Problems and Solutions with Many Indicators and Latent Variables in CFA-SEM Models

An Empirical Study of Marketing Research Effectiveness in the Enterprises

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Introduction

The problems that appear in practice of measurement (CFA) and structural equation modeling (SEM) pertain to:
- number of indicators per factor,
- number of parameters per factor and in model
- number of latent variables in CFA-SEM models.

Large number of indicators cause also problems associated with:
- the strength of association between the indicators and latent variables (Bandolos, 1997; Boomsma, 1992; Gerbing & Anderson, 1985; MacCallum et al., 1999; Velicer & Fava, 1998)
- the degree of multivariate normality of latent variables (Anderson, 1996; West, Finch, & Curran, 1995)
- the estimation method (Fan, Thompson, & WANG, 1999; Fan & Wang, 1998; Tanaka, 1987)

CFA-SEM MODEL STRUCTURE

F_1 - General factor - organizational determinants:
Factor 1: Decision makers’ personal attitudes to marketing research and its results (items: 111, 112, 113)
Factor 2: Benefits of wide communication in structural organization on the basis of marketing research (items: 122, 131, 132, 134)
Factor 3 - Informational culture and firm’ identity derived from marketing research (items: 133, 141, 142).

CFA SEM MODEL STRUCTURE

Factors 4:
Factor 4: Orientation on models, methods and techniques (items: 133, 141, 142).

Factors 5:
Factor 5 - Benefits of wide communication in structural organization on the basis of marketing research (items: 111, 112, 113)
Factor 6 - Informational culture and firm’ identity derived from marketing research (items: 133, 141, 142).

MEASURES:

Latent variables were operationalized by items which were expressed in the form of statements, and measured on Likert 7-point scale.

Method

PROPOSED SOLUTION:

In the present study, in order to obtain satisfying solution in the model fit and parameter estimates, author reduced a number of indicators for each latent variable by adding particular indicators in data set. The other alternatives: index reliability, parceling strategy, submodels (Kenny & McCoach, 2003).

SUBJECT OF EMPIRICAL STUDY:

The author’s research objective was to diagnose the relationships between two general conditions (organizational and methodological determinants) which affect the level of the marketing research effectiveness in the enterprises.

DATA:

Survey (through the two social networking sites: LinkedIn and Golden Line) was conducted, with a direct link to the online questionnaire which was sent via personal emails.

Empirical research: March 1 - August 31 in 2014 in Poland Sample structure:
- Marketing Directors (45%), Product Managers (27%), Managing Directors, CEO (20%), Marketing Executives (8%) in the Enterprises.
- Employment levels: less than 15 (9%), 16-99 (17%), 100-249 (16%), 250-490 (8%), above 499 (50%).

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F_2AF - General factor - methodological determinants:
Factor 4: Orientation on models, methods and techniques resulting from scientific norms (items: 211, 212)
Factor 5: Methodological pragmatism during the ongoing marketing research (items: 213, 214)
Factor 6: Proper conditions of defining the research problem (items: 221, 222, 224)
Factor 7: Predisposition of researchers to identify important research questions and articulate decision makers’ information needs (items: 223, 225)

METHOD OF ESTIMATION: ML

Most of constructed CFA-SEM „meta” models in a number of important modern applications (as social sciences research) due to high complexity level of the researched phenomena, are overloaded with variables and simultaneously parameters.

In consequence they generate:
- problems with models identification
- unacceptable levels of model fit
- misleading values of the parameter estimates and standard errors,
- unreliable and invalid research results.

An appropriate solution to prevent such problems comes along with strategies such as: single index, index reliability, parceling and construction of submodels.

Conclusions

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Table 1-3 Fit indices for the Marketing Research Effectiveness models - complex and simplified solutions

Figure 1 SEM path diagram for the Marketing Research Effectiveness model - complex solution

Figure 2 SEM path diagram for the Marketing Research Effectiveness model - simplified solution

single index strategy with parameter estimates

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