Journal of Business Research 66 (2013) 1255–1260

Contents lists available at SciVerse ScienceDirect

Journal of Business Research

Marketing's SEM based nomological network: Constructs and research streams in 1987–1997 and in 1998–2008☆

Edward Ramirez [a,*], Meredith E. David [b,1], Michael J. Brusco [c,2]

[a] University of Texas at El Paso, TX, United States
[b] University of South Carolina, SC, United States
[c] Florida State University, FL, United States

ARTICLE INFO

Article history:
Received 1 February 2010
Received in revised form 1 May 2011
Accepted 1 September 2011
Available online 27 February 2012

Keywords:
Marketing thought
Nomological network
Network analysis
Structural equation models
Bibliometry

ABSTRACT

Which constructs are most important to marketing? Has their importance waxed or waned over time? Is the discipline converging or diverging conceptually? Although scholars have attempted to study the evolution of the discipline, such questions remain largely unanswered. The present research addresses these issues by examining marketing's nomological network—the interconnection of psychometric variables found in the discipline's structural equation models (SEM)—using sociometric techniques. Two digraphs containing the interleaved and concatenated results from SEMs during two periods are investigated. The findings suggest that although marketing thought in SEM studies is somewhat fragmented, two dominant research streams emerge—one dealing with organizational behavior issues and the other with relationship marketing. The focus on SEMs suggests that the findings are particularly relevant for scholars or practitioners in survey-based research, as they provide direction for future research and suggest that firms can prosper by improving customer relationships.

1. Introduction

As a science matures, the progress, evolution, and impact of that particular science are assessed by philosophers of science (Ramos-Rodríguez & Ruíz-Navarro, 2004). As such, marketing's relative importance to a wider audience of social scientists has been investigated (Hoffman & Holbrook, 1993). These efforts have resulted in attempts to determine if marketing is converging on a set of agreed upon propositions that are useful for both researchers and practitioners (Stremerch, Verniers, & Verhoef, 2007). In particular, the structure and process of the discipline have been studied with citation analysis (Hoffman & Holbrook, 1993). By analyzing the discipline's citation patterns, marketing's evolution can more clearly be traced.

The research presented, however, contributes to understanding the discipline's progress by examining the discipline's constructs and their interrelationships. Specifically, several network analysis algorithms are leveraged to investigate the evolution of marketing's nomological network—the law-like interconnection of measured, latent constructs found in the domain (Cronbach & Meehl, 1955). By examining the relationships between the constructs embedded in structural equation models (SEM) in the *Journal of Marketing*, *Journal of Marketing Research*, *Journal of Consumer Research*, and *Marketing Science* over two decades, inferences can be drawn regarding the discipline's advancement. Although these inferences are limited to marketing's psychometric variables, they provide valuable insights for both research and practice.

The present research discusses bibliometric techniques and how these methods have been used to explore the field's progression. In particular, network analysis is used to discover which constructs are most central, and hence most important, to the field, as well as revealing the waning relative importance of others. This analysis also suggests that the marketing discipline is highly fragmented, as numerous versions of semantically related and context specific constructs are identified. The discipline embodies some degree of coherence, as two overarching themes dominate during the past two decades. Additionally, a permutation test assesses the degree to which a network of constructs exhibits symmetry, providing clues as to how researchers assemble SEMs. Finally, a permutation procedure known as the BEA uncovers subsets of constructs with cohesive relationships. Accordingly, direction for the discipline is provided, offering insights for

☆ The authors thank Donghoon Kim, Robert Li, and JBR reviewers for their helpful comments and suggestions on previous versions of this manuscript.

* Corresponding author at: University of Texas at El Paso, College of Business Administration, Department of Marketing and Management, Room 214, 500 W. University Ave., El Paso, TX, 79968-0539, United States. Tel.: +1 404 732 4891; fax: +1 915 747 5348.
E-mail addresses: eramirez29@utep.edu (E. Ramirez), meredith.david@grad.moore.sc.edu (M.E. David), mbrusco@cob.fsu.edu (M.J. Brusco).
[1] University of South Carolina, Moore School of Business, Columbia, SC 29201, United States. Tel.: +1 803 413 6899.
[2] Florida State University, College of Business, Department of Marketing, 359 RBB, Tallahassee, FL 32306-1110, United States. Tel.: +1 850 644 6512; fax: +1 850 644 4098.

0148-2963/$ – see front matter © 2012 Elsevier Inc. All rights reserved.
doi:10.1016/j.jbusres.2012.02.022

substantive researchers developing new constructs, theories, and research streams using SEM. In addition, insights for managers seeking the most effective strategies for winning and keeping customers are provided. Finally, given the focus on SEMs, the present research should be particularly applicable to the large B2B literature, the marketing management literature, or any domain that relies upon survey data.

2. Conceptual background

A sizable body of literature combines citation analysis and a desire to understand the evolution of a scientific domain (Baumgartner & Pieters, 2003; Bettencourt & Houston, 2001). Broadly classified as bibliometrics, such efforts operate by examining journal citations. The inclusion of a citation interconnects articles, suggesting agreement on the cited author's findings (Shadish, Tolliver, Gray, & Gupta, 1995). For example, citing Parasuraman, Zeithaml, and Berry (1988) might suggest a bias towards assessments of service quality based on a perceived gap between expectations and actual performance. Additionally, bibliometry examines co-citations where two or more authors make a reference to a particular article, perhaps indicating agreement on a theoretical stance.

Bibliometry is an accepted method for examining business disciplines, yielding insight into the sociology of science, while "requir [ing] minimal subjective judgments by the researcher" (Tellis, Chandy, & Ackerman, 1999, p. 121). These techniques provide the foundation for studies on hidden colleges and academic career advancement (Casey & McMillian, 2008; Seggie & Griffith, 2009). Bibliometry also explores researcher productivity, the epistemological proximity of journals, and sources of new ideas (Baumgartner & Pieters, 2003; Bettencourt and Houston 2001; Tellis et al., 1999). These techniques examine research authorship and article impact (Stremerch et al., 2007). Thus, bibliometry is an accepted method for exploring a discipline's evolution and impact.

Some methodologists, however, take issue with the validity of the results derived from such methods, suggesting that they may be sufficient for counting co-citations, but not author agreement (Shadish et al., 1995). Consider that an author may cite another that they disagree with to develop a countervailing argument. For this reason, bibliometry may lack construct validity.

The analysis of marketing's nomological network found in the present research overcomes some of the weaknesses inherent in such methods by evaluating the linkages among constructs with a series of network analyses. Specifically, the present research examines constructs found in SEMs. Since a domain's constructs, and their relative positions in the nomological network, create substantive and theoretical meaning, this technique allows for a more direct assessment of a domain (Cronbach & Meehl, 1955). Thus, an examination of marketing's nomological network provides further insights into the evolution of the discipline that may be obscured to bibliometricians (Campbell, 1960).

3. Methods and data collection

3.1. Graph-theoretic framework

Marketing's nomological network is framed as a directed graph, G(V, E), where V and E are the vertex and edge sets. The vertex set, $V=\{v_1,\ldots v_n\}$, consists of n latent constructs identified in SEM studies published from 1987–2008. A directed edge between a pair of vertices $\{v_i, v_j\}$ is established if at least one study investigates the effect of latent construct v_i on latent construct v_j. v_i is the sending construct and v_j is the receiving construct (Wasserman & Faust, 1994). As the effect of a latent construct on itself is not plausible, loops are not included ($\{v_i, v_i\}\notin E$ for all $1\le I\le n$). As the effect of one construct v_i on construct v_j might be measured in one study and the impact of v_j on v_i might be examined in another, $\{v_i, v_j\}\in E$ and $\{v_j, v_i\}\in E$. An $n\times n$ matrix, $\mathbf{X}=[x_{ij}]$, is obtained from G(V, E) such that $x_{ij}=1$ if $\{v_i, v_j\}\in E$, else $x_{ij}=0$.

3.1.1. Network metrics

A number of metrics summarize **X**, including density, δ:

$$\delta=\frac{\sum_{i=1}^{n}\sum_{j=1}^{n}x_{ij}}{n(n-1)} \tag{1}$$

Density represents the total number of directed edges in the network matrix divided by the number of possible edges (note the use of $n(n-1)$, as loops are not permitted).

Two other noteworthy metrics are in-degree and out-degree centrality. For each vertex v_j, the in-degree centrality, ω_j, represents the number of directed edges entering the vertex divided by the total number of vertices. The computation of in-degree centrality:

$$\omega_j=\frac{\sum_{i=1}^{n}x_{ij}}{n},\ \forall 1\le j\le n. \tag{2}$$

The average in-degree centrality across all vertices is obtained as:

$$\bar{\omega}=\frac{\sum_{j=1}^{n}\omega_j}{n} \tag{3}$$

In a similar manner, the out-degree centrality for each vertex j, denoted η_j, and the corresponding average across all vertices are computed as follows:

$$\eta_j=\frac{\sum_{i=1}^{n}x_{ji}}{n},\ \forall 1\le j\le n. \tag{4}$$

$$\bar{\eta}=\frac{\sum_{j=1}^{n}\eta_j}{n}. \tag{5}$$

To provide additional information regarding the relative importance of a construct, a measure of construct embeddedness is calculated. For each vertex, v_j, the subset V_j is defined such that $v_i\in V_j$ if $\{v_i, v_j\}\in E$ and/or $\{v_j, v_i\}\in E$. V_j is the subset of constructs that are either direct senders or receivers to construct v_j. The measure of embeddedness for construct v_j, which is denoted as ϕ_j, is a straightforward density calculation based on the constructs in V_j. If v_j has only one immediate neighbor, then $\phi_j=0$; otherwise, ϕ_j is computed as follows:

$$\varphi_j=\frac{\sum_{i\in V_j}\sum_{l\in V_j}x_{il}}{\left(\left|V_j\right|\right)\times\left(\left|V_j\right|-1\right)},\ \forall 1\le j\le n, \tag{6}$$

where $|V_j|$ is the cardinality of V_j (the number of vertices). The embeddedness measure is a density calculation for each construct, assessing local neighborhood embeddedness. Constructs with larger values of ϕ_j play a key role in explaining and predicting other constructs and, thus, have greater usefulness for both theory and practice.

3.1.2. Permutation test of symmetry

A permutation test, based on quadratic assignment, is used to test the null hypothesis that a matrix does not exhibit symmetric properties versus the alternative of symmetry. The observed statistic for Mantel's (1967) test is the sum of the products of two $n\times n$ matrices. The reference distribution is obtained by holding one of the matrices