

Guidance for General Managers

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General managers preside over system development projects, system acquisitions, product lines, systems of systems (SoSs), and commercial and government organizations. For general managers, the SEBoK serves as a primary information source and quick, comprehensive reference for systems engineering information.

In particular, the SEBoK helps the general manager understand:

- the boundaries and synergies among systems engineering (SE), systems development, project management (PM), and life cycle support
- how those boundaries and synergies are likely to evolve with increasing use of evolutionary development, lean and agile methods, and systems that provide purchased services as opposed to salable products
- how to best balance a mix of hardware, software, human factors, domain, and specialty-area systems engineers and
- how an organization can evolve to take advantage of the trend towards cross-discipline systems engineers.



Contents

Use of Topics

Vignette: Emerging Nation Satellite System

Vignette: Commercial Safety Equipment Company

Summary

References

Works Cited

Use of Topics

For general managers, most parts of the SEBoK offer immediately relevant knowledge about SE.

Part 1:

- explains the relationship between SE, system development, and project management
- summarizes overall trends in the nature of systems interdependency, complexity, assurance levels, and pace of change
- describes the evolving nature of integrated hardware-software-human systems and
- provides pointers to other parts of the SEBoK of interest to general managers.

Part 3:

- explains evolving system life cycle models and their elements, indicating which elements are SE-intensive (see Life Cycle Models) and
- provides overall guidance on the management of SE activity.

Part 4:

- explains how the SE function varies by class of system product, service, enterprise, and systems of systems engineering).

Part 5:

- explains SE governance and competence development.

Part 6:

- explains how SE relates to software engineering, project management, industrial engineering, procurement and acquisition, and specialty engineering for such specialties as safety, security, maintainability, and usability.

Part 7:

- provides case studies and vignettes to illustrate how the parts have been used in similar situations in successes to emulate and failures to avoid.

Vignette: Emerging Nation Satellite System

Tom Lee is General Manager for Telecommunications in a ministry of a large emerging nation. The government does not have much existing capability for developing capital-intensive infrastructure projects. The government decides to use a major investment in technology as a vehicle to develop national enterprise capabilities.

To accomplish this, the minister assigns Tom to lead a project to develop a national satellite system for telecommunications and earth resources observation. Tom understands that this is a very complex system and decides to do some background research. During this research, Tom discovers the SEBoK and decides that it may be a useful resource.

Tom first reads:

- Part 1 for an overview and pointers to relevant sections of Parts 3 through 6,
- portions of Part 3, Part 4, Part 5, and Part 6 to learn about the life cycle, nature, scope, and management aspects of enterprise SE,
- the successful satellite system case studies in Part 7 (Global Positioning System, Miniature Seeker Technology Integration spacecraft) for approaches to emulate, and
- the satellite system case study in Part 7 which describes development and integration problems (Hubble Space Telescope) for pitfalls to avoid.

Tom continues by carefully reading Part 5. He realizes that he must simultaneously develop individuals, teams, and the enterprise. The knowledge areas (KAs) from Part 5 give useful background. For this project, Tom enlists both a proven multi-national satellite SE company and some of his brightest aerospace systems engineers. Tom expects his local systems engineers to learn from the SE company, and he plans to use them as the core group of the national satellite system as it ultimately develops and operates.

He realizes that correct problem definition and requirements setting will be critical first steps. He carefully reads the System Concept Definition KA. As his team develops the stakeholder needs and the system requirements, he makes sure they follow good practices as listed in the SEBoK. Once architectural designs have been proposed and approved, he requires his team to perform cost-benefit tradeoff analyses of alternative solutions.

Thus prepared, Tom is confident that he can formulate and execute a successful approach.

Vignette: Commercial Safety Equipment Company

Maria Moreno is General Manager at Safety First Equipment Company, specialists in hardware-intensive safety equipment. Maria's background is in electromechanical systems. Safety First is highly successful but beginning to lose market share to competitors who offer software-intensive capabilities and user amenities.

Maria is preparing an initiative to make Safety First into a leading software-intensive safety equipment provider. She decides to make the SEBoK a primary resource for gathering concepts and insights for the initiative. She begins by skimming through all of Parts 1 through 6, both to become familiar with the SEBoK itself and to start organizing her thoughts on SE.

Now Maria is ready to focus on subjects of prime importance to her task. Here are those subjects, listed with the places in the SEBoK where she finds information about them.

In Systems Engineering and Software Engineering in Part 6:

- the nature of software,
- differences between hardware and software architectures and practices and
- key aspects of managing software teams.

In the article Human Systems Integration in the Systems Engineering and Quality Attributes knowledge area, also in Part 6:

- the SE of user amenities.

In the Next Generation Medical Infusion Pump Case Study in Part 7:

- the software aspects of safety practices, such as software fault tree analysis and failure modes and effects analysis and
- overall approaches for concurrent engineering of the hardware, software, and human factors aspects of safety-critical equipment.

In the Medical Radiation Case Study in Part 7:

- hardware-software pitfalls to avoid in safety-critical equipment.

Maria chose the last two items from among the case studies in Part 7 because being safety-critical, they contain lessons directly applicable to her initiative at Safety First.

With this framework of concepts and practical information in place, Maria begins assembling a core team of Safety First systems engineers, complemented by external experts in software and human factors engineering. Maria wants the team to begin by developing a shared vision. To that end, she asks them to read the portions of the SEBoK that she has found most valuable in assessing the challenges of transitioning Safety First into a leading software-intensive, user-friendly safety equipment provider.

Summary

For the general manager whose organization includes systems engineers, the relationship between SE, systems development, project management, and life cycle support is a central concern. The SEBoK provides insights and guidance about this and other aspects of SE principle and practice, and explains the role of SE in a variety of management challenge areas and application domains.

The SEBoK complements the general management guidance available in sources such as the *PMBOK® Guide* (PMI 2013).

References

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< Previous Article | Parent Article | Next Article (Part 2) >

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