CHAPTER 53
Decision Support System Evolution: Predicting, Facilitating, and Managing Knowledge Evolution

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Decision support systems (DSSs) need to evolve over time for many reasons, including changing user needs, technologies, and problem understanding. This chapter investigates what constitutes DSS evolution, taking the view that DSS evolution means that changes occur in all aspects of those systems, including hardware, databases, user interface, applications, and knowledge. This chapter summarizes and extends some of the literature on evolution and it also summarizes some approaches designed to help manage DSS evolution, including both the prediction and facilitation of evolution.

Keywords: Decision support system; Evolution

1 Introduction

Apparently, Courbon et al. (1978) were the first to use the notion of evolution in decision support systems (DSSs). Soon after that, Keen (1980) elaborated on key aspects related to evolution in DSSs. That research was mostly concerned with the notion that DSSs evolve over time, that the development methodology of DSSs is evolutionary. In a closely related set of developments, Lehman et al. (1983) appear to have been the first to use the term evolution in conjunction with generic computer software. In particular, Lehman (1998) labeled software development and maintenance as software evolution. He described software change and enhancement as unending, suggesting that evolution is also unending.

1.1 Scope

DSSs as a bundle of hardware, data and knowledge, user interface, and software application change and evolve over time. The purpose of this chapter is to investigate the notion of DSS evolution and DSS characteristics and component evolution. Previous literature has primarily been concerned with notions that DSSs evolve and that methodologies of DSS development consider this evolution. In addition, there has been some concern as to why DSSs evolve. However, there has been limited research into how DSSs actually change and evolve over time.
Accordingly, we review the previous literature on DSS evolution, according to its individual components, and clarify the process of DSS evolution for its components over time. In addition, we extend the notion of evolution to a more-proactive perspective aimed at management of evolution, where we try to predict and facilitate evolution as part of DSS management, rather than just passive evolution.

The scope of this chapter is to investigate the evolution of DSSs in general as well as in its components. For some DSS components there is an extensive evolution literature, for example, for database schema. However, for others there is a more-limited literature, for example, the evolution of different knowledge representations. Because of the extensive nature of this topic, we provide an additional discussion on knowledge evolution, including knowledge artifacts, such as taxonomies.

1.2 Structure of the Chapter

This chapter proceeds as follows. Section 2 discusses key issues associated with evolution and how it relates to DSSs, including such issues as the nature of DSS evolution, some sources of evolution, and the extent to which backward compatibility is an important issue in DSS evolution. Section 3 provides a review of some of the previous literature that deals with DSS evolution, analyzing each of the major components of a DSS. Section 4 focuses on knowledge evolution, while Section 5 drills down on how to manage knowledge evolution by facilitating and predicting knowledge evolution. Section 6 provides a brief summary.

2 DSS Evolution

This section lays out the key issues in DSS evolution, including defining what we mean by DSS evolution.

2.1 What is Evolution?

Before we talk about DSS evolution, what do we mean by evolution? Typically, definitions suggest a gradual change in whatever is evolving, generally as it moves to a different state. For example, definitions include,

- “A process in which something passes by degrees to a different stage (especially a more advanced or mature stage),” or
- “A gradual process in which something changes into a different and usually more complex or better form” (http://www.thefreedictionary.com/evolution).