Chapter 7.7
Towards Stable Model Bases for Causal Strategic Decision Support Systems

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ABSTRACT

Most decision support systems (DSS) based on causal models fail to analyze the empirical validity of the underlying cause-and-effect hypotheses, but instead concentrate on numerous analysis techniques within the method base. However, the soundness of these cause-and-effect-relations as well as the knowledge of the approximate shape of the functional dependencies underlying these associations turns out to be the biggest issue for the quality of the results of decision supporting procedures. Therefore this article strives towards an approach to prove the causality of nomologic cause-and-effect-hypotheses by empirical evidence as a prerequisite for the approximation of the mostly unknown causal functions. Since the latter very often show non-linear influences, it is necessary to employ universal function approximators for this purpose: consequently the proposed approach adopts artificial neural networks (ANN) as an inductive method to learn a calculational model of cause-and-effect functions from empirical time series.

INTRODUCTION

One critical challenge in planning and implementing corporate strategies is deriving appropriate decisions and measures from an uncertain and diffuse informational background. Therefore, a crucial requirement for any application supporting this type of decisions is necessary to tackle at least two elementary issues. First, the decision maker has to be supplied with appropriate data about the underlying relevant key figures and business drivers as well as environmental information related to the market or competitors. This first function of data support as outlined before is the

main focus of so-called management information systems (MIS). These tools usually employ powerful techniques to gather the necessary figures as a basis for strategic planning efforts.

Second, this raw data has to be arranged within decision models in order to reduce the variety and complexity coming with it. One characteristic of a complex strategic decision that is it is influenced by an immense set of business variables which have to be analyzed in this context. As a consequence, data supporting tools do not provide appropriate aids for this type of entrepreneurial function. It is to reduce the complexity emerging from this amount of data which becomes the principal task of decision support systems (DSS). Hence it can be observed that the architecture of any arbitrary DSS is highly dependent of the managerial approach it is designed to support. It necessarily incorporates the notion of a mental model underlying the respective decision theory as well as techniques to derive decisions from these assumptions. Sprague & Carlson (1982) specify these two core components of a DSS as model base and method base, respectively. The former defines the structure of the decision model, which arranges the raw data provided by a data support component, whereas the latter encompasses decision theoretic methods specifically designed to operate on the given decision model. According to the type of the model base, analytic techniques, like optimization as well as statistical methods or stochastic approaches, like simulation, are used to draw decisions from the raw data organized in the decision model.

A considerable number of recent approaches within the domain of strategic decision making propose to organize business indicators in the form of causal models. The main task of these models is to visualize the cause-and-effect relations which the decision maker assumes to exist between the given variables and/or goals (Hillbrand & Karagiannis, 2002a).

One well-known example for this type of strategic decision methodologies is the balanced scorecard approach (Kaplan & Norton, 1992): The main idea behind this concept is that short-term goals of financial nature like the improvement of profitability measures are usually influenced by long-term objectives of non-financial type. Therefore Kaplan and Norton (1992) postulate a balanced selection of strategic goals out of (at least) four distinct dimensions: financial-, customer-, process- and, development-specific perspectives should be included in the strategic process. Between the goals and measures of these dimensions the decision maker has to make hypotheses about the underlying cause-and-effect relations. Subsequently they can be used to disaggregate main strategic goals into tactical objectives and measures.

Similar principles are encompassed by the French tableau de board methodology (Mendoza et al., 2002) as well as by cybernetic management principles as proposed for example by Vester (1988) in his biocybernetic approach, whose main concepts are reused in the St. Gallen management model (Gomez & Probst, 1999; Schwaninger, 2001; Spickers, 2003).

Although these managerial approaches for strategic decision support provide some practical approaches for the reduction of complexity coming with a sense-making process the implementations of these ideas in the form of DSS are rather weak. It can be observed that software tools supporting such approaches are focused on techniques out of the method base in order to draw conclusions from a hypothetically assumed cause-and-effect model as outlined before (Hillbrand & Karagiannis, 2002a, p. 368). Therefore most DSS of this type provide simulation techniques as well as how-to-achieve- and what-if-analyses. However, the model base usually remains unproven with respect to the empirical evidence of the hypothetically assumed cause-and-effect relations between the business variables. As a logical consequence, the overall quality of the decision support provided by such a system is directly related to the completeness and soundness of the underlying