few general principles for systems in organizations are discussed or used. For example, typical systems analysis and design textbooks used in business schools provide extensive guidelines for doing systems analysis for developing information systems, but say almost nothing about the principles that should apply to the work systems that are being built or supported.

Work system principles should not be confused with the common term "success factor." Success factors are factors that are statistically correlated with success, whereas principles are generalizations that apply to almost all systems of a particular type. For example, the principles "please their customers" and "perform work efficiently" apply to almost every system in an organization. In contrast, the success factors "top management support" and "prior experience with the technology" increase the likelihood of success but may be absent from successful systems, which may be invisible to top management and may use unfamiliar technology.

None of the principles in Figure 5.5 explicitly mentions topics such as speed, profitability, and competitiveness because those topics might be important in some cases but unimportant elsewhere. For example, although speed is often important, speed in delivery can be counterproductive if the recipient is not ready to receive a delivery when it arrives. Similarly, because many essential systems such as accounting systems are usually not a source of competitive advantage, a general principle about being competitively significant is inappropriate. Ideally, work system principles should be culture independent, and should apply in any national or organizational culture.[37] This criterion fits best with principles that involve characteristics of work practices and less well for principles involving people and their personal well-being.

24 Work System Principles

The 24 principles in Figure 5.5 apply to almost any work system. These principles can be used at different points when analyzing a work system. Early in the analysis they can be used to identify issues that might not be apparent and might be overlooked in the analysis. Later in the analysis, the principles can be used to sanity-check the recommendation by asking whether the recommended changes will lead to improvements or at least will do no harm in relation to each of the principles.

The 24 principles point to important issues but cannot be used mindlessly because combinations of two or more principles often present goal conflicts that require compromises. For example, principle #1 (please the customer), #4 (perform the work efficiently), and #10 (serve the participants) often push in opposite directions. Assume the system involves a service situation such as teaching or providing medical care. Typical customers would like to receive services when, where, and how they want those services, regardless of the convenience or efficiency of the providers. Unfortunately, pleasing the customer (#1) conflicts with providing those services in an efficient way (#4) that serves the participants (#10) by not placing them under undue stress. Many other combinations of principles call for similar tradeoffs.

The internal contradictions between some work system principles do not make them invalid. At work and at home our everyday lives are filled with compromises between valid, but contradictory principles (e.g., being ambitious but not trampling others, using resources efficiently but not being a miser, disciplining children but not being a drill sergeant, and so on). Although there is no formula for making tradeoffs in most of these situations, the principles can help in making well-considered decisions and not ignoring relevant factors that might have been overlooked.

Figure 5.5. Work system principles

<table>
<tr><th colspan="2">Customers</th><th>Products & Services</th></tr>
<tr><td colspan="3">• #1: Please the customers.
• #2: Balance priorities of different customers.</td></tr>
<tr><td colspan="3">Work Practices (Major Activities or Processes)</td></tr>
<tr><td colspan="3">• #3: Match process flexibility with product variability
• #4: Perform the work efficiently.
• #5: Encourage appropriate use of judgment.
• #6: Control problems at their source.
• #7: Monitor the quality and timing of both inputs and outputs.
• #8: Boundaries between steps should facilitate control.
• #9: Match the work practices with the participants.</td></tr>
<tr><td>Participants</td><td>Information</td><td>Technologies</td></tr>
<tr><td>• #10: Serve the participants.
• #11: Align participant incentives with system goals.
• #12: Operate with clear roles and responsibilities.</td><td>• #13: Provide information where it will affect action.
• #14: Protect information from inappropriate use.
•</td><td>• #15. Use cost/effective technology.
• #16: Minimize effort consumed by technology.</td></tr>
<tr><td>Infrastructure</td><td colspan="2">• #17: Take full advantage of infrastructure.</td></tr>
<tr><td>Environment</td><td colspan="2">• #18: Minimize unnecessary conflict with the external environment</td></tr>
<tr><td>Strategies</td><td colspan="2">• #19: Support the firm's strategy</td></tr>
<tr><td>Work System as a Whole</td><td colspan="2">• #20: Maintain compatibility and coordination with other work systems.
• #21: Incorporate goals, measurement, evaluation, and feedback.
• #22: Minimize unnecessary risks.
• #23: Maintain balance between work system elements.
• #24: Maintain the ability to adapt, change, and grow.</td></tr>
</table>

The current version of the work system method uses 24 principles.[38] It is not clear whether increasing or decreasing that number would help in generating better results. A much smaller number of principles would provide less guidance about common issues and problems, but too many principles could be overwhelming. Each of the current work system principles will be discussed briefly.

#1: Please the customers. Work systems exist to produce products and services for their customers. A basic tenet of quality management is that customers evaluate the product and that work system effectiveness is linked to customer satisfaction. Relevant performance indicators include cost to the customer, quality perceived by the customer, reliability, responsiveness, and conformance to standards and regulations.

Although few successful business people would argue with the general idea of pleasing the customer, a major part of today's business buzz seems to imply that the importance of the customer was discovered recently. Otherwise we wouldn't hear so much about organizing around the customer, customer-facing processes, customer relationship management, and providing a great customer experience. Obviously the importance of pleasing the customer is not new. The purpose of stating this principle and all of the other 23 principles is to put them together in a form that makes them easy to use and hard to forget.

#2: Balance priorities of different customers. Many work systems have multiple customers with different goals and needs related to the products and services the work system produces. Ideally, whatever resources are available for the work system should be deployed in a way that reflects the relative priority of different groups of customers. That may lead to different versions of the same products and services, much like the airlines' distinction between first class, business class, and coach class. It may also lead to producing fundamentally different products for different customers, such as services for primary customers and performance information for managers who are secondary customers of a work system.

#3: Match process flexibility with product variability. Work systems designed for repetitive production of a single, unvarying product or service need much less flexibility than work systems designed for production of products and services that have many variations. For example, a production line that produces cans of diet soda needs much less flexibility than a job shop that manufactures different custom-built products for different customers. The idea of matching process flexibility with product variability is expressed by the Work System Framework's double-headed arrow between work practices and products and services. That arrow says that the work practices should match the products and services, just as three other double-headed arrows say that work practices should match the participants, information, and technology.

#4: Perform the work efficiently. Effectiveness is about pleasing customers (principle #1). In contrast, efficiency is about using resources well in the internal operation of the work system. Although there are exceptions in some situations, performance indicators that are positively related to efficiency include activity rate, output rate, consistency, speed, and uptime. Performance indicators that are negatively related to efficiency include error rate, rework rate, and vulnerability.

#5: Encourage appropriate use of judgment. This is a restatement of the sociotechnical principle of "minimal critical specification," i.e., that no more should be specified in the design of work practices than is absolutely essential. In work system terms, this is reflected in the appropriate amount of structure in work practices. If work practices are structured too tightly, work system participants will not be able to use their judgment. If they are not structured enough, participants will be more likely to apply inconsistent judgments to questions and issues that have known answers and approaches.

Notice the term *appropriate use of judgment*. This principle does not say that any work system participant should be able to exercise judgment about anything. In many situations, work system participants should be required to perform the work in a prescribed manner using prescribed rules; in many other situations, the rules should be treated as guidelines that can be overridden based on judgment; in yet other situations, no general guidelines exist for important decisions even though rules may be enforced for clerical activities such as data collection.

#6: Control problems at their source. Some steps in many business processes receive inputs from other work systems. In many situations, those inputs contain errors, noise, incompleteness, and timeliness problems that should have been corrected elsewhere. Likewise, errors sometimes occur during activities within the work system. The principle of controlling problems at their source says that problems should be identified and corrected immediately instead of letting them affect other steps. Sometimes called the "sociotechnical criterion," this principle is consistent with Deming's view[39] that people should monitor the quality of their own work and should be responsible for it, rather than making after-the-fact inspectors responsible for quality.

#7: Monitor the quality and timing of both inputs and outputs. In practice, quality and timing issues might be observed in work system inputs, during specific activities within the work system, or in the outputs produced by those activities. For example, an overnight delay caused by untimely completion of a previous step may cause the same problems regardless of whether the delayed completion occurs within the work system or in a separate work system that provides inputs.

#8: Boundaries between business process steps should facilitate control. The work system method assumes a work system's work practices may include business processes consisting of individual steps. According this principle, any redefinition or reorganization of those steps should set the boundaries between steps in a way that makes it easy to check that the step is producing the right results and using resources efficiently.

#9: Match the work practices with the participants. Work practices well matched to some participants might be poorly matched to others with different interests and capabilities. This is a reason why the same business process may be successful in one site and unsuccessful in another. Even within a specific site and even when work practices are well defined, different individuals may perform at different levels of competence and ambition, and may do some of the work differently. For example, great programmers produce far better programs than mediocre programmers produce. Similarly, different managers may pay attention to different issues and may use different types of information when performing the same management role. When work system participants in the same roles have significantly different capabilities and interests, the design of the system may have to accommodate those differences.

#10: Serve the participants. This includes providing healthy work conditions and resources needed to do the work effectively and efficiently. Healthy work conditions include meaningful work, appropriate levels of challenge and autonomy, and possibilities for personal growth. Serving the participants is consistent with the sociotechnical principle of providing a high quality of work life.

#11: Align participant incentives with system goals. Participants in many systems have incentives that are inconsistent with system goals, for example, when management says that quality is the top priority but pays people based on their rate of production. Alignment of participant incentives with system goals reflects the sociotechnical principle of "support congruence," whereby systems of social support should reinforce desired behaviors.

#12: Maintain clear roles and responsibilities. Viewing a situation as a work system assumes at least some regularity about how work is done, who does it, and under what circumstances. The scope of the regularity may include different methods for different situations within the system, but it always assumes that the situation can be described as a system with identifiable elements such as work practices and participants.

Clear roles and responsibilities are part of the regularity within a work system. When roles and responsibilities are less clear, work system participants are less sure about who should do which work within the system. This uncertainty leads to continual negotiation and re-negotiation of who should do what. In unusual, extremely novel situations, the negotiations may be necessary, but in most situations clear roles and responsibilities lead to greater efficiency and effectiveness. Clarity of roles and responsibilities does not imply that each participant must play the same roles every time,

however. It is certainly possible for roles to rotate depending on the situation.

#13: Provide information where it will affect action. This is the sociotechnical principle of "information flow." Participants in many systems have access to information that is never used; participants in other systems lack access to information they need. In both cases, better system performance might result from system changes that facilitate creation of value from information.

#14: Protect information from inappropriate use. As system-related information is increasingly computerized, protection of information has become more important because of heightened vulnerability to unauthorized access and modification, misuse, and theft.

#15. Use appropriate technology. Inappropriate technologies may be poorly tailored to the situation, inadequate for doing the job, or too expensive in capital costs and effort. The frequent use of inappropriate technologies implies that this should be included as a separate work system principle even though "performing the work efficiently" (principle #4) usually requires use of appropriate technology with appropriate interfaces and other features.

For example, this principle can be used to think about a customer tracking system that uses a spreadsheet to store critical information. Use of the spreadsheet may seem simple and straightforward, but the high error rates in using spreadsheets[40] imply that this may be an error-prone choice. The risk is even higher if the spreadsheet was created by a non-programmer with little skill in debugging.

#16: Minimize effort consumed by technology. Unfortunately, even seemingly appropriate technologies consume effort in learning about the technology, performing set-ups and technology tweaks, recovering from crashes and mistakes in using the technology, and generally just "futzing around" with the technology.[41] Additional effort consumed by technology often implies less effort devoted to the work system's value added work.

#17: Take full advantage of infrastructure. Fuller use of shared human, information, and technical resources may lead to better work system performance. For example, it may be possible to offload effort and improve productivity by using slack resources that are readily available in the infrastructure.

#18: Minimize unnecessary conflict with the external environment. Systems containing inherent conflicts with the environment typically operate with more stress and excess effort than systems that fit the organizational, cultural, competitive, technical, and regulatory environment.

#19: Support the firm's strategy. Consistent with the many articles that have been written about business/IT alignment, the form and operation of work systems should fit with the firm's strategy and should not contradict it unless there is a conscious reason for doing so in a particular situation. For example, a firm that positions itself as a top of the line retailer should have customer service and product returns systems that are consistent with its top of the line image.

#20: Maintain compatibility and coordination with related work systems. Every system receives inputs from other systems and produces products and services that are used by other systems. Relationships between work systems operate much more smoothly and efficiently when the producer system's product is compatible with the customer system's standards and procedures.

The analysis of how to improve a particular work system should include its impact on other work systems because the current system or a future revision might actually export problems to other work systems. Examples of exporting problems include:

- sending erroneous, substandard, or otherwise inadequate products to other work systems
- sending outputs at the wrong time
- communicating ineffectively with other work systems

From a corporate viewpoint it makes little sense to improve one system in a way that unexpectedly degrades performance of another system. However, managers under pressure to improve their own performance sometimes make decisions that cause this type of sub-optimization.

#21: Control the system using goals, measurement, evaluation, and feedback. A basic tenet of quality control is that feedback loops should help work system participants identify and evaluate gaps between goals and measured results. This type of feedback helps the work system stay on course. The related sociotechnical principle is that feedback systems should be as complex as the problems that need to be controlled. In practice, this means that a single goal with an associated metric is often insufficient for controlling a system. For example, trying to control a factory using the single metric of meeting monthly production quotas ignores other aspects of performance such as quality, productivity, and employee satisfaction.

#22: Minimize unnecessary risks. Most work systems have meaningful risks related to at least several work system elements. Risk cannot be eliminated, especially when people perform some of the work. However, unnecessary risk should be avoided by identifying important risks in a current or proposed system and deciding what can or should be done to minimize those risks.

#23: Maintain balance between work system elements. The double-headed arrows in the Work System Framework in Figure 2.1 indicate that the various elements of a work system should be in balance. Imbalances usually interfere with some aspect of performance. Typical imbalances include:

- work practices not consist with desired quality of products and services
- participants inappropriate for work practices
- work practices inappropriate for participants
- information inadequate for desired work practices
- available information not used by work practices
- technology inadequate for or too expensive for the work practices.

#24: Maintain the ability to adapt, change, and grow. Because a system's environment will probably change over time, the work system should have the capability of adapting, changing, and growing. In some cases the use of computerized information systems supports adaptability. In other cases, the computerized capabilities act like electronic concrete. They prevent change by making it excessively difficult or expensive to convert to different software that supports different work practices that use different information.

Checklists of Useful Ideas

Figures 5.1 through 5.5 list a large number of ideas that are useful when analyzing a work system. Many of those ideas are explained, rather than just listed, in Chapters 9 through 14. Even without reading those chapters the ideas can be used as checklists of topics that are often relevant for answering the AP (analysis and possibilities) questions in WSM's Level Two.

The use of these ideas within WSM can be organized in two ways.

Drill down. The AP questions in Level Two refer to a single work system element. Each of the tables on the following pages refers to one of the AP questions, and lists relevant ideas that were included in Figures 5.1 through 5.5. In effect, each table is a reminder of ideas that are often relevant to one of the AP questions. There is no obligation to use any of these ideas in answering any particular question, but the use of appropriate ideas from these tables leads toward clearer, more specific answers.

Scan across. It is also possible to convert Figures 5.1 through 5.5 into checklists that take a particular theme across all of the work system elements. For example, such a checklist could serve as a reminder of typical performance indicators or work system strategy decisions across a work system. The Appendix presents five checklists filled out for the loan approval example in Chapter 8. In each of those cases, one column of the checklist identifies the topics and other columns provide space for relevant details such as specific metrics and their numerical values.

AP1: Who are the work system's customers and what are their concerns related to the work system?

Principles	Diagrams and Methods
#1: Please the customers. #2: Balance priorities of different customers.	• Kano analysis (delighters, satisfiers, dissatisfiers) • House of Quality (from quality function deployment)[42]
Performance Indicators	**Strategy Decisions**
• Customer satisfaction • Customer retention	• Customer segmentation • Equality of treatment for customers • Nature of the customer experience • Style of interaction with customers
Stumbling Blocks and Risks	**Possibilities for Change**
• Unrealistic expectations • Unmet customer needs or concerns • Disagreement about customer requirements or expectations • Customer segments with contradictory requirements • Unsatisfying customer experience • Lack of customer feedback	• Add or eliminate customer groups • Change customer expectations • Change the nature of the customer relationship • Change the customer experience

AP2: How good are the products and services produced by the work system?

Principles	Diagrams and Methods
#3: Match process flexibility with product variability	• Product/service positioning diagram (See Figure 9.1)
Performance Indicators	**Strategy Decisions**
• Cost to the customer • Quality perceived by the customer • Responsiveness to customer needs • Reliability • Conformance to standards or regulations • Satisfaction with intangibles	• Product features • Service features • Information features • Product/service variability • Relative emphasis on product or service • Relative emphasis on physical things or information • Commodity vs. customized • Controllability by customer • Adaptability by customer • Treatment of by-products
Stumbling Blocks and Risks	**Possibilities for Change**
• Difficulty using or adapting the work system's products and services • Unfamiliar products or services • High cost of ownership • Complex product, stringent requirements • Incompatibility with significant aspects of the customer's environment	• Change information content • Change physical content • Change service content • Increase or decrease customization • Change controllability and adaptability by the customer • Change the relationship between work system participants and customers • Provide different intangibles • Change by-products

AP3: How good are the work practices inside the work system?

Principles

#4: Perform the work efficiently.
#5: Encourage appropriate use of judgment.
#6: Control problems at their source.
#7: Monitor the quality of both inputs and outputs.
#8: Boundaries between process steps should facilitate control.
#9: Match the work practices with the participants

Diagrams and Methods

- Flow chart (See Figure 10.1)
- Swimlane diagram (See Figure 10.2)
- Data flow diagram (See Figure 10.3)

Performance Indicators

For business process or activities:

- Activity rate
- Output rate
- Consistency
- Speed
- Efficiency
- Error Rate
- Rework Rate
- Value Added
- Uptime
- Vulnerability

For communication:

- Clarity of messages
- Absorption of messages
- Completeness of understanding
- Efficiency: Value compared to amount of information

For decision making:

- Quality of decisions
- Degree of consensus attained
- Range of viewpoints considered
- Satisfaction of different legitimate interests
- Justifiability of decisions

Strategy Decisions

- Degree of structure
- Range of involvement
- Degree of integration
- Complexity
- Variety of work
- Degree of automation
- Rhythm – frequency
- Rhythm – regularity
- Time pressure
- Amount of interruption
- Degree of attention to planning and control
- Error-proneness
- Formality in exception handling

Stumbling Blocks and Risks

- Inadequate quality control
- Uncertainty about work methods
- Excessive variability in work practices
- Frequent changes in work practices
- Over-structured work practices
- Excessive interruptions
- Excessive complexity
- Inadequate security
- Inadequate methods for planning the work
- Omission of important functions
- Built-in delays
- Unnecessary hand-offs or authorizations
- Steps that don't add value
- Unnecessary constraints
- Unclear or misunderstood business rules and policies
- Low value variations in methods or tools
- Large fluctuations in workload

Possibilities for Change

- Change roles and division of labor
- Improve business process by adding, combining, or eliminating steps, changing the sequence of steps, or changing methods used within steps
- Change business rules and policies that govern work practices
- Eliminate built-in obstacles and delays
- Add new functions not currently performed
- Improve coordination between steps
- Improve decision making practices
- Improve communication practices
- Improve the processing of information, (capture, transmission, retrieval, storage, manipulation, and display)
- Change practices related to physical things (creation, movement, storage, modification, usage, protection, etc.)

AP4: How well are the roles, knowledge, and interests of work system participants matched to the work system's design and goals?

Principles

#10: Serve the participants.
#11: Align participant incentives with system goals.
#12: Operate with clear roles and responsibilities

Diagrams and Methods

- Organization chart
- Social network diagram[43]

Performance Indicators

- Individual or group output rate
- Individual or group error rate
- Training time to achieve proficiency
- Job satisfaction
- Turnover rate
- Amount of management attention required

Strategy Decisions

- Management attention required
- Reliance on personal knowledge and skills
- Personal autonomy
- Personal challenge

Stumbling Blocks and Risks

- Inadequate skills, knowledge, or experience
- Inadequate understanding of reasons for using current methods
- Multiple, inconsistent incentives
- Unclear goals and priorities
- Responsibility without authority
- Inadequate role definitions
- Lack of accountability
- Inadequate management or leadership
- Unnecessary layers of management
- Inconsistency between the organization chart and actual work patterns.
- Poor morale
- Disgruntled individuals
- Lack of motivation and engagement
- Ineffective teamwork
- Turnover of participants
- Inattention
- Excessive job pressures
- Failure to follow procedures
- Departmental rivalries and politics

Possibilities for Change

- Change the participants
- Provide training on details of work
- Assure that participants understand the meaning and significance of their work
- Provide resources needed for doing work
- Change incentives
- Change organizational structure
- Change the social relations within the work system
- Change the degree of interdependence in doing work
- Change the amount of pressure felt by participants

AP5: How might better information or knowledge help?

Principles

#13: Provide information where it will affect action.
#14: Protect information from inappropriate use.

Diagrams and Methods

- Entity-relationship diagram (See Figure 12.1)
- Data Dictionary
- Data flow diagram (See Figure 10.3)

Performance Indicators

- Accuracy
- Precision
- Age
- Believability
- Traceability
- Ease of access
- Access time
- Controllability of selection and presentation
- Relevance
- Timeliness
- Completeness
- Appropriateness
- Conciseness
- Ease of understanding
- Vulnerability to inappropriate access or use

Strategy Decisions

- Quality assurance for information
- Awareness of information quality
- Ease of use
- Information security

Stumbling Blocks and Risks

- Use of obsolete or inaccurate information
- Difficulty accessing information
- Misuse of information developed for a different purpose
- Misinterpretation of information
- Multiple versions of the same information
- Inconsistent coding of information
- Re-entry of previously computerized information
- Inadequate control of information access and modification
- Unauthorized access
- Poorly articulated knowledge about work practices

Possibilities for Change

- Provide different information or knowledge
- Use different rules for coding information
- Codify currently uncodified information
- Eliminate some information
- Organize information so it can be used more effectively
- Improve information quality
- Make it easier to manipulate information
- Make it easier to display information effectively
- Protect information more effectively
- Assure understanding of details of tasks and use of appropriate information and knowledge in doing work
- Provide access to knowledgeable people

AP6: How might better technology help?

Principles

#15: Use cost/effective technology
#16: Minimize effort consumed by technology.

Diagrams and Methods

- Network architecture (many variations)

Performance Indicators

- Functional capabilities
- Ease of use
- Uptime
- Reliability
- Compatibility with complementary technologies
- Maintainability
- Price/performance
- Training time to achieve proficiency
- Time absorbed by setup and maintenance

Strategy Decisions

- Functionality
- Ease of use
- Technical support for technology usage
- Maintenance

Stumbling Blocks and Risks

- Use of inadequate technology
- Undocumented technology
- Inadequately maintained technology
- Technology incompatibilities
- Technology complex or difficult to understand
- Non- user friendly technology
- Equipment and software downtime
- New or unproven technology
- Mismatch with needs of work practices
- Unauthorized usage
- Software bugs
- Unauthorized changes to software

Possibilities for Change

- Upgrade software and/or hardware to a newer version
- Incorporate a new type of technology
- Reconfigure existing software and/or hardware
- Make technology easier to use
- Improve maintenance of software and/or hardware
- Improve uptime of software and/or hardware
- Reduce the cost of ownership of technology

AP7: How well does the work system fit the surrounding environment?

Principles	Diagrams and Methods
#18: Minimize unnecessary conflict with the external environment	Various diagrams and methods can be used to analyze the competitive environment that affects the system.
Performance Indicators • Fit with environment	**Strategy Decisions** • Alignment with culture • Alignment with policies and procedures
Stumbling Blocks and Risks • Lack of management support and attention • Poor fit with organizational policies and procedures • Poor fit with organizational culture • Negative impacts of recent organizational initiatives • Poor fit with organizational and competitive pressures • Noncomformance to regulations and industry standards • High level of turmoil and distractions.	**Possibilities for Change** • Change the work system's fit with organizational policies and procedures (related to confidentiality, privacy, working conditions, worker's rights, use of company resources, etc.) • Change the work system's fit with organizational culture • Respond to expectations and support from executives • Change the work system's fit with organizational politics • Respond to competitive pressures • Improve conformance to regulatory requirements and industry standards

AP8: How well does the work system use the available infrastructure?

Principles	Diagrams and Methods
#17: Take full advantage of infrastructure.	• Diagram of network architecture or information architecture (many variations)
Performance Indicators • Adequacy of human infrastructure • Adequacy of information infrastructure • Adequacy of technical infrastructure	**Strategy Decisions** • Degree of reliance on human infrastructure • Degree of reliance on information infrastructure • Degree of reliance on technical infrastructure
Stumbling Blocks and Risks • Poor fit with or use of human infrastructure • Poor fit with or use of information infrastructure • Poor fit with or use of technical infrastructure	**Possibilities for Change** • Make better use of human infrastructure • Make better use of information infrastructure • Make better use of technical infrastructure

AP9: How appropriate is the work system's strategy?

Principles	Diagrams and Methods
#19: Support the firm's strategy	
Performance Indicators • Fit with organization's strategy • Fit with reality faced by work system	**Strategy Decisions** • Designing fit with organization's strategy • Designing fit with strategy of related work systems
Stumbling Blocks and Risks • Misalignment with the organization's strategy • Poorly articulated corporate strategy	**Possibilities for Change** • Improve alignment with the organization's strategy • Change the work system's overall strategy • Improve strategies related to specific work system elements

AP10: How well does the work system operate as a whole and in relation to other work systems?

Principles	Diagrams and Methods
#20: Maintain compatibility and coordination with other work systems. #21: Incorporate goals, measurement, evaluation, and feedback #22: Minimize unnecessary risks. #23: Maintain balance between work system elements. #24: Maintain the ability to adapt, change, and grow	General-purpose techniques that may be useful in analyzing an entire work system or any part of it include, among many others, histograms, scatter plots, run charts, control charts, fishbone diagrams, and Pareto charts.
Performance Indicators • Quality of inputs from other work systems • Timeliness of inputs from other work systems • Effectiveness of communication with other work systems • Effectiveness of coordination with other work systems	**Strategy Decisions** • Degree of centralization • Capacity • Resilience • Scalability • Agility • Transparency
Stumbling Blocks and Risks • Inadequate resources or capacity • Inadequate management • Inadequate security • Inadequate measurement of success	**Possibilities for Change** (Change individual elements appropriately.)

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Chapter 6: Justifying a Recommendation

- Desired Changes to Work System Elements
- Alternatives not Selected
- Comparison with an Ideal System
- Likely Success Addressing the Original Problems
- Negative Impacts of Recommended Changes
- Fit with Work System Principles
- Implementation of the Recommendation
- Stakeholder Analysis
- Costs, Benefits, and Risks
- Questionable Assumptions
- How Much Justification Is Needed?

The overview of the work system method in Chapter 4 identified ten questions (RJ1 through RJ10) for assuring that the recommendation and justification are coherent and compelling enough to explain to others. In effect, these questions express typical objections that often arise in planning meetings, such as:

- Did you consider all of the changes that need to take place, not just changes in software and hardware?
- Did you consider alternatives?
- Is this just a stopgap, or is it really a solution?
- Did you consider new problems that might be caused?
- Do you have a tentative plan that seems feasible?
- Did you identify the questionable assumptions that might be showstoppers?

Questions RJ1 through RJ10 serve several purposes. First, they identify issues that should be considered before pursuing a recommendation. Second, they make sure that the recommendation is justified from economic, organizational, and practical perspectives. Third, they can help in recognizing topics that need a deeper discussion and/or additional expertise. Although none of these questions is intrinsically technical, several require input from IT professionals. For example, it is rarely feasible to produce a cost-benefit justification without help from someone who understands the technical issues and technical resources required. This chapter discusses some of the main issues related to each of the ten questions about a recommendation and its justification. Each of the Chapter's subheadings identifies the main topic of one of those questions.

Desired Changes to Work System Elements

Because a work system is a system, changes in one part of a work system usually result in changes elsewhere. Therefore, the first step in identifying the recommended changes is to summarize the proposed

changes for each element of the work system. It isn't enough to say that new software will be used or that the participants will receive training.

To clarify the nature of the intended changes and to make sure the tentative project plan is realistic, it is useful to distinguish three types of changes:

- work system changes that are primarily unrelated to information system changes, such as changing incentive structures or providing training on work practices not related to the information system
- work system changes that are directly related to information system changes, such as changing work practices that rely on new information system capabilities
- information system changes that have little bearing on how the work system typically operates, such as making hardware or software changes that are not visible to work system participants, but that help in maintaining the hardware or software.

Separating the three types of changes usually reveals that a change in technology will not accomplish the desired change in work system performance by itself. Establishing realistic expectations related to changes that do not involve IT is essential. Well over half of the costs of most IT-related changes in work systems are devoted to things other than hardware or software. A leading researcher on IT economics found that nine dollars of **complementary assets** including human capital and organizational capital are required for every dollar of IT hardware capital that a company owns.[44]

A complete recommendation considers possible changes in each element of the work system, not just technology.

Alternatives not Selected

Too many recommendations are made without serious consideration of alternatives. In such cases the assumed options are to do nothing or to adopt a particular proposal. Identifying and considering genuine alternatives other than doing nothing decreases the likelihood that a better alternative was not even considered.

In some situations, the decision is easy because one alternative is better than all other alternatives on all relevant criteria. But in many other situations, several alternatives are better on some criteria, but not all. In those cases, it is useful to identify the factors and tradeoffs that led to the selection of the preferred alternative. Examples of typical factors and tradeoffs include:

- current out-of-pocket costs versus costs of long term delays
- advantages and disadvantages of doing one large project versus several small projects
- costs and other impacts of retraining current employees versus hiring new employees
- relative emphasis on privacy versus monitoring and control
- costs and benefits of real time feedback versus delayed feedback.

Comparison with an Ideal System

Recommendations may be based on so many assumed constraints and limitations that highly beneficial options are never considered seriously. It may be unclear whether the recommendation only attempts to stop the bleeding or whether it represents a good long term approach to the problem. It may make sense to revise the recommendation or to do nothing until a more complete project can be undertaken.

Ackoff's concept of idealized redesign provides a way to talk about an ideal system. "An ideally redesigned system is one with which the designers would now replace the existing system if they were free to replace it with any system they wanted." For the idealized design to be meaningful, it must be technologically feasible with current technology and must be operationally viable in the current environment. However, implementation issues should not be considered at this stage because they might constrain creativity.[45] The attempt to describe an ideal system might lead to a realization that the recommendation is no more than a stopgap measure. Also, it might clarify that the recommendation is only a first step in a beneficial direction, but that additional steps should follow when time and other resources are available.

Likely Success Addressing the Original Problems

In some situations, clear and pressing needs that were recognized by project initiators gradually become diffused as the analysis proceeds and additional factors emerge. For example, the analysis may find that one of the initial goals is infeasible technically, that another goal is being handled by another project, and that three additional problems that were not part of the original mandate will have to be resolved in order to make progress on the original problem. Sometimes the scope of the project is reduced in order to meet a completion date. Under such circumstances it is especially important to ask how well the recommended changes address the original problems and opportunities.[46] If the original vision is not going to be realized, the project's customers and funders may prefer to cancel the project rather than attempting to achieve only part of the original goal.

Negative Impacts of Recommended Changes

Changing one part of a system often causes problems elsewhere in the system. In some situations, the new problems may be worse than the original problems that motivated the change. For example, an attempt to solve an efficiency problem may result in new work practices that lead to employee turnover.[47] Speaking about technological change at a more general level, the social critic Jacques Ellul said:

> All technical progress exacts a price; while it adds something on the one hand, it subtracts something on the other.
>
> All technical progress raises more problems than it solves, tempts us to see the consequent problems as technical in nature, and prods us to seek technical solutions to them.
>
> The negative effects of technological innovation are inseparable from the positive. It is naive to say that technology is neutral, that it may be used for good or bad ends; the good and bad effects are, in fact, simultaneous and inseparable.
>
> All technological innovations have unforseeable effects.[48]

Whether or not Ellul sounds too pessimistic, his basic point about changes generating new problems is worth heeding when evaluating a recommendation to improve a work system. An example from Zuboff's *In the Age of the Smart Machine* illustrates the point. An insurance company installed a new information system for processing dental claims, thereby reducing the knowledge demands of the job in order to speed processing. According to a manager, "a lot of quality issues are now built into the machine. It requires less thought, judgment, and manual interventions." The new work system was designed to maximize productivity by minimizing tasks that involved interpersonal coordination, such as collecting mail or answering the telephone. Although productivity of claims processing increased by 105% over two years, a manager "felt somewhat appalled at the nature of the job he had helped to create." He said, "It's reached a point where the benefits analysts can't move their fingers any faster. There is nowhere to go anymore if you don't want to sit in front of a terminal." A shift occurred in how benefits analysts related to their work. According to one analyst, "I don't know half the things I used to. I feel that I have lost it – the computer knows more. I am pushing buttons. I'm

not on top of things as I used to be." Another analyst said, "You don't have to think that much because the system is doing the thinking for you. You don't have to be concerned with what is on that claim. People here have begun to feel like monkeys."[49] This example concerned impacts on work system participants. Other types of negative impacts might be related to costs, stresses elsewhere in the organization, or undesirable impacts on customers.

Fit with Work System Principles

The recommended work system should reduce any significant nonconformance to work system principles. In addition, based on the general goal of doing no harm, it should conform to each principle in Figure 5.5 at least as well as the existing work system. At minimum, if the recommendations will create new problems, the benefits of the recommendations should outweigh those problems.

The Appendix shows how a work system principles checklist can be applied to an example during the analysis and possibilities (AP) step. The same checklist applies equally during the recommendation and justification (RJ) step. During AP, it is used to identify problems that should be addressed; during RJ, it is used to evaluate whether the recommendation solves those problems and whether it creates new problems. Merely going through the work system principles checklist during the RJ step is no guarantee that the recommendation will succeed. However, looking for conflicts between the principles and the recommendation is worthwhile because significant conflicts could indicate trouble ahead unless the recommendation is changed or other corrective actions are taken.

Implementation of the Recommendation

There is little value in producing recommendations that are infeasible organizationally, economically, or technically. Therefore any serious recommendation should include a tentative implementation plan. In practice, this means that ownership and management of the project and work system should be clear. In addition, a tentative project plan should seem reasonable in terms of timing, expenses, and availability of people and other resources.

Ownership of the project and work system. Implementation of any planned change usually requires a combination of will and authority. Someone has to care about the recommended change and someone has to have the authority to make sure it happens. At minimum, this requires:

- ***A work system owner***, who has the authority make changes in the work system, assuming that the recommended software or hardware changes are feasible
- ***A project manager,*** who will make sure that the steps in the project are carried out effectively
- ***A funder***, an organization or individual who will provide funding and other resources needed to perform the project
- ***Project participants***, people who will do the work on the project.

Project scope and tentative project plan. The work system life cycle model (WSLC) that will be presented in Chapter 7 provides a useful summary of steps that might be included in a simplified project plan. For each step, the tentative plan should identify tentative resource requirements (key people, number of person days, and other resources) and start and end dates. As will be explained, use of the WSLC model instead of a software project model emphasizes the goal of improving a work system, not just producing and installing new or improved software.

Stakeholder Analysis

To increase the likelihood of success, it is important to make sure that the views of different stakeholders are heard and considered seriously. In the many cases when this is not done, the ignored stakeholders

are less likely to support the change and may resist it or undermine it. Typical examples of important stakeholders or stakeholder groups include:

- ***Top management***, but only if the project is big enough that they will approve the funding or will need to provide symbolic or personal support to encourage successful implementation
- ***Business unit management***, because they own the work system and therefore are responsible for the success of work system changes
- ***Supervisors***, because they are directly involved in making sure the work system operates properly
- ***Work system participants***, because they do the work in the work system and use hardware and software directly
- ***Unions***, in case the work system changes are at all related to significant union issues
- ***Managers and key participants in other affected work systems***, because their work systems may provide inputs or use outputs from the work system that is being changed; also because they may be affected indirectly through changes in responsibilities, power, or other issues that matter to them
- ***The IT group***, because it will have to do the technical work related to computer hardware and software, and will have to maintain the hardware and software over time. If contractors are involved rather than company employees, the IT group may have to manage the contractors or maintain whatever IT capabilities they produce.

Costs, Benefits, and Risks

Economic justification includes a wide range of topics, starting with identification and timing of costs, benefits, and risks:

- ***Direct costs*** related to accomplishing the change from the existing work system to the new work system. These costs are for salaries, software expenses, other expenses directly related to the system change project.
- ***Indirect and hidden costs*** that might be missed because they are already included in other budgets. An example is the salaries of managers and work system participants who participate in the project. Their salaries are included in existing budgets, but a substantial amount of their work may be devoted to the project. In many projects, the indirect and hidden costs may exceed the direct costs.
- ***Tangible benefits*** that can be measured directly. These benefits include cost savings due to headcount reduction, increased efficiency, travel reduction, and other ways in which the direct cost of operating the new work system will be less than the direct cost of operating the old work system.
- ***Intangible benefits*** that may be very important but cannot be expressed easily in dollar terms. These include better decision making, better coordination, better information about customers or internal operations, and greater job satisfaction. In many projects, intangible benefits may be more important than the tangible benefits that are easier to measure.
- ***Risks*** of many types may affect the likelihood of attaining the originally estimated costs and benefits. The example in the Appendix includes a checklist for the work system risks and stumbling blocks identified in Figure 5.4. It also includes an additional checklist for risks that apply specifically to the initiation, development, and implementation phases in the work system life cycle (explained in Chapter 7).

One of the reasons for analyzing a project's costs, benefits, and risks is to provide a basis for comparing and selecting among proposed projects, especially when resources are insufficient for doing all of the projects that are proposed.

- ***Financial comparisons*** are used to help in selecting among potentially beneficial projects whose total costs exceed the available resources. These comparisons start by expressing each project's monthly or quarterly costs and benefits in monetary terms. Producing dollar estimates is easier for direct costs and tangible benefits, but even estimates for those categories may contain

large errors due to unexpected problems or delays. The cost and benefit stream for each project is summarized using financial measures such as net present value or internal rate of return.[50] These financial measures can also be used in post-implementation audits that try to extract lessons for the future by assessing the accuracy of the estimated costs and benefits.

- ***Payback period*** is the estimated length of time until the project's cumulative net benefits catch up with its cumulative net costs. Payback period is important for deciding whether the project is too risky to undertake and whether it is better to reduce the risk of a large failure by subdividing the project into several smaller projects that are easier to manage and will produce useful results sooner.
- ***Business and strategic priority*** is important to consider because some seemingly beneficial projects may not make a significant contribution to the organization's competitive advantage. For example, a strategically significant customer service project needed to match capabilities of a key competitor might seem to have a lower rate of return than an internal accounting project that will reduce clerical costs. In this case, the project with a lower rate of return should have higher priority because it matters more to business success.
- ***Real options***. Some companies use decision trees and other tools to consider the potential value of future possibilities (sometimes called real options) that will emerge when the project is completed. For example, implementation of a new customer database may solve a current problem and may also be the first step toward new customer service capabilities that might be developed later. Doing the project might lead to future possibilities that seem impossible without doing the project, but are not yet analyzed or budgeted.

When using cost/ benefit analysis it is important to recognize that most of the numbers are estimated costs and benefits related to things that should happen in the future. Those estimates may be reasonably reliable if similar projects have been done frequently in the setting. On the other hand, they can be far off if the project is novel, involves a lot of research, or has many unknown details. Given that many of the costs and benefits are probably inaccurate, one might wonder whether it is worth the trouble of producing the estimates and rolling them up into financial calculations such as net present value or internal rate of return. The basic answer is that a genuine effort of specifying the plan and estimating the numbers often leads to greater understanding of costs, benefits, risks, and other factors that might have been overlooked by the people making the proposal. Furthermore, the review of the plan and the associated estimates of costs and benefits can help in discussing the relative merits of different projects.

Even with inaccuracies, being explicit about costs, benefits and risks provides a useful discipline that makes the project selection process more rational, at least on the surface. Lurking below the surface is the recognition that the people who proposed the project may have a vested interest in it and may have underestimated costs, overestimated benefits, and ignored risks. The need to understand cost, benefit, and risk estimates is one of the reasons for the checklists and templates in the Appendix.

Questionable Assumptions

Every recommendation is built on a set of judgments, assumptions, and facts. A final step in sanity-checking a recommendation is to ask whether a change in any of those assumptions, judgments, or facts might have an impact on the recommendation. Common examples of such assumptions include:

- enthusiasm and genuine support of top management
- genuine involvement of work system participants and their managers
- availability of key individuals whose knowledge is needed to specify the detailed requirements or to produce software
- availability of database, browser, or other software that will be used
- availability of computers or communication networks that will be used
- knowledge of the technical staff
- knowledge of IT users
- likelihood of being able to insulate the project from other pressing issues in the organization

It is important to identify assumptions such as these because a review of the recommendation may reveal that important assumptions are incorrect, and that the recommendation may be invalid as a result.

How Much Justification Is Needed?

As was mentioned in Chapter 1, the success rate for systems in organizations and system-related projects is disappointing. Great things have been accomplished, but many opportunities have been missed and many unnecessary failures have occurred. Inadequate analysis and communication in the early stages of projects are cited repeatedly as one of the main reasons for these disappointments.

The ten RJ questions serve a sanity-checking role. Before an organization devotes significant resources to a project, considering these questions can help make sure that obvious issues have been covered:

- Does an understandable recommendation exist, and does it explain how the work system will change?
- To what extent do the recommended changes solve the original problem or create other problems?
- How feasible is the project from organizational, economic, and technical perspectives?
- Are there any easily recognized weak points that should be discussed?

This chapter discussed the main issues behind each of the ten RJ questions. The questions themselves simply try to make sure that a project team evaluates the recommendation from different viewpoints that are pertinent to most system-related projects. Many smaller projects require only simple answers; some of the issues may not be important for some projects. Large, complex projects require a much longer list of questions, sub-questions, and sub-sub-questions. Regardless of whether the project is small or large, the amount of time needed to consider these issues is miniscule compared to the time and effort that could be wasted if a project proceeds from an inappropriate recommendation.

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Chapter 7: The Work System Life Cycle

- Phases of the WSLC
- Operation and Maintenance
- Initiation
- Development
- Implementation
- Importance of Change Management
- Collaborating throughout the WSLC

The Work System Framework is useful for summarizing a work system's operation and scope, analyzing a work system, and identifying potentially beneficial changes. A different model, the Work System Life Cycle model (WSLC), is useful for understanding how those changes occur, and how work systems evolve over time. In effect the Work System Framework and WSLC are like common denominators for understanding systems in organizations. One focuses on how systems operate; the other, on how systems change.

As shown in Figure 7.1, the WSLC says that a work system evolves through multiple iterations of four phases, operation and maintenance, initiation, development, and implementation. The names of the phases were chosen to describe both computerized and non-computerized systems, and to apply regardless of whether application software is acquired, built from scratch, or not used at all. The WSLC encompasses both planned and unplanned change. Planned change occurs through a full iteration encompassing the four phases of the WSLC, i.e., starting with an operation and maintenance phase, flowing through initiation, development, and implementation, and arriving at a new operation and maintenance phase. Unplanned change can occur within any phase through adaptation, improvisation, and experimentation.

The pictorial representation of the work system life cycle model places the four phases at the vertices of a rectangle. Forward and backward arrows between each successive pair of phases indicate the planned sequence of phases and allow the possibility of returning to a previous phase if necessary. To encompass both planned and unplanned change, each phase has an inwardly curved "adaptation loop" to denote unanticipated opportunities and unanticipated adaptations.

The WSLC's iterative nature and its inclusion of planned and unplanned change illustrates that most of the "life cycle" models used by IT professionals focus on a software development project rather than a system's life cycle. Although often called **system development life cycle** models, those models represent the end of the life cycle as the point when the software goes into maintenance mode or when the software changes have been accepted.

As an example of the iterative nature of a work system's life cycle, consider the sales system in a software start-up. Its initial sales system consists of

little more than the visionary CEO selling directly to the initial customers. At some point the CEO can't do it alone, several salespeople are hired and trained, and marketing materials are produced that can be used by someone other than the CEO. As the firm grows, the sales system becomes regionalized and an initial version of sales tracking software is used. Later, the firm changes its sales system again to accommodate needs to track and control a larger sales force and predict sales several quarters in advance. A subsequent iteration might include the acquisition and configuration of commercial customer relationship management (CRM) software.

The first iteration of the sales work system's life cycle starts with an initiation phase. Each subsequent iteration involves deciding that the current sales system is insufficient; initiating a project that may or may not involve significant changes in software; developing resources such as procedures, training materials, and software that are needed to support the new version of the work system; and finally, implementing the new work system in the organization. Based on that logic, the transition to the version of the sales system that uses CRM is not about implementing CRM software. Rather, it is about implementing an improved work system that is enabled by CRM software and other technology.

Consistent with a business viewpoint, the WSLC model focuses on the work system but recognizes that information systems are often essential for the work systems they support. Because the WSLC describes a work system life cycle rather than an IT project, it portrays unplanned changes and adaptations as part of business reality, not as undesirable deviations from a project plan. It recognizes that business requirements change frequently and that unanticipated adaptations may emerge during any phase even though project milestones within each phase should be identified and scheduled in advance. Accordingly, the graphical representation of each phase includes an "adaptation loop" as a reminder that unplanned changes and innovations may modify or extend systems in unanticipated directions. Including these adaptation loops instead of pretending they don't exist encourages continuing negotiation around the natural conflict between the IT group's need to define bounded, measurable projects and the business's need to improve work practices and adapt to changing business problems and opportunities.

Phases of the WSLC

The work system life cycle explains how the initial version of a work system is created and how the transition occurs between two successive versions of the same work system. The phases of the work system life cycle model are named so that they apply to any work system, regardless of whether IT is involved.

- **Operation and maintenance** is the ongoing operation of the work system after it has been implemented, plus small adjustments, corrections of flaws, and enhancements.
- **Initiation** is the process of defining the need for significant change in a work system and describing in general terms how the work system changes will meet the need.
- **Development** is the process of defining and creating or obtaining the tools, documentation, procedures, facilities, and any other physical and informational resources needed before the desired changes can be implemented successfully in the organization.
- **Implementation** is the process of making a new or modified system operational in the organization, including planning for the rollout, training work system participants, and converting from the old way of doing things to the new way.

Table 7.1 summarizes issues that are addressed in each of these phases. At the end of this chapter, Figures 7.2, 7.3, 7.4, and 7.5 combine these with many other issues that are discussed throughout the chapter.

Figure 7.1. The work system life cycle (WSLC) model[51]

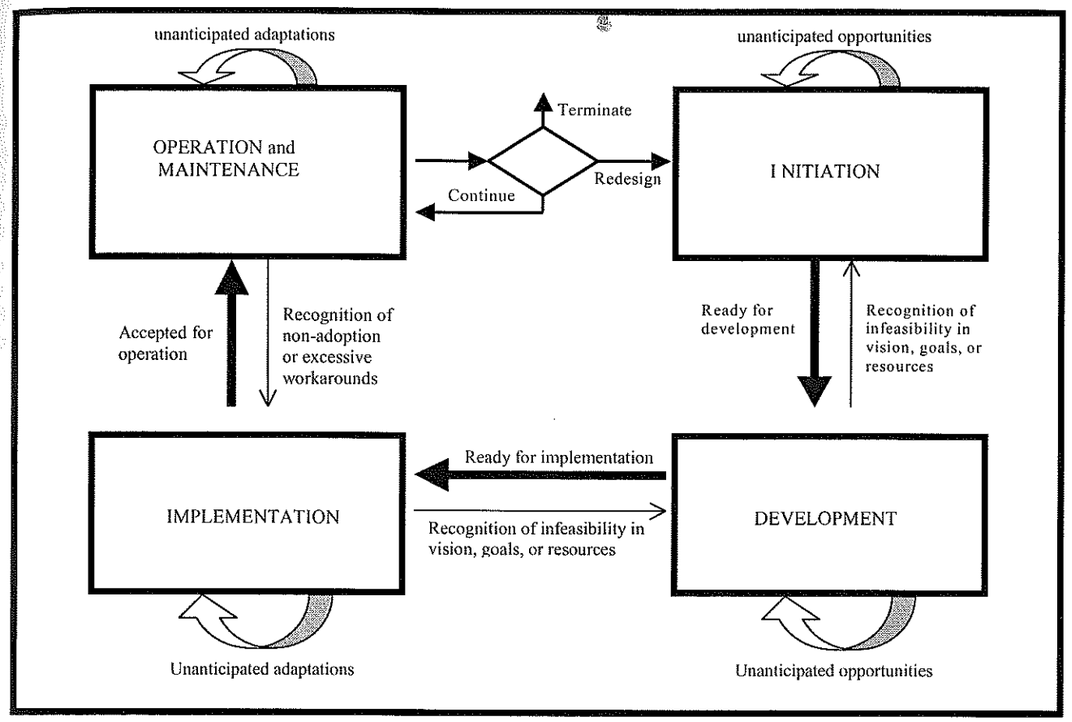


Table 7.1. Issues addressed by WSLC phases

Phase of the WSLC	*Typical issues addressed in this phase*
Initiation	• Can we agree on the purposes and goals of the proposed changes? • Are the proposed changes feasible economically, technically, and organizationally? • Are the changes unnecessarily elaborate and expensive?
Development	• Can we assure that the work system changes genuinely solve the problem? • Do the information system changes conform to the organization's expectations and standards for technical quality?
Implementation	• Can we convert effectively and painlessly from the old work system to the new work system? • Can we resolve personal and political issues related to changes in work patterns and power relationships?
Operation and maintenance	• Can we attain acceptable work system performance? • Can we maintain and improve performance with incremental changes, adjustments, and experimentation?

Operation and Maintenance

The discussion of the Work System Framework throughout most of this book is actually about work systems in operation, i.e., the operational aspects of the operation and maintenance phase. Chapter 3 explained that the work system method starts by identifying an existing (operational) work system and problems or opportunities related to that work system. The goal of the analysis is to determine how to improve that work system.

The maintenance aspects of the operation and maintenance phase involve monitoring the work system and making small adjustments and corrections to keep it operating effectively. This phase continues until the work system is terminated or until major changes are required. At that point, management allocates resources to initiate a project.

Initiation

The initiation phase is the process of clarifying the reasons for changing the work system, identifying the people and processes that will be affected, describing in general terms what the changes will entail, and allocating the time and other resources necessary to accomplish the change. This phase may occur in response to obvious problems, such as unavailable or incorrect information. It may be part of a planning process searching for innovations even if current systems pose no overt problems. When the work system involves software, errors and omissions in the initiation phase may result in software that seems to work on the computer but needs expensive retrofitting after initial attempts at implementation in the organization. Unless the initial investigation shows the project should be dropped, this phase concludes with a verbal or written agreement about the proposed work system's general function and scope, plus a shared understanding that it is economically justified and technically and organizationally feasible. This agreement might be general and informal, or might be quite specific in identifying budgets, time lines, and measurable objectives.

Key issues during the initiation phase include attaining agreement on the purpose and goals of the proposed change and assuring that the likely benefits far exceed the likely costs in terms of time and resources. The larger the project, the more desirable it is to document specific expectations along with a plan for accomplishing genuine results (as opposed to just performing specific activities at specific times). Regardless of how formal the agreement is, the details of the desired changes will be worked out in the development phase.

The initiation phase defines a new project and assures that it makes sense from different perspectives.

Business responsibilities. The main questions in the initiation phase involve summarizing the need for changes, describing the nature and scope of the desired changes, and summarizing the budget, resources, and desired approach for accomplishing those changes. Even when some of the changes will involve computerized parts of the system, business professionals need to be involved in the initiation process because they have the clearest view of business issues and the direct responsibility for organizational and economic success.

- They should be cautious about proposed changes that seem great in the abstract but may be difficult and expensive to implement due to the amount of organizational change required or due to political and cultural obstacles. Business professionals cannot expect the technical staff to anticipate and manage such issues.
- They need to watch out for techno-hype and implied promises that technology itself will solve operational, organizational, or political problems.
- They should remember that too many technology investments are based on management whim rather than on careful consideration of how the technology will be used to help generate value for internal or external customers.
- Consistent with their responsibility for work system performance, they should also make sure that IT professionals participate actively in this phase to provide their expertise on what IT can and cannot do with differing levels of effort and expense.

Feasibility study. Work system changes often include changes in an information system and changes in other parts of the work system. In these situations, it is usually worthwhile to write a formal **functional specification** that outlines the goal in general terms and explains how changes in the work system and in the information system will lead to better work system performance. The feasibility study in the initiation phase is often more complicated if the issues about work system and information system changes are intermingled. The estimates of costs and benefits produced for these feasibility studies are often inaccurate because the development phase will clarify many details. Sometimes the development phase becomes a research project that finds problems never anticipated during the original feasibility study. For example, the mere fact that an information system is involved may broaden the scope of the inquiry if changes in the information system touch upon IT infrastructure that affects other work systems.

Development

The development phase is the process of specifying and creating or obtaining the tools, documentation, procedures, facilities, and other physical and informational resources needed before the desired changes can be implemented in the organization. This phase includes deciding how the work system will operate and specifying which parts of the work will and will not be computerized.

Most development projects involve changes related to software. Those changes may be accomplished through various combinations of programming new software, acquiring commercial software from software vendors, and developing prototypes that help in refining requirements. If new software is to be programmed, the development phase may include producing detailed specifications of how the software will operate and what the software users will see. If commercial software is to be used, that software must be configured for the current situation. In some cases additional programming will be required. Alternatively, if an iterative prototyping approach is used, representatives of work system participants will evaluate a series of prototypes to define the required functionality. In any of these cases, the IT staff will create and/or acquire the software, and will configure the software so that it operates properly and satisfies the requirements. Any new hardware will be acquired and installed, and the entire technical system of hardware and software will be tested.

Key issues in this phase revolve around creating or obtaining all required resources in a cost-effective manner and, if necessary, demonstrating that tools and procedures actually meet the requirements. Whether the work system will absorb or reject the desired changes is determined by the next phase.

The development phase for a work system involves much more than building software.

Completion of development does not mean "the system works." Rather, it only means that the tools, documentation, and procedural specifications have been produced, and that computerized parts of the work system operate consistent with those specifications. Whether or not the computerized parts of the work system operate adequately will be determined by how the entire work system operates in the organization.

Business and IT responsibilities. Inclusion of changes in the information system requires several sets of activities in the development phase. One set of activities is aimed at designing and codifying the work practice changes that will be implemented in the organization. Business professionals are largely responsible for these activities even though systems analysts who work in the IT group may be heavily involved. Another set of activities is aimed at improving the hardware and software in the information system. These changes are designed to support the desired work practices. Therefore the redesign of work practices must be completed before the information system changes can be specified in detail (unless successive prototypes are used).

Business professionals should be responsible for assuring that the IT professionals understand how work practices will change. They also should define or approve the user's view of the hardware, software, and user interface. Based on these specifications, the IT professionals will do the technical work of acquiring and installing any new hardware; acquiring, creating, or modifying software; and testing and documenting the hardware and software. If at all possible, business professionals should be involved in testing hardware and software features that users will see.

Four development models for information systems. The development phase for the information system can be handled in a number of very different ways that were mentioned in the previous paragraphs. It is useful to say a bit more about four idealized models of the development phase for information systems. Entire books have been written on each of these.

- ***Structured software development.*** The IT staff designs, programs, and tests the information system modifications based on detailed specifications created within the development phase. The work of the IT staff in the development phase is controlled by producing a sequence of deliverables that must be reviewed and signed off. The first deliverable is an external specification that explains exactly what screens and reports will look like to the user. This deliverable is produced through collaboration between business representatives and the IT staff. Next is an internal specification that provides a technical blueprint for the information system's internal structure. These deliverables provide detailed guidance for producing software and documentation. The software and documentation are produced and debugged. The final step is to test the system of hardware and software to make sure that it satisfies the requirements.
- ***Prototyping.*** Working in close cooperation with representatives of work system participants, programmers use a trial and error method to figure out how the information system should operate. They do this by creating, evaluating, and improving successive versions of a working model of the information system. When the prototyping effort has yielded the required insights, the prototype may be adopted for use, or the process may switch to structured software development based on the knowledge gained by prototyping. **Agile development** methods and various forms of **extreme programming**[52] are designed to obtain rapid feedback about a succession of prototypes or other partial versions of the information system.
- ***Commercial application package.*** Purchasing an application package from an outside vendor is the most common approach for acquiring software. This type of software is built to support a specific set of business processes, such as billing customers, accepting customer orders, or keeping track of inventory. Commercial application software has significant advantages and disadvantages. Purchasing vendor software saves a huge amount of time and may provide higher quality software than could be produced by the firm's IT group. On the other hand, the commercial software was developed to support work systems at other firms, and the business process models built into that software may not be a good fit for the needs that launched this project. It may be necessary to change work systems to fit the software rather than producing software to fit work system needs.
- ***End-user development.*** It may be possible to bypass programmers if an information system is to be very simple, and if end-users are willing and able to develop it using spreadsheets and simple database software. This approach is effective only when the situation is simple enough that the information system can be designed, programmed, and tested without the help of an IT professional. Even in these situations, the risk of mistakes is relatively high because non-IT professionals know little or nothing about how to debug and maintain software.

A key goal in the development phase is assuring that information system features genuinely solve problems that managers and work system participants want solved. This is sometimes difficult because work system participants may be unable to describe exactly how a new or modified information system should help them. They also may not see that a new information system could help them in some ways but might become a hindrance in other ways.

Another key goal is to perform the technical work in a way that makes it easier to modify the information system as new needs arise in the future.

Freezing requirements. IT professionals often face the challenge of trying to keep projects under control even though business needs change. To retain their own sanity and to make information system projects manageable, they often call for freezing software requirements so that they can do their work without aiming at a shifting target. Freezing requirements makes it possible to manage the project, but leaves the possibility that the information system that is developed will not meet the business needs that exist when it is implemented. In extreme cases, meeting the schedule becomes more important to developers than providing what their customers need. A common compromise is to attempt small, easily managed projects whose short-term deliverables can be produced quickly. This approach reduces the risk of wasting tremendous effort in a large project that builds the wrong information system.

All too often, business requirements change long after a project is underway.

Business professionals whose main exposure to computers involves spreadsheets and word processing often wonder why it takes IT professionals so long to produce what may seem like minor changes in an information system. They sometimes fail to realize that personal work creating spreadsheet calculations is quite different from development or maintenance of an information system designed for use over an extended period by an organization. Their personal work on spreadsheets involves calculations they control completely and may not need to explain to anyone else. A week or month later it may not matter if they cannot remember the precise logic of those calculations. In contrast, IT professionals building or maintaining software need to make the results of their work understandable to users and IT staff members months or years in the future.

As was mentioned earlier, completion of the development phase for the information system does not mean that a work system project is a success. Rather, it only means that the computerized parts of the work system operate on a computer. Whether or not the work system changes are successful will be determined later based on the implementation in the organization.

Implementation

The implementation phase is the process of making the desired changes operational in the organization. Implementation activities include planning the rollout, training work system participants, converting to the new work methods, and following-up to ensure the entire work system operates as it should. Ideally, the bulk of the work in this phase should occur after development is complete, implying that all tools and procedures are ready and that all software has been tested and operates correctly on the computer. The implementation phase ends when the updated work system operates effectively in the organization.

Conversion to the new system. Detailed planning for the conversion from the old way of doing things to the new is an important step in the implementation phase. The actual conversion to the new work system occurs after work system participants are trained. Conversion to the new system usually raises issues about how to move to different work practices with minimum disruption and how to deal with political questions and changes in power relationships. If a work system's development phase created or modified an information system, some parts of the conversion involve the changeover to the new or modified information system. Other parts of the conversion may involve changes in practices that are unrelated to the information system. When the conversion affects information and methods used for transaction processing, there may be some risk that the new work system will encounter unforeseen problems that jeopardize or prevent its successful operation. To minimize the risk of disrupting business operations, it is often necessary to perform the transaction work twice, once using the old work system and once using the new work system. With this approach, the old system will remain available as a fallback if the new system fails. Unfortunately, operating two systems in parallel often places

substantial stress on the organization, which may already be overworked.

Importance of Change Management

Across the four phases, the success of planned changes is determined partially by the details of the changes and partially by perceptions of the development and implementation processes. It is possible for a work system change to fail organizationally even though a software change succeeded technically.

Overcoming inertia. The likelihood of success drops if the implementation effort cannot overcome the inertia of current work practices or if the implementation itself causes resistance. Involvement and commitment by participants and their managers based on benefits they will receive is often important for overcoming social inertia. Low levels of involvement and commitment make it more likely that the system will never reach its full potential or will fail altogether. If commitment is low, software that has been implemented somewhat successfully may be used for a while and then gradually abandoned, eventually making it seem that the project never happened. Unless a business problem is both evident and painful, overcoming inertia may absorb more time and energy than the computer-related parts of system development. A passage from Machiavelli's *The Prince*, written in 1513, is often cited in conjunction with system implementation: "It must be remembered that there is nothing more difficult to plan, more doubtful of success, nor more dangerous to manage than the creation of a new system. For the initiator has the enmity of the old institution and merely lukewarm defenders in those who would gain by the new ones."[53]

Resistance to change. Even with Herculean efforts to make the implementation successful, many systems encounter significant resistance from participants and outside stakeholders. This resistance may be motivated by a desire to help the organization, such as when someone believes a system change is a step backwards. Resistance may also have selfish or vindictive motives, such as when someone believes the new system will undermine personal ambitions or improve the prospects of personal rivals.

Resistance to change may take many different forms. Overt forms range from public debate about the merits of the system to outright sabotage through submission of incorrect information or other forms of conscious misuse. Between the extremes of public debate and sabotage are many less overt forms of resistance. A person resisting a system through *benign neglect* says nothing against it but takes no positive action to improve its chances of success. Resistance through *resource diversion* involves saying nothing against the system but diverting to other projects the resources it needs. Resistance through *inappropriate staffing* involves assigning people to the project who lack the background and authority to do a good job. Resistance through *problem expansion* involves trying to delay and confuse the project effort by claiming that other departments need to be included in the analysis because the system addresses problems related to their work.[54]

Many books and articles have been written about change management because it is a significant and complex topic. Although different authors use different terms, discussions of change management typically include the following components:

Vision. A planned change that will have significant consequences requires a clear vision that can be explained convincingly. There is an important distinction between a vision and a **slogan**. A charismatic leader might be able to deliver slogans such as "work smarter" or "just do it," but a vision with lasting impact needs to have enough depth that people can visualize how it will affect them, their colleagues, and the larger organization.

Planning. Change does not occur by wishful thinking. Major changes usually require careful planning related to roles and resources. A variety of roles are sometimes lumped under the general heading of **change agent**, a person who promotes change in an organization. A more detailed look at change agents often identifies a variety of roles, including executive sponsor, project manager, trainer, and manager or supervisor of people whose work practices are to be changed. The primary resources needed for most change are the time and energy of change agents and of work system participants. There is a common tendency to underestimate how much time and energy will be required for even relatively small changes that involve a large number of people.

Project success depends on many non-technical factors such as change management and effective collaboration between business and IT professionals.

Leadership. Executive sponsors and line managers who explain the vision and plan perform the most visible leadership roles, but leadership in successful change is often shared by change agents and work system participants themselves. The leadership from work system participants occurs in discussions with colleagues about the advantages and disadvantages of the proposed changes, and in honest feedback about important issues that might otherwise be repressed or ignored.

Communication. In change projects, communication is such a major success factor that "communication, communication, communication" is almost a mantra for change agents. Effective communication covers the project's rationale, its specifics, and its likely impacts on work system participants and others in the organization. Effective communication is a two-way street. People need to know what is coming, but they also need to express objections, confusions, and other concerns. That type of feedback is essential for assuring that implementation issues are identified and managed.

Training. Many change projects require carefully executed training on the details of new procedures, new information, and new computer interfaces. Ineffective training often results in confusion and errors during the conversion from the existing work system to the new work system. These problems absorb time and energy and can raise doubts about whether the work system changes make sense and will be successful.

Measurement. As with any project, the progress of change projects should be monitored and measured. Planned activities such as training sessions should be monitored for timeliness and effectiveness. The monitoring should include qualitative indicators and key incident reporting about how well the project and the change are being accepted by work system participants and other stakeholders.

Perseverance. Changing the way people work requires perseverance. Apparent completion of the implementation phase may not guarantee that the intended changes will survive over time. Work system participants may revert to the previous way of doing their work if the rationale and details of new processes seem questionable. Therefore change management efforts should include ongoing monitoring and feedback about whether the desired changes have actually occurred, whether there are problems, and what is being done about those problems.

Collaborating throughout the WSLC

By focusing on work system issues rather than IT issues, both the Work System Framework and the work system life cycle (WSLC) model can serve as a common basis of communication that can support collaboration between business and IT professionals. Figures 7.2 through 7.5 summarize areas in which the WSLC can be used to support these collaborations.

Keeping the big picture in view. Figure 7.2 summarizes the activities in each phase of the WSLC. Effective collaboration between business and IT requires a shared vision of how current projects are related to the on-going life cycle of particular work systems. This shared vision is the basis of informed agreements about planned activities, milestones, key deliverables, willingness to incorporate unanticipated adaptations, and criteria for progressing to the next step or reworking a previous step. Key questions raised by Figure 7.2 include:

- Do we agree about which work system is being improved and why?
- Where are we in the life cycle of this work system?
- Are we able to move forward or should we to go back to rework prior assumptions and deliverables?
- What is our stance about unanticipated adaptations and opportunities for the work system, for the information systems that support it, and for projects attempting to improve both systems?

Agreeing about roles and responsibilities. Figure 7.3 represents a typical division of responsibilities between business and IT professionals. It shows that business professionals have important roles and responsibilities in each phase of the work system life cycle. Effective collaboration across a work system's life cycle requires clarification of those roles and responsibilities, especially since the IT group typically has no authority to manage or enforce changes in work practices in other departments.

Agreeing on performance indicators. Each phase in a work system life cycle should be monitored and measured. Figure 7.4 presents typical performance indicators that are often relevant within each phase. The performance indicators for the operation and maintenance phase are typical performance indicators for work systems in operation, such as efficiency, consistency, and speed. Those same indicators also apply to the initiation, development, and implementation phases because each is a work system on its own right. Figure 7.4 is designed to emphasize that a work system and an information system that supports it may have some indicators in common and others that are different. This is why the performance indicators for initiation, development, and implementation are grouped under the headings of general indicators, indicators for work systems, and indicators for information systems.

Avoiding common pitfalls. The sheer complexity of IT-related projects brings many unavoidable difficulties, but many pitfalls and risks in the work system life cycle can be named, discussed, and minimized. Figure 7.5 names a number of common pitfalls.

The ideas presented in these Figures can be used at different levels of detail. Just the names of the phases and the forward and backward arrows between the phases clarify the nature of the work system life cycle. The backward arrows emphasize that ineffective or incomplete work in one phase usually requires rework, regardless of what the schedule might say. Recognizing the range of activities within the four main phases can help business professionals appreciate why they have responsibilities in each phase, why producing or upgrading software is only part of the battle, and why no one should declare victory until the work system changes have been implemented and the work system is meeting its operational goals. Furthermore, identification of the many business and shared roles within those phases can help business professionals understand their responsibilities in projects related to IT-reliant work systems. At a more strategic level, CIOs and other IT executives can use this model to explain the overall role and function of an IT organization in both continuous and discontinuous change. They can also use it to negotiate about coordinating and sharing responsibilities throughout the work system life cycle.

Figure 7.2. Activities in each phase of the work system life cycle

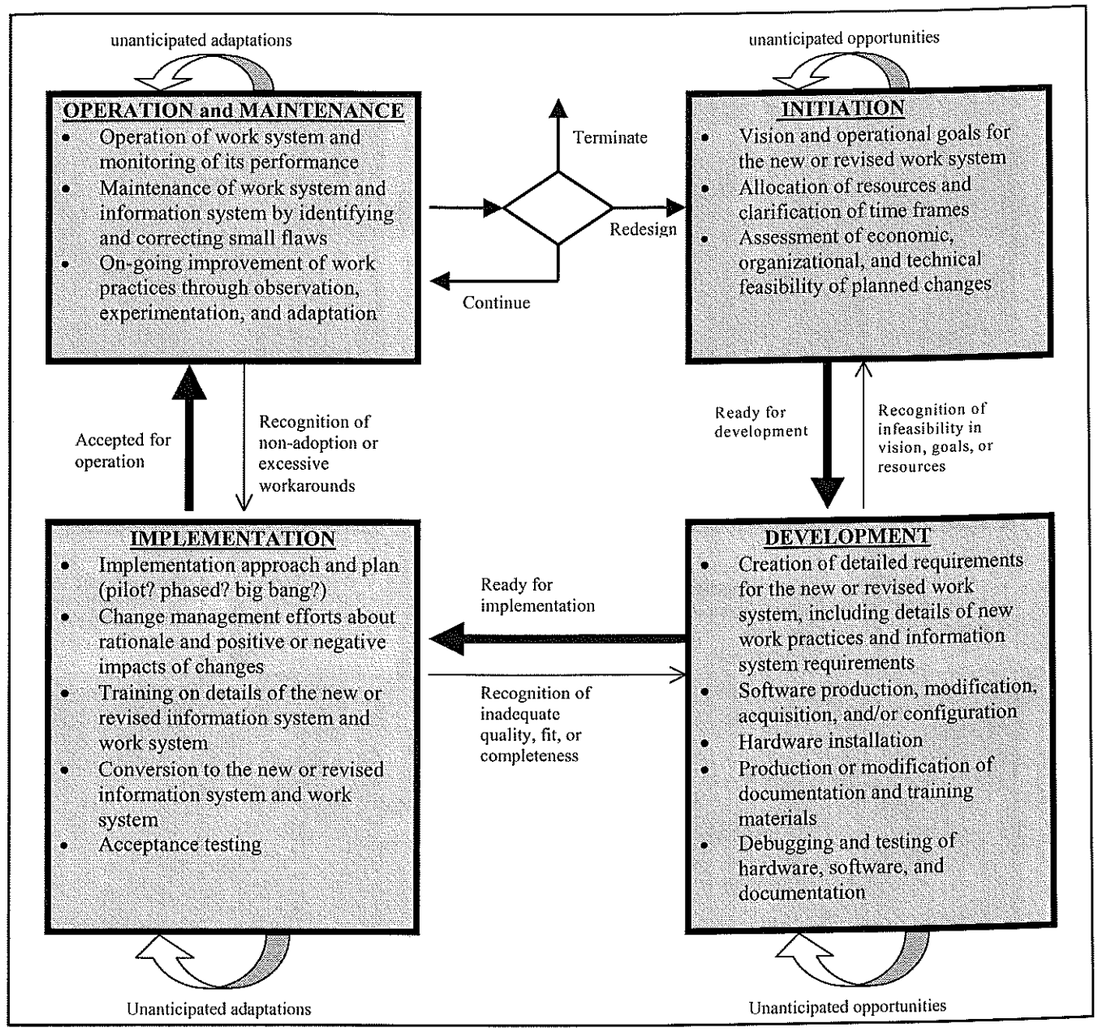


Figure 7.3. Typical responsibilities across the work system life cycle

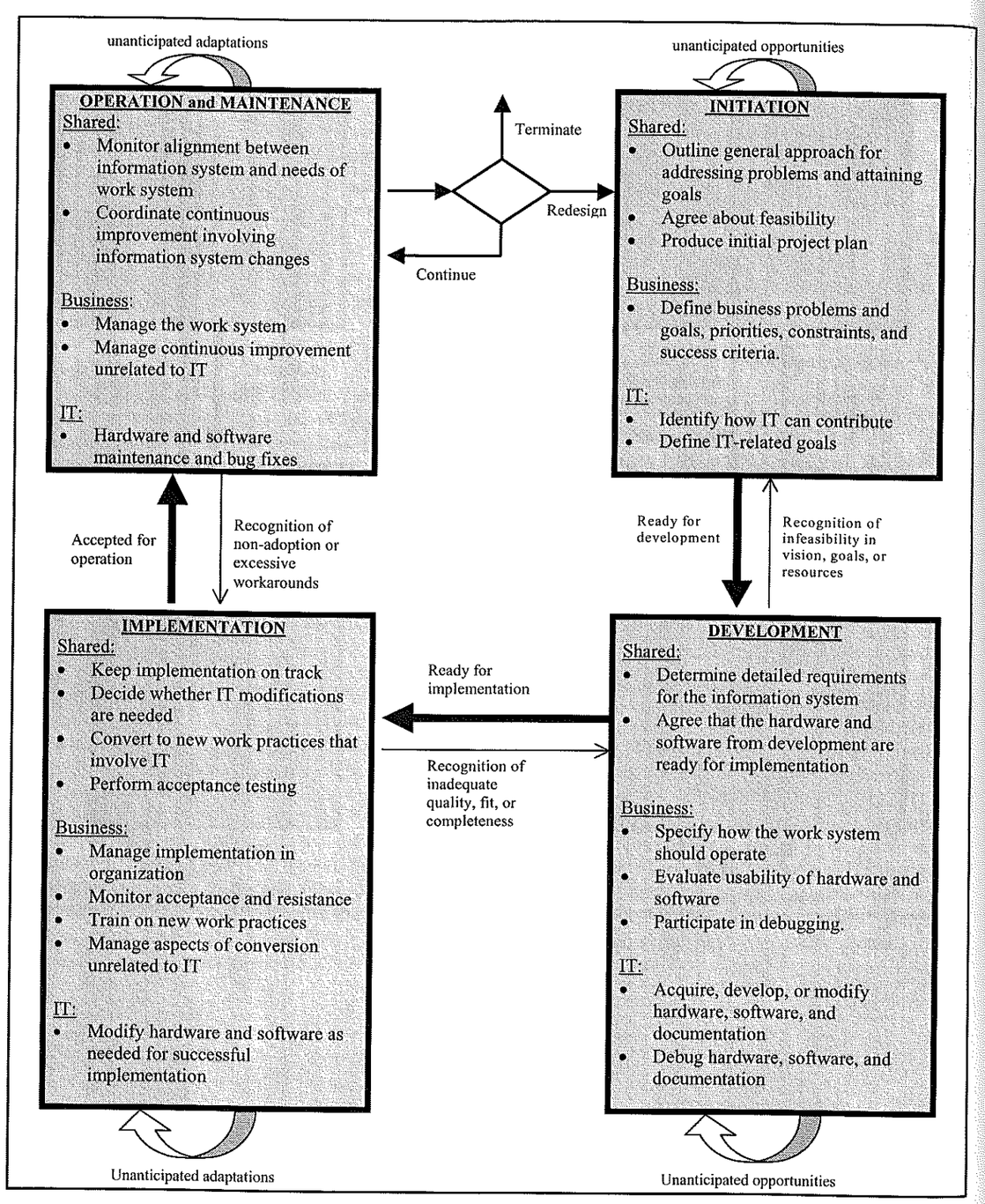


Figure 7.4. Performance indicators across the work system life cycle

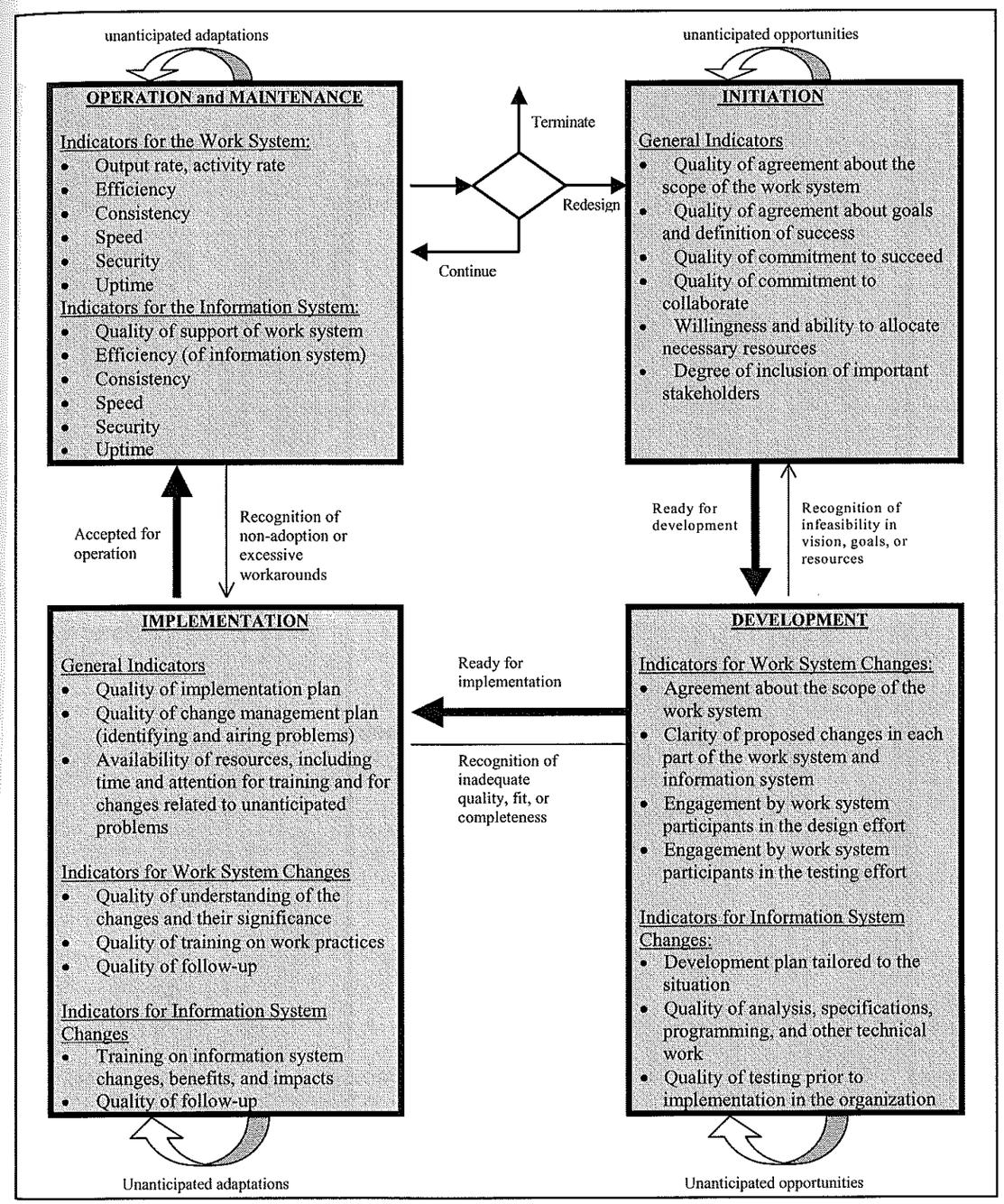
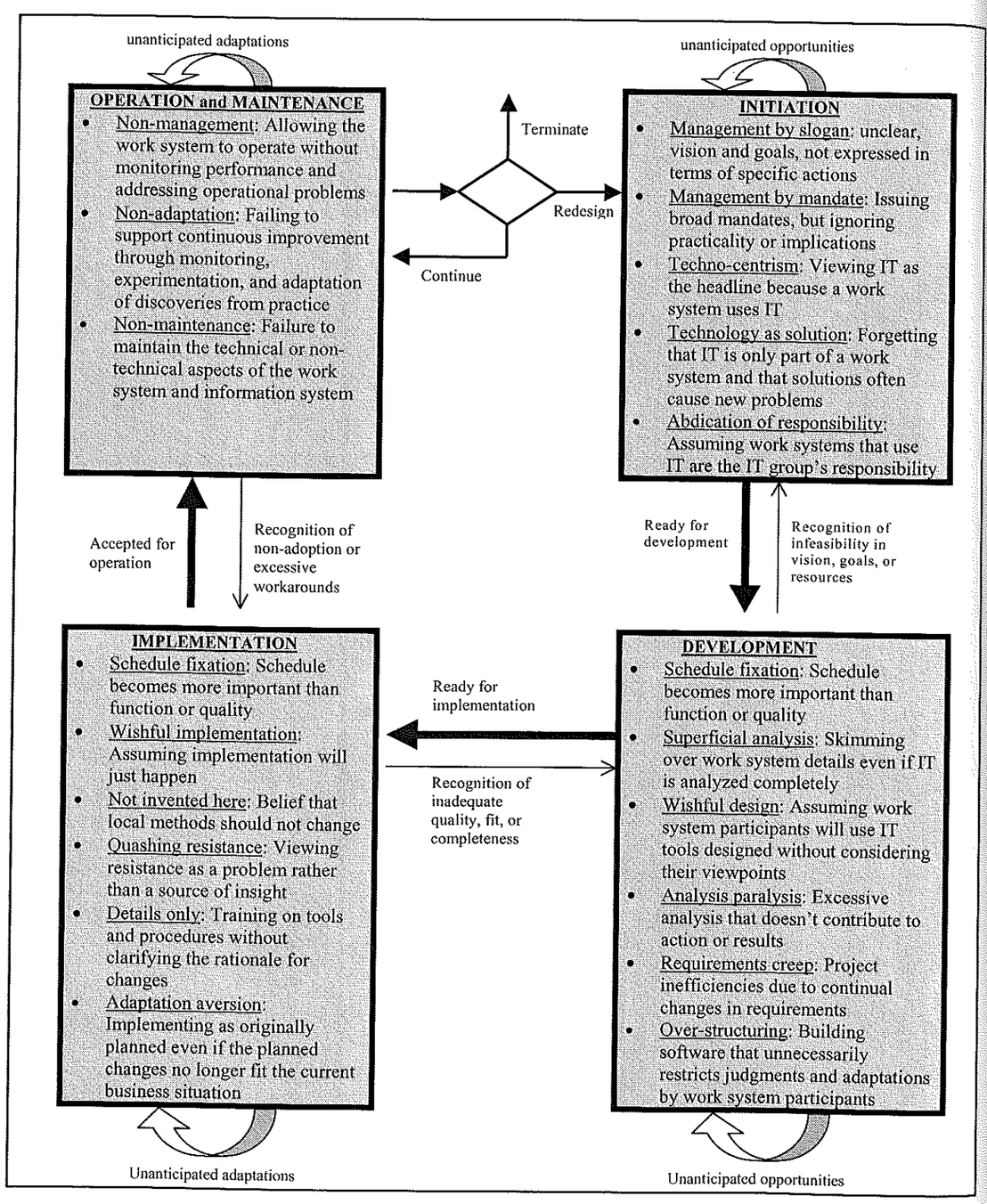


Figure 7.5. Common pitfalls across the work system life cycle



Chapter 8: Example Illustrating the Work System Method

Part I of this book consisted of Chapters 1-7, which introduced the basic ideas about work systems and the work system method. Part II goes into more depth with explanations and examples related to topics that have been summarized thus far but not explained fully.

This chapter presents an example that helps in visualizing how the work system method is applied. It also helps in recognizing the relevance of topics explained in Chapters 9-14, which are organized around work system elements. Three of those chapters are about specific elements (work practices, participants, and information) and three combine two elements (customers and products & services; technology and infrastructure; environment and strategies). Sections within those chapters provide brief discussions of components of each element, evaluation criteria, strategies, tradeoffs, and other topics. Many of those topics appear in the Level Three checklists mentioned in Chapters 3 and 5. Chapter 15 shows how the work system approach helps in identifying omissions from system- and IT-success stories and in interpreting jargon related to IT and systems. The Appendix shows how the example presented in this chapter might appear in a multi-level work system questionnaire.

The example. This chapter's example concerns a loan approval system in a large bank. It was constructed to illustrate the importance of many diverse issues that will be discussed in Chapters 9 through 14. To accomplish this goal, it combines material from a bank management textbook[55] and various aspects of case studies of repetitive decision making involving financial risk. No proprietary information is included, and all values of metrics are fabricated. Some of the issues are about IT, but others are about other aspects of work systems. The description of the situation looks at each work system element, starting with customers, products and services, and work practices.

IMPORTANT: This example was constructed to show the potential significance of a wide range of topics and issues, perhaps more than a typical real world situation would include. You may question the rationale for some aspects of the current situation, and you may or may not agree with the recommendations in the Appendix. That type of questioning is exactly what business and IT professionals need to do when they collaborate to create or improve work systems. The example illustrates the type of analysis and level of detail that would just be a starting point for producing a carefully designed and well-justified replacement for a current work system.

First-cut answers, not completed documentation. Following a brief introduction to the situation, the loan approval example is presented as a set of first cut answers to the Level Two questions identified in Chapter 3. Shown next to the answers are possible questions from a manager reviewing the incomplete analysis that has been done thus far. The goal here is not to show what a completed report would look like, but rather, to show how the initial analysis would raise new questions and would probably demonstrate the need for further clarifications.

Answers to the five SP questions for identifying the system and problem are followed by answers to