Introduction

PURPOSE, FORMAT, AND CONTENT OF THIS BOOK

Many organizations have used geographic information system (GIS) technology effectively for more than 30 years. In fact, the origins of GIS software and data management go back to the late 1960s when crude (by today's standards) grid-based GISs, on mainframe computers, were developed for use in regional applications (land use and natural resources analysis). In the mid and late 1970s, CAD-based computer mapping systems became popular for use by engineering firms and public sector mapping agencies. By the mid-1980s, more robust GIS and automated mapping systems were becoming commonplace in a wide range of government and private sector organizations. See Foresman (1997) and Wellar (2012) for more information about the history of GIS. Because GIS is an interdisciplinary technology with its share of implementation challenges, GIS practitioners of varying professional backgrounds and organizational roles are forced to focus on the technical aspects of design and implementation in order to make it work and serve the needs of an increasingly larger community of users.

GIS has become an accepted information technology tool for a wide range of public-sector organizations and private companies. As GIS has evolved from a tool for discipline specialists to an enterprise technology, organizations find themselves needing to focus more intently on the management and institutional aspects of its deployment—and not just on the bits and bytes. Sound planning and operational management are the keys to successful use of the technology and its ability to deliver value to organizations.

With a lot of help from many GIS professionals, I have written this book to serve as a guide and resource for GIS managers and staff—to help in the planning, implementation, and management of GIS programs and projects. My intention is to provide GIS professionals with a tool to make them more effective, to support organizational improvements, and to deliver increased benefits to GIS user communities. If you are a GIS manager or an aspiring manager, a user, or a student seeking a better perspective on management of GIS, this book will be a valuable resource for you. It conveys the concepts, practices, and techniques that will help you understand the organizational environment of GIS programs and will put you in an effective position to apply and manage the technology. While the primary audience of this book is the practitioner (in all types of organizations), this book is also usable as course book for upper-level undergraduate and graduate degree programs and GIS Certificate programs.

Readers will quickly recognize that this book addresses management issues common not just to GIS but to many different types of information technology (IT) programs and organizations, but that it approaches these common management topics from a GIS perspective and speaks to the specific challenges that GIS managers face. This book will be of value to professionals in all types of organizations that use GIS technology; although many of the examples are taken from public-sector and utility organizations, they apply as well to GIS programs in private companies and non-profit organizations. Regardless of the nature of the organization you serve, you will benefit from this book if you are a current GIS manager or a GIS staff person who is considering moving into a GIS program or project management role.

The topics covered in this book will also make it of interest and value to a wider audience, including the following:

- IT personnel involved in GIS integration, oversight, and coordination of GIS with overall IT programs.
- Senior executives and policymakers who have roles in overseeing, governing, or funding GIS programs or projects.
- Academicians and advanced students with an interest in GIS organizational development and management concepts and practices.
- Members of organizations who provide products and services to GIS users and must understand the "market" and the customers that they support.

You can gain a comprehensive picture of GIS management issues and practices by reading this book in its entirety, but GIS

and IT professionals can also use it effectively as a reference to focus on specific topics to help them respond to challenges and issues they confront on the job. When you face a particular management concern or issue, use this book to help determine a course of action, confirm your ideas, or find references for more detailed examination when necessary. This book will help managers develop and cultivate sound leadership skills and adopt effective management practices that will make a difference in real-world organizational settings.

OVERVIEW OF SECOND EDITION

This is the second edition of this book. It preserves much of the content of the first (2009) edition, but includes some key revisions and updates. The most important changes from the 2009 edition are summarized below:

- Additional research and updated citations of references in all book chapters. Chapter 10 includes a comprehensive and up-to-date bibliography, organized by topic areas, that provides readers with a resource for additional reading and research on GIS and related IT management topics.
- A new section on GIS quality management (in Chapter 3) with information on GIS and IT quality standards and management frameworks and how they relate to GIS programs and projects.
- Augmentation of material in personnel and human resource management in Chapter 4 reflecting new research, changes in staff roles and classification, job satisfaction factors, salary surveys, nature of the workforce, work delegation, and other human resource management topics.
- Significant revision and additions to GIS legal and policy issues and management approach in Chapter 6.
- Information on open-source software and open data.
- Updates and additions, in all chapters, on best practices in GIS management and examples from actual GIS programs. Information from a recent survey of GIS managers is included.
- Major update and expansion of technical management concepts and practices in Chapter 7.
- Restructuring and updates of the book glossary and appendices.
- Inclusion of a collection of "supplemental sources"—digital documents and files that are actual examples, from GIS programs, of practical materials and tools (e.g., GIS Charter). These are cited in the book and will be made available to readers of the book.

This book covers all pertinent topics of GIS management including organizational structure and governance, management practices, GIS program planning and implementation, staffing and human resources management, financial management, legal and policy issues, technical management, and project planning and management. The book is highly orientated to the practical side of GIS program and project management covering the following areas of interest to current or future managers:

- Concepts and terminology relating to GIS management issues and methods.
- GIS management practices and techniques that have contributed to effective programs and projects.
- Practical examples that serve as models to emulate or adapt for their own programs and projects.
- References to books, papers, Web sites, and other sources of information useful to GIS managers.

MAIN CONCEPTS AND OVERVIEW OF CHAPTER CONTENT

This book addresses management of GIS programs and projects. The distinction between programs and projects is important because management concerns and practices apply somewhat differently to program and project environments. The Project Management Institute (PMI), which is the leading professional organization that develops and encourages the use of management standards and practices defines three main terms "project," "program," and "portfolio" as follows:

- Project: "A temporary endeavor undertaken to create a unique product or service."
- Program: "A group of related projects, subsidiary programs, and program activities managed in a coordinated way to obtain benefits and control not available from managing them individually." NOTE: Many GIS managers view this PMI definition as too "project centric" and prefer a modified definition of program as, "an initiative or formal organizational entity providing on-going GIS services that address the business needs of an organization or specific community of users." This latter characterization of "program" is primarily used in this book.
- Portfolio: "A collection of projects or programs and other work that are grouped together to facilitate effective management of that work to meet strategic business objectives. The projects or programs of the portfolio may not necessarily be interdependent or directly related.

For the purposes of this book, all references to "project" will accept the PMI's definition. The operative phrases in that definition are "temporary" and "product or services." Every GIS project should be scheduled to have a start and end and well-defined outcomes. A GIS "program" is established by an organization to support its mission and business needs by maintaining GIS resources (e.g., system infrastructure, software, data, and applications) and providing a range of GIS services for users. The GIS program is responsible for management and execution of projects under its responsibility as well as for ongoing services and support. A GIS program has a defined management and staff and is resourced for sustained operations.

This book is organized into ten chapters that collectively cover all aspects of GIS planning, development, and operational management—the technical aspects, as well as the important areas of human resources, financial management, project and performance tracking, communications, and organizational coordination:

Chapter 1, GIS Management Overview and Context, identifies and defines concepts, terminology, and key issues and provides a context for the discussion of specific program and project management topics in subsequent chapters. Key foundational concepts are introduced including the scope of GIS programs, GIS as a profession, organizational types using GIS, and the value of aligning GIS technology with an organization's business requirements.

Chapter 2, GIS Program Development, addresses the approach for planning and implementing a GIS program. This covers the main phases in GIS program development including situation and requirements evaluation, strategic planning, conceptual design, cost-benefit and business case justification, implementation planning, and the preparation of technical specifications. Useful methodologies and tools to support program assessment and planning are explained.

Chapter 3, GIS Program Organizational Structure, Governance, and Coordination, covers a range of concepts, issues, and practices in GIS program development. It addresses critical topics associated with GIS program management, including organizational structure, formal policies supporting GIS operations, performance and quality management, GIS program communications, and change management. Many examples as well as accepted standards and guidelines are cited and summarized.

Chapter 4, Human Resources Management for GIS Programs, deals with critical aspects of managing people—creating and sustaining a productive workforce for high-quality GIS operations and services. It addresses needs for GIS staff positions and compensation, staff recruitment and hiring, and non-traditional options for staffing. This chapter provides an overview of personnel policies and legal implications, employee morale and satisfaction, approaches for effective work delegation, and employee performance evaluation. There is a passage on professional ethics, management of professional development and training, and suggestions on manager transition and stress management.

Chapter 5, Funding, Financial Management, and Multi-organizational Agreements, covers a comprehensive spectrum of topics related to GIS program finances. This includes a review of program budgeting and the policies and operational procedures for managing procurements of products and services. This chapter includes a detailed discussion of funding sources and strategies for GIS programs and ideas on revenue generation from the sale of GIS products and services. It concludes with a discussion of inter-organizational funding agreements, license fees, and collaborative agreements that support GIS program financing.

Chapter 6, GIS Program Legal and Contract Issues, includes an overview of important legal and policy issues with

a focus on issues impacting geographic information management and distribution. It discusses such areas as public information access laws and exemptions, privacy considerations, liability concerns, copyright protections, records retention requirements, intellectual property, legal aspects of GIS data collection, GIS data and product licensing, and other legal matters.

Chapter 7, Management of GIS Program Technical Elements, gives a comprehensive summary of the main technical management areas of importance to GIS programs. It gives an overview of approaches for managing technical design (system configuration, data, applications) and the development of these technical GIS components. A thorough discussion of commercial and open-source software is presented with discussion of the management concerns associated with GIS software licensing and support. The chapter discusses ongoing technical management and operational concerns, including system administration, database design and maintenance, application development and management, and database administration activities. The chapter concludes with a review of key technology trends influencing GIS and a description of technical standards and their impact on GIS programs and projects.

Chapter 8, GIS Office Operations, Service Delivery, and User Support, contains an overview of critical operational concerns, including workspace design, maintaining a productive work environment, user support management, monitoring user satisfaction, responding to user requests, and a range of routine operational requirements that require the attention of managers.

Chapter 9, GIS Projects and Project Management, covers project management concerns and practices from a GIS project perspective beginning with an overview of project lifecycles (based on practices espoused by the Project Management Institute). It includes a detailed discussion of project planning and estimation, project management structure and roles, project quality management, monitoring and reporting, risk management, practices for resourcing, and project communications. It also gives an overview of the use of project management software to support project planning and execution.

Chapter 10, Guide to Additional Resources for GIS Managers, identifies useful sources of information, including books, white papers, Web-based resources, professional organizations, and other information resources of value to GIS managers. These information sources are indexed topically to help readers find pertinent resources. Chapter 10 also includes a glossary of management terms.