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Visualizing Moderating Effects in Path Models with Latent Variables

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ABSTRACT

Path models with and without latent variables are extensively used in e-collaboration research. Both direct and moderating relationships can be included in such path models. Moderating relationships involve three latent variables, the moderating variable and a pair of variables that are connected through a direct link. This paper discusses the visualization of moderating relationships through two-dimensional and three-dimensional graphs. The software WarpPLS version 5.0 is used in this discussion, since it provides an extensive set of graphs that can be used to visualize moderating effects.

KEYWORDS

E-Collaboration, Partial Least Squares, Path Analysis, Statistical Moderation, Structural Equation Modeling, WarpPLS

INTRODUCTION

Path models with and without latent variables are extensively used in e-collaboration research (Kock, 2011; 2014a). Such models can be analyzed through the method of path analysis (Wright, 1934; 1960), which itself provides the foundation for structural equation modeling (Kock & Mayfield, 2015; Kock & Verville, 2012). In these analyses, latent variables have been traditionally approximated via composities, employing partial least squares algorithms (Kock & Mayfield, 2015). A recent related development is the estimation of the true latent variables through factor-based algorithms (Kock, 2015a).

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DATA USED IN THE ANALYSES

Departing from a "true" model, which is a model for which we know the nature of the relationships among variables and their respective magnitudes, we created 300 rows of data for several latent

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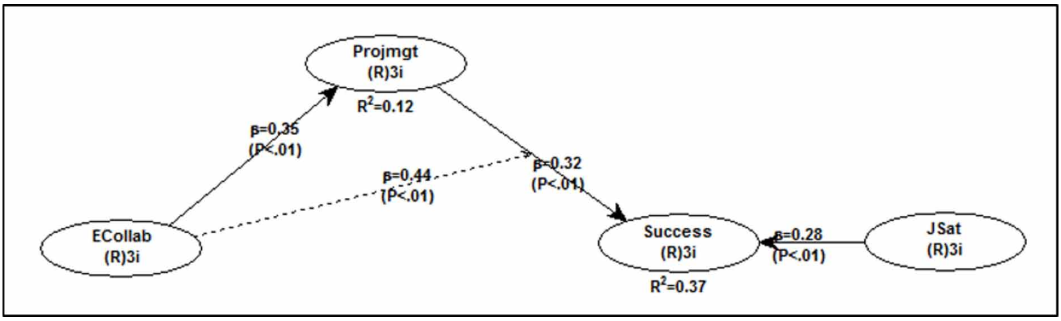
Figure 1. Results of the analysis



variables and indicators based on a Monte Carlo simulation (Robert & Casella, 2005; Paxton et al., 2001). These are equivalent to 300 returned questionnaires.

The true model was based on an actual study of the effects of e-collaboration technology use on team-based project success, previously used by Kock & Lynn (2012) to illustrate the phenomena of vertical and lateral collinearity. At the time of this writing, the data we created was publicly available as a sample dataset from the WarpPLS web site: warppls.com.

The following variables were included in the illustrative analyses discussed here: e-collaboration technology use (ECollab), project management (Projmgt), job satisfaction (JSat), and project success (Success). More details about these variables are provided below.

E-Collaboration Technology Use (ECollab)

This is the main technology-related latent variable in the model. It measures, through three indicators, the extent to which a team that is tasked with the development of a new product (e.g., a new toothpaste or airplane part) uses an e-collaboration technology that integrates several synchronous and asynchronous features (e.g., e-mail, text-based chat, video-conferencing, discussion board).

Project Management (Projmgt)

This latent variable measures, through three indicators, the degree to which the team uses project management techniques that allow team members to monitor and control the progress of their work.

Job Satisfaction (JSat)

This latent variable measures, through three indicators, the degree to which team members are satisfied with their current jobs.

Project Success (Success)

This latent variable measures, through three indicators, the degree to which the new product developed by the team is successful in the marketplace (i.e., has a high volume of sales, with a good profit margin).

In our true model, e-collaboration technology use (ECollab) directly influences project management (Projmgt). Job satisfaction (JSat) also directly influences project success (Success). Finally, e-collaboration technology use (ECollab) moderates the relationship between project management (Projmgt) and project success (Success). Figure 1 shows the results of our analysis.

In our analysis we employed "PLS Regression" as the outer model (a.k.a. measurement model) analysis algorithm, "Stable3" as the "resampling" method used in the analysis, and "Linear" as the default inner model analysis algorithm (Kock, 2015b). The Stable3 is referred to as a "resampling" method for simplicity; it does not actually generate resamples, and yields more reliable estimates of

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