Chapter 2.16
A Framework for a Scenario Driven Decision Support Systems Generator

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ABSTRACT

Traditional Decision Support Systems (DSS) provide strong data management, modelling and visualisation capabilities for the decision maker but they do not explicitly support scenario management appropriately. Systems that purport to support scenario planning are complex and difficult to use and do not fully support all phases of scenario management. We introduce scenario as a core component of decision making systems and present a life cycle approach for scenario management, which helps the decision maker with idea generation, scenario planning, development, organisation, analysis, execution, evaluation, and decision support. This research designs and develops a domain independent framework and architecture for Scenario-driven Decision Support Systems Generator that aligns the DSS with the scenario management process. We then propose a generalised evaluation process that allows homogeneous and heterogeneous scenario comparisons among multiple instances of similar and dissimilar scenarios respectively. The framework and architecture is implemented and validated through a concrete prototype.

INTRODUCTION

Herman Kahn, a military strategist at Rand Corporation, first applied the term scenario to planning in the 1950s (Schoemaker, 1993). Scenario analysis was initially an extension of traditional planning for forecasting or predicting future events. Currently, scenarios are constructed for discovering possibilities, leading to a projection of the most likely alternative. Scenario has been defined as

a management tool for identifying a plausible future (Alter, 1980; Porter, 1985; Schwartz, 1991; Tucker, 1999) and a process for forward-looking analysis. Scenario has also been defined in many other ways, for example. a kind of story that is a focused description of a fundamentally different future (Schoemaker, 1993); that is plausibly based on analysis of the interaction of a number of environmental variables (Kloss, 1999); that improves organization learning by putting many bits of information in order (De Geus, 1997; Desmarais, 2000; Van der Heijden, 1996; Wack, 1985); that is analogous to a "what if" story (Tucker, 1999); that is more dynamic and interactive than the what-if analysis (McGillivray & McGillivray, 1995). It is a description of the current situation and a series of events that could lead the current situation to a possible or desirable future state (Schoute, Finke, Veeneklaas, & Wolfert, 1995). Scenarios are not forecasts (Schwartz, 1991), future plans (Epstein, 1998), trend analyses or analyses of the past. It is for strategy identification rather than strategy development (Schoemaker, 1993) and to anticipate and understand risk and to discover new options for action. Ritson (1997) agrees with Schoemaker (1995) and explains that scenario planning scenarios are situations planned against known facts and trends but deliberately structured to enable a range of options and to track the key triggers which would precede a given situation within the scenario.

Scenarios explore the joint impact of various uncertainties, which stand side by side as equals. Usually sensitivity analysis examines the effect of a change in one variable, keeping all other variables constant. Moving one variable at a time makes sense for small changes. However, if the change is much larger, other variables do not stay constant. Schoemaker (1995) argues that scenario, on the other hand, changes several variables at a time, without keeping others constant. Decision makers have been using the concepts of scenarios for a long time, but due to its complexity, its use is still limited to strategic decision making tasks. Scenario planning varies widely from one decision maker to another mainly because of lack of generally accepted principles for scenario management. Albert (1983) proposes three approaches for scenario planning, namely, expert scenario approach, morphological approach and cross-impact approach. Ringland (1998) identifies three-step scenario planning—namely brainstorming, building scenarios, and decisions and action planning. Schoemaker (1995) outlines a ten-step scenario analysis process. Huss and Honton (1987) describe three categories of scenario planning. The literature still lacks a suitable approach for planning, developing, analyzing, organizing and evaluating the scenario using model-driven decision support systems. Currently, available scenario management processes are cumbersome and not properly supported by the available tools and technologies. Therefore, we introduce a life cycle approach based scenario management guideline.

Generation of multiple scenarios and sensitivity analysis exacerbate the decision maker's problem. The available scenario planning tools are not suitable for assessing the quality of the scenarios and do not support the evaluation of scenarios properly through comparison processes. We introduce an evaluation process for comparison of instances of homogeneous and heterogeneous scenarios that will enable the user to identify the most suitable and plausible scenario for the organization. Considering the significance of scenarios in the decision-making process, this research includes scenario as a decision-support component of the DSS and defines Scenario-driven DSS as an interactive computer-based system, which integrates diverse data, models, and solvers to explore decision scenarios for supporting the decision makers in solving problems.

Traditional DSS have been for the most part data-driven, model-driven and/or knowledge-driven but have not given due importance to