Chapter 2
Structural Equation Modeling Algorithm and Its Application in Business Analytics

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ABSTRACT

Structural Equation Modeling (SEM) is a statistical-based multivariate modeling methods. Application of SEM is similar but more powerful than regression analysis; and number of scientists using SEM in their research is rapidly increasing. This review article algorithmically discusses the SEM methodology. SEM strategies, SEM steps and SEM stages are introduced in this article; validity tests are presented as well. Novelty of this article is in modified steps of SEM application in modeling strategies, also in its developed practical comprehensive SEM application flowchart. This article is a roadmap for business advisors and those scholars trying to compute SEM for their decision making, complex modeling and data analysis programming.

INTRODUCTION

Structural equation modeling, also known as SEM, is referred to as one of the most effective multivariate statistical tool for analysis. The extent to which SEM's technique is applied to relationship analysis simply ranges from independent and dependent variables to complex analysis of measurement equivalence for first and higher order constructs (Cheung 2008). The framework for developing and analyzing complex relationships among a number of variables is flexible and also permits researchers to test the theory's validity through empirical models. Perhaps its prominent strength is in its capacity to manage errors in measurement, which is among the greatest limitations of most studies. A couple of years back Gonzalez, Boeck and Tuerlinckx (2008), Beran and Violato (2010) and numerous different researchers classified it as a "most of the time" used technique. "With SEM's strength as a statistical tool to analyze complex relationships among variables, and even posit and test causal relationships with non-experimental data, it allows researchers to explain the development of phenomena" (Beran, et al. 2010). The utilization

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of SEM has now elevated to be the across-the-board, crosswise technique over research domains. The citation recurrence of SEM has consistently increased from 18 in 1980, to 494 in 2000, then to 4269 in 2015, as shown in Figure 1 which is based on Scopus indexed articles (Scopus 2016). A search for SEM in the Scopus database, with "structural equation modeling" in title, abstract and/or keywords of indexed articles, reveals that psychology, social Sciences, engineering, and medicine researchers are among the top users (Scopus 2016). Although SEM is widely used in research, the number of technical note articles showcasing a roadmap or application flowchart are very few. The main purpose of current paper is to introduce a comprehensive programming flowchart for SEM application and computation.

RESEARCH METHODS

Two basic methods of research found in literature are quantitative and qualitative research (Curran & Blackburn, 2001; Trochim, 2005; Gobakhloo, 2009). Qualitative research uses words to describe situations, individuals, or circumstances surrounding a phenomenon, while quantitative research uses numbers and formulas usually in the form of counts or measurement in an attempt to give precision to a set of observations (Remenyi, Williams, Money & Swartz, 1998; Vignali, Gomez, Vignali & Vranesevic, 2001; Gray, Williamson et al. 2007; Gobakhloo, 2009).

These methods complement each other and are therefore mutually supportive. According to Karami (2007), appropriate research in some applied sciences requires the right balance between qualitative and quantitative methods. Figure 2 presents a contingent model development research approach that aims is to identify such a balance. This approach is applicable in both model and theory developments.

There are diverse views on the role and place of theory in the sequence and relationship of the activities involved in research. It has been found by Curran and Blackburn (2001) that there is interwoven play between data collection and analysis. Therefore, data are obtained through quantitative and qualitative

Figure 1. Scopus documents
Source: Scopus (2016)