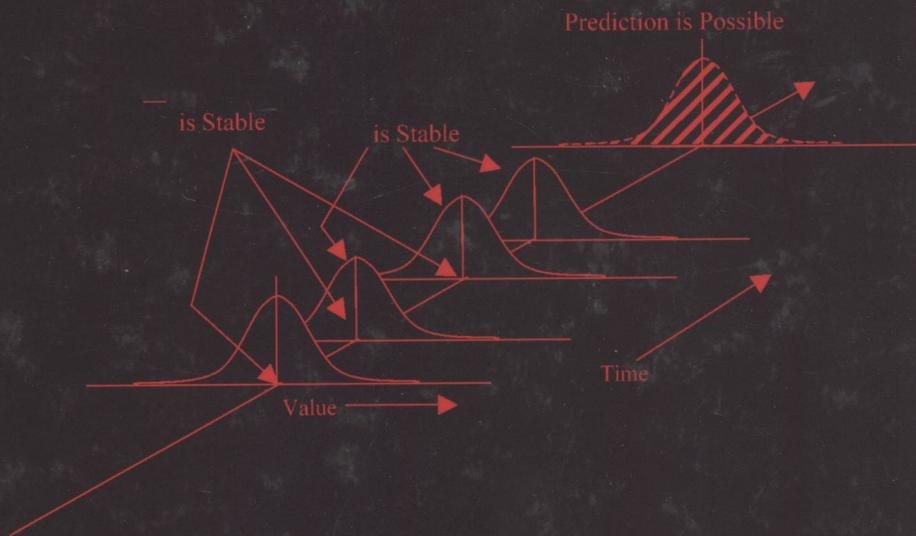


INDUSTRIAL PROJECT MANAGEMENT

Concepts, Tools, and Techniques



ADEDEJI BADIRU
ABIDEMI BADIRU
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Dedication

*Dedicated to the memory of Omolade Badiru
The bud that never got to bloom, but whose spirit lives on*

Preface

Industry represents the pulse of economic development of any nation. Successful industrial project management thus holds a key position in advancing regional and national development. Project management is the process of managing, allocating, and timing resources to achieve a given goal in an efficient and expeditious manner. The objectives that constitute the specified goal may be in terms of time, costs, or technical results. Projects can range from the very simple to the very complex. Owing to its expanding utility and relevance, project management has emerged as a separate body of knowledge that is embraced by various disciplines ranging from engineering and business to social services. Project management techniques are widely used in many endeavors, including construction management, banking, manufacturing, engineering management, marketing, health care delivery systems, transportation, research and development, defense, and public services. The application of project management is particularly of high value in industrial enterprises. In today's fast-changing and highly competitive global market, every industrial enterprise is constantly striving to get ahead. Integrative project management offers one avenue to achieve that goal.

Project management represents an excellent basis for integrating various management techniques such as statistics, operations research, Six Sigma, computer simulation, and so on. The purpose of this book is to present an integrated approach to project management for industrial applications. The integrated approach covers the concepts, tools, and techniques (both new and tested) of project management. The elements of the project management body of knowledge provide a unifying platform for the topics covered in the book. The book also contains a project-oriented chapter on Lean Six Sigma. The chapters of the book are

- Chapter 1: Characteristics of Industrial Projects
- Chapter 2: Principles of Project Management
- Chapter 3: Time and Schedule Management
- Chapter 4: Project Duration Diagnostics
- Chapter 5: Schedule Compression Techniques
- Chapter 6: Resource Analysis and Management
- Chapter 7: Techniques for Project Forecasting
- Chapter 8: Six Sigma and Lean Project Management
- Chapter 9: Project Risk Analysis
- Chapter 10: Project Economic Analysis
- Chapter 11: Industrial Project Management Case Studies

Appendix A of the book presents project terms and definitions, and Appendix B presents project acronyms. The premise of the book is that both simple and complex industrial projects can be managed better if an integrated approach is utilized. The integrated approach in the book covers managerial principles and analytical techniques. The book presents tools and techniques for mitigating the adverse effects of the typical constraints of time, cost, and performance in any project.

This book is intended to serve as a reference for project planners, designers, and managers; as a guidebook for industrial consultants; as a textbook resource for students and teachers; as a supplementary reading for practicing engineers; and as a handbook for project operators. It will appeal a great deal to practitioners and consultants because of its practical orientation.

Adedeji Badiru

Abi Badiru

Ade Badiru

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Abi Badiru: I extend my thanks to my extended circle of friends from different parts of the world. I extend appreciation to my present and former colleagues from Kraft Foods and ConAgra Foods.

Ade Badiru: Many thanks and love to my wife, Deanna Badiru, whose continual love and support inspire me in all my professional endeavors.

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1 Characteristics of Industrial Projects

IMPORTANCE OF INDUSTRIAL PROJECTS

Industry represents the pulse of economic development of any nation. The goods and services provided by industry directly influence the social, political, economic, and cultural structures of any population. Thus, successful industrial project management holds a key position in advancing local, regional, and national development. A community that cannot institute and sustain industrial vitality will eventually become politically delinquent and economically retarded. Project management is the process of managing, allocating, and timing resources to achieve a given goal in an efficient and expeditious manner. The intrinsic benefits of this definition are even more pronounced in fast-paced and globally influenced industrial projects.

TIME-COST-RESULT GOALS OF INDUSTRY

The objectives that constitute industrial project goals may be in terms of time, costs, or technical results. Projects can range from the very simple to the very complex. Owing to its expanding utility and relevance, project management has emerged as a separate body of knowledge that is embraced by various disciplines ranging from engineering and business to social services. Project management techniques are widely used in many endeavors, including construction management, banking, manufacturing, engineering management, marketing, health care delivery systems, transportation, research and development, defense, and public services. The application of project management is particularly of high value in industrial enterprises. In today's fast-changing and highly competitive global market, every industrial enterprise is constantly striving to get ahead. Integrative project management offers one avenue to achieve that goal.

LASTING LEGACY OF PROJECT MANAGEMENT

Project management has had more direct impacts on human development than any other single discipline of study in the history of the world. From the time of ancient history and Mesopotamia's early development to the modern times, acts of project management have brought to bear on human accomplishments. Early examples include the construction of Stonehenge in England, the erection of the Pyramids, and the development of the notable Wonders of the World. The ancient projects using gears and pulleys required extreme preparation, labor coordination, and cooperation. Although there was no formal discipline of project management in those ancient times, the processes of planning, organizing, scheduling, and control, no doubt, were

used in accomplishing those feats. In spite of its long-standing benefits, it was only in the past few years that project management has emerged as a formal discipline; and it is now being globally recognized. The Project Management Institute has an envisioned goal that states, “Worldwide, organizations will embrace, value, and utilize project management and attribute their success to it.” This vision is already being broadly realized. This is evidenced by the rapid growth in project management professional memberships around the world. Interest in the discipline is growing rapidly around the world—in Europe, Asia, North America, South America, the Far East, the Caribbean, Africa, and so on. There is no single country that can claim not to be touched daily by the impact of project management processes.

ELEMENTS OF INDUSTRIAL OPERATIONS

Industrial development is one primary path to achieving national economic development. So, industry is very vital to the development of any nation. Historical accounts abound on how the industrial revolution had a profound effect on world development. A sustainable industrial development can positively impact the political, economic, cultural, and social balance in a community. In order to achieve and sustain industrial development, both the technical and managerial aspects of industrial projects must come into play. This book focuses on the integration of managerial approaches and analytical techniques to improve the planning, scheduling, and execution of industrial projects.

The primary goal of any industry is to plan operations ahead and allocate resources appropriately to improve industrial project efficiency, effectiveness, and productivity while reducing production waste (Lean) and improving product quality (Six Sigma). Using a formal project management approach makes it possible to achieve this goal. For projects to be effectively managed in an industrial system, managers and analysts must understand the industrial operating environment. Any high-tech industrial project is a complex undertaking that crosses diverse areas of endeavors. Both technical and organizational issues must be addressed in order to avoid system-wide project failures. This chapter covers the building blocks essential for the application of project management to industrial operations. The contents of this and the subsequent chapters will enable the project analyst to accomplish the following learning objectives:

- Understand the basic steps and components of project management.
- Learn best-practices approach to project planning, organizing, scheduling, and control.
- Use case examples as the basis for understanding “what went wrong” and how develop sustainable project solutions.
- Learn how to develop project scope and develop a project charter.
- Using planning as the roadmap toward project success.
- Create cohesive project teams using the Triple C model of communication, cooperation, and coordination.
- Develop project work breakdown structure.
- Use a mix of qualitative and quantitative techniques to enhance project management.

- Develop compromise or tradeoff strategies for cost, schedule, and performance constraints.

Manufacturing is the process of creating a product by processing raw materials from an initial point through to the end product. It encompasses several functions that must be strategically planned, organized, scheduled, controlled, and terminated. A manufacturing cycle includes such functions as forecasting, inventory control, process planning, machine sequencing, quality control, decision analysis, production planning, cost analysis, process control, facility layout, work analysis, and a host of others. All of these are functions that fall within the process of planning, organizing, scheduling, and control cycles of project management. Industrial projects can be characterized by a combination of the following attributes:

- Large external stakeholders, customers, owners
- Internal stakeholders
- Short product life cycle (in high-tech industries)
- Variable investment sources
- Narrow margins for success.

As with all projects, industrial projects are subject to three basic constraints of time, cost, and performance as illustrated in Figure 1.1. Any other constraint in the project environment will somehow fall under one of these three constraints. Several factors lurk behind the screen of the triple constraints. Issues such as workforce capability, operating tools, and process structure impinge on the project’s ability to be delivered on time, within budget, and in line with performance expectations.

Industrial operations are predicated on strategic operations, which utilize high-tech tools, knowledge workers, and complex processes. Consequently, project management in an industrial operation implies the management of people, process, and technology, as shown in Figure 1.2, to satisfy the triple constraints.

While the proliferation of technology in industry has led to a loss of jobs, it has also led to the creation of new types of jobs, and so the coupling of technology and manufacturing has spawned a need for retraining of workers and realignment of functions. Even though high technology is sometimes blamed for stifling creativity and restricting traditional personal workmanship, it has also been credited with fostering *industrial innovation*.

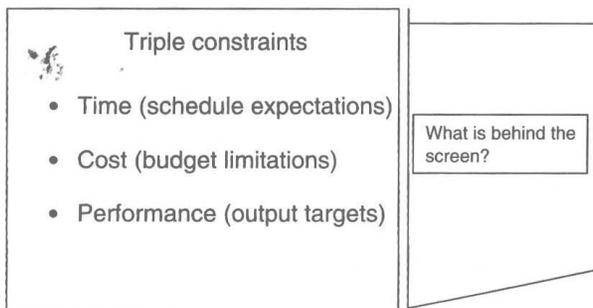


FIGURE 1.1 Triple constraints on projects.

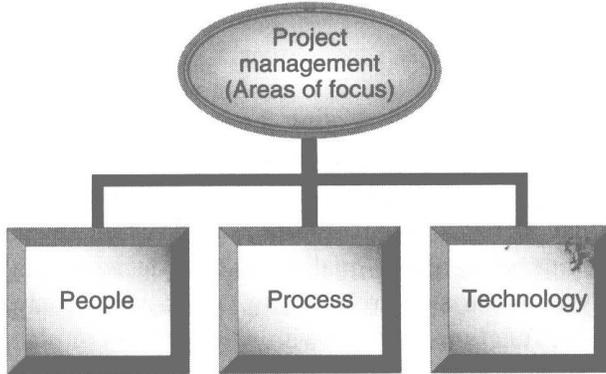
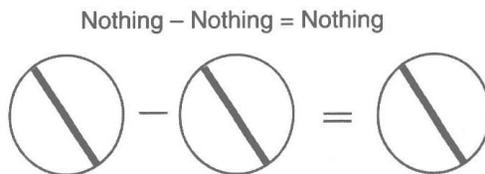


FIGURE 1.2 Focus on people, process, and technology.

This requires new management approaches. Effectively managing industrial technology requires project management skills on the part of management, employees, and clients in order to ensure the successful design, development, production, transfer, introduction, and implementation of various forms of technology to generate products and or services. Innovative applications of new and existing management techniques are needed to address the rapidly changing nature of industrial operations. Project management approaches are at the forefront of such applications.

DEPENDENCY ON HUMAN CAPITAL

In spite of the increasing proliferation of automation in industry, human capital still holds a major role in accomplishing industrial output. Investment in human resource assets should be a primary focus of any organization's project efforts. The success of the Toyota production system is not due to any magical properties of the approach, but rather due to the consistency, persistence, and dedication of the humans who apply the Toyota approach to all their industrial projects. This cannot be achieved without giving something (e.g., operator training, technology tools, and doable process) to obtain desired outputs. Recalling the cliché of "nothing from nothing is nothing," as illustrated graphically in the following figure, industrial organizations should invest in their human capital in order to maximize project output. Figure 1.3 shows the central role of people in the various aspects of an industrial system.



GLOBAL INDUSTRIAL COMPETITION

Many North American manufacturers cannot compete globally on the basis of labor cost, where improvement efforts are often directed. The competitive advantage for

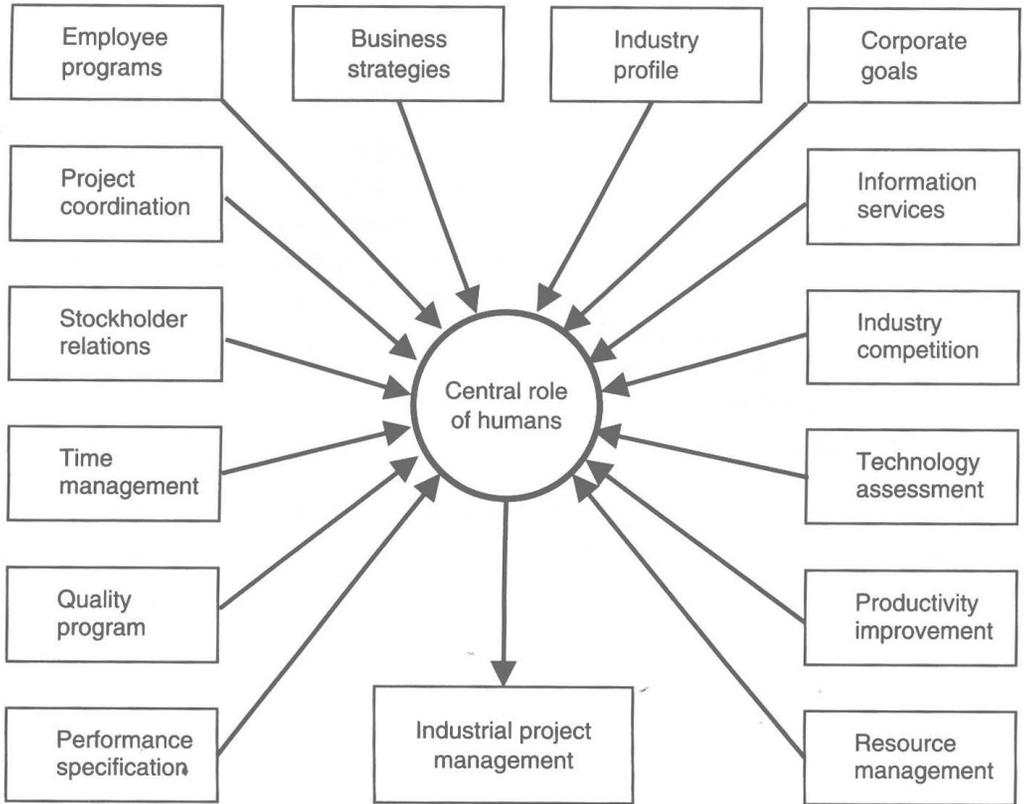


FIGURE 1.3 Role of human decisions in industrial projects.

many manufacturers will come from appropriate infusion of technology into the manufacturing enterprise. Strategic research, development, and implementation of technological innovations will give manufacturers the edge needed to successfully compete globally. In spite of the many decades of lamenting about the future of manufacturing, very little has been accomplished in terms of global competitiveness. Part of the problem is the absence of a unified project management approach. Managing global and distributed production teams requires a fundamental project approach.

One valid industrial proposition is the need to pursue more integrative linkages of technical issues of production and the operational platforms available in industry. Many concepts have been advanced on how to bridge the existing gaps. But what is missing appears to be a pragmatic project-oriented road map that will create a unified goal that adequately, mutually, and concurrently addresses the profit-oriented focus of practitioners in industry and the knowledge-oriented pursuits of researchers in academia. The problems embody both scientific and management issues. Many researchers have not spent adequate time in industry to fully appreciate the operational constraints of industry. Hence, there is often a disconnection between what research dictates and what industry practice requires. An essential need is the development of an industrial project road map. Two aspects that are frequently ignored in industrial project implementations involve human factors and ergonomics parameters of the work environment. A project management approach facilitates an appreciation of this crucial component of industrial projects.

SYSTEM'S VIEW OF INDUSTRIAL PROJECTS

An industrial system is a collection of interrelated elements brought together to achieve a specific objective of meeting product or service goals. In a management context, the purposes of a system are to develop and manage operational procedures and to facilitate an effective decision-making process. A systems approach is particularly essential for contemporary manufacturing because of the various factors that interact. Four of the major desired characteristics of an industrial project system include:

1. Possession of a definite objective
2. Ability to interact with the environment
3. Ability to self-regulate
4. Ability to carry out self-adjustment.

The various elements (or subsystems) of a system act concurrently, in a separate but interrelated fashion, to achieve the common goal. This synergism helps to expedite the decision process and to enhance the effectiveness of decisions. The supporting commitments from other subsystems of the organization serve to counterbalance the weaknesses of a given subsystem. Thus, the overall effectiveness of the system will be greater than the sum of the individual efforts of the subsystems. The increasing complexity and globalization of industrial operations make the systems approach essential. The classic approach to the decision-making process follows rigid lines of organizational charts. By contrast, the systems approach considers all the information interactions necessary between the various elements of an organization. The industrial system has shifted considerably over the past decades as illustrated in Figure 1.4. The primary focus in the 1960s was on industrial efficiency. Today, we are concerned not only with globality, but also with nanoscale industrial production; and cyber-space consciousness is already making dominant inroads into every level of project operations.

Industrial Project System Integration

Any project can be viewed as a system of operations and activities. There are several major steps for successfully initiating, implementing, and managing a project system. Some of the steps are summarized as follows:

1. *Definition of Problem*: Define the problem using keywords that signify the importance of the problem to the overall organization. Prepare and announce the project scope and plan.
2. *Assignment of Personnel*: The project group and the respective tasks and responsibilities should be explicitly established.
3. *Initiation of the Project*: Arrange organizational meetings and project kickoff, during which a general approach to the project is announced.
4. *Development of System Prototype*: If applicable, develop a prototype system, test it, and learn more about the problem from the test results.