



The Impact of CEO/CIO Convergence on IT Strategic Alignment

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ABSTRACT

Researchers have suggested that convergence between an organization's top business and IS executive enables the alignment of IS and business strategy, thus increasing the potential contribution of IS to the firm. A postal survey of 202 pairs of business and IS executives tested the effect of convergence on such alignment, and that of alignment on IS contribution. Convergence was measured in terms of the role of IT in the organization, and strategic alignment was measured in terms of the fit between business and IS strategy. Validation procedures reduced IS contribution to two factors, operational and financial contribution. Convergence predicted aggressiveness, analysis, and innovativeness alignment. Business and IS executives diverged for the relationships of the analysis, innovativeness, external defensiveness, and aggressiveness alignment with IS operational contribution. Operational contribution predicted financial contribution. The study contributed by demonstrating that convergence predicts some forms of alignment and that the views of the impact of alignment vary for business and IS executives.

INTRODUCTION

Organizations invest large amounts of resources in IT primarily because business executives believe that such investment can contribute substantially to their firm's success. However, executives have frequently reported an inability to realize value from their IT investments (Ross and Weill 2002). Observers have suggested that for organizations to benefit from those investments, alignment must exist between the firm's business and IT strategy (Sabherwal and Chan 2001).

Many studies have suggested that mutual understanding % often referred to as convergence % between an organization's CEO and CIO is a prerequisite to such alignment (Feeny *et al.* 1992; Reich and Benbasat 2000). This study extends research by examining Chan *et al.*'s (1997) STROEPIS (i.e., Strategic Orientation of the Existing Portfolio of IS Applications) dimensions of alignment model. First, the study investigates the relationship of CEO/CIO convergence about the role of IT (Raghunathan *et al.* 1999) to each of the STROEPIS dimensions. Then, it examines the relationship between each of the STROEPIS dimensions and the IS contribution to organizational performance (Premkumar and King 1992).

CEO/CIO CONVERGENCE

Researchers have used the terms convergence, mutual understanding, shared understanding, and other phrases interchangeably to indicate the state where communicating individuals agree on a certain topic or issue. This paper defines convergence as the "degree of mutual understanding" (Lind and Zmud 1991, p. 195) between an organization's CEO and CIO about the role of IT.

IT STRATEGIC ALIGNMENT

Researchers have provided a variety of characterizations of IT strategic alignment. For example, they have characterized it as the extent to which IS planning is integrated or linked to business planning (Reich and Benbasat 1996, 2000). Drawing on the work of Venkatramen (1989a), Chan *et al.* (1997) used eight dimensions to describe it. Their STROEPIS model defined it as the fit between business strategy and IS strategy for eight dimensions of strategic orientation.

IS CONTRIBUTION TO THE ORGANIZATION

Research has described IS contribution to the organization in terms of individual IS applications as well as the impact of overall systems (Seddon *et al.* 2002; Tallon *et al.* 2000). Premkumar and King (1992) viewed IS contribution in terms of that overall impact. They studied that impact using IS contribution to customer satisfaction, sales revenue, market share, return on investment, and operating efficiency as their survey items.

HYPOTHESES: CONVERGENCE PREDICTS ALIGNMENT

The CIO's understanding of the CEO's view of the importance of IT to the organization (i.e., convergence) typically occurs as a result of their communication with each other and their knowledge sharing (Armstrong and Sambamurthy 1999; Reich and Benbasat 2000). The CEO would have shared knowledge with the CIO about the organization's business strategy and the CIO would have shared knowledge with the CEO about the general capabilities of IT and the potential for IT to support the business strategy. Hence, the CIO would be better able to use the combined knowledge about the business strategy and IT capabilities to conceive and create IT strategy aligned with business strategy.

Furthermore, the CEO's understanding of the CIO's view of the importance of IT to the organization and CEO's shared knowledge of IT capabilities would foster the development of a business strategy consistent with the CIO's IT strategy. This is because the CEO would have a broader knowledge of the limits on IT capabilities (as reflected in the IT strategy), and could use that knowledge to understand how IT could support business goals. Moreover, the CEO would be able to support the deployment of IT as a catalyst for new business strategy, as well as a foundation for existing business strategy (Henderson and Venkatraman 1993).

In summary, we expect IT strategic alignment to be greater in organizations where the CEO and CIO converge on the role of IT within the organization. Such strategic alignment is best explained by multiple constructs (Chan *et al.* 1997). Because it is conceptualized as eight dimensions, Hypotheses 1-8 are proposed:

Convergence between the CEO and CIO about the role of IT is positively related to ...

- H1: aggressiveness alignment.
- H2: analysis alignment.
- H3: internal defensiveness alignment.
- H4: external defensiveness alignment.
- H5: futurity alignment.
- H6: proactiveness alignment.
- H7: riskiness alignment.
- H8: innovativeness alignment.

HYPOTHESES: ALIGNMENT PREDICTS IS CONTRIBUTION

The IS organization is better able to ensure that applications are critical to the organization when its strategy is aligned with the overall business strategy (Stepanovich and Mueller 2002). It can better develop systems that enable, support, initiate, and stimulate business strategies (Henderson and Venkatraman 1993).

Conversely without alignment, completed projects may be unrelated to business objectives and strategy (Stepanovich and Mueller 2002). Thus, by ensuring that IS resources are not dedicated to low-impact projects, alignment would positively influence IS contribution to organizational performance.

Both the CIO and CEO assess that contribution. Traditionally however, the CIO was often seen as a technical expert who lacked business understanding and the CEO as a business expert who lacked IS understanding (Broadbent and Weill 1993). Their different roles were thought to cause different views about the potential IS contribution (Galliers 1992). Today each is generally more knowledgeable about the other's domain (Karlgaard 2003). Such shared knowledge has, for example, enabled both to hold similar attitudes about the IT function (Vedder and Guynes 2002) and critical IS issues (Burn and Szeto 2000). Therefore, alignment would predict contribution regardless of who assesses that contribution. Because alignment is conceptualized as eight dimensions, Hypotheses 9-16 are proposed:

- H9: Aggressiveness alignment ...
- H10: Analysis alignment ...
- H11: Internal defensiveness ...
- H12: External defensiveness ...
- H13: Futurity alignment ...
- H14: Proactiveness alignment ...
- H15: Riskiness alignment ...
- H16: Innovativeness alignment ...

...is positively related to IS contribution to organizational performance as assessed by the: a. CEO. b. CIO.

METHODOLOGY

The authors developed two postal questionnaires, one for the CEO of the organization and one for the CIO. Both questionnaires contained items about the role of IT in the organization. The items comprised one factor and came from Raghunathan *et al.*'s (1999) current role of IT instrument. The mean of the absolute value of the difference between the CEO and CIO response for each item would represent CEO/CIO convergence.

The CEO questionnaire contained 27 items about the organization's business strategy. The items came from Chan *et al.*'s (1997) version of Venkatramen's (1989a) STROBE instrument. The CIO questionnaire contained 30 items about the information systems in the organization. These items came from Chan *et al.*'s (1997) STROEPIS instrument. IT strategic alignment would be calculated for each dimension by multiplying the average of the items for the corresponding business strategy dimension by the average of the items for the IS strategy dimension, as recommended by Venkatramen (1989b) and applied by Chan *et al.* (1997).

Both the CEO and CIO questionnaire contained five items on a 1 (no extent) to 5 (great extent) scale concerning the extent to which IS contributed to return on investment, sales revenue, market share, operating efficiency, and customer satisfaction. The items came from Premkumar and King's (1992) contribution of IS to organizational performance instrument. IS contribution would be calculated as the average of the items for each subject.

The content validity of each questionnaire was examined prior to mailing. Five IT professors and five sets of executives (one CEO and one CIO per set) pilot tested the survey.

Subjects returned 204 matched surveys for a response rate of 20%. Two were unusable due to incomplete responses so 202 were used as the sample for the study. Manufacturing, medicine/law/education, finance/insurance, and wholesale/retail accounted for over 50% of the industries represented.

RELIABILITY AND VALIDITY STATISTICS

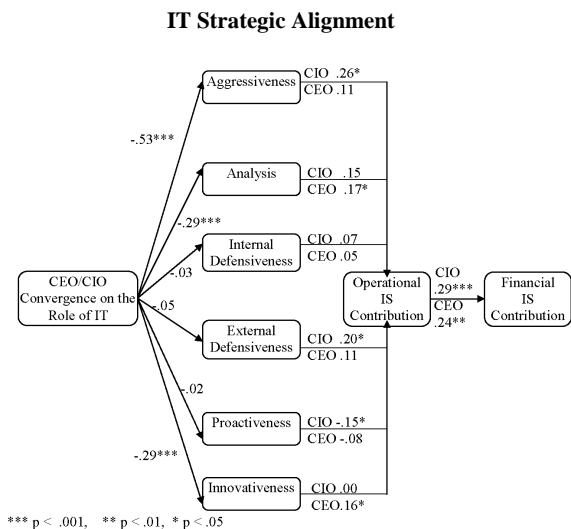
Several tests were used to validate the constructs. Principal components analysis (PCA) with varimax rotation assessed their dimensionality. The scree test and eigenvalue criteria determined the factors retained. Cronbach's alpha measured the internal consistency of each factor. Convergent validity was assessed by examining average variance extracted estimates for each factor. Three measures of discriminant validity, the chi-square difference test, the confidence interval test, and the variance extracted test, were also used (Hatcher 1994). Reliability and validity was support for each of constructs. Two business strategy dimensions, namely futurity and riskiness, failed to emerge for the PCA and their Cronbach alphas were also low. So, they were dropped from further analysis for the business and IT strategy construct.

HYPOTHESIS TESTING

Multivariate regression analysis was used to test the relationship between CEO/CIO convergence and the IT strategic alignment dimensions. Figure 1 shows the final research model (after a necessary revision) with the path coefficients. It is now discussed.

Convergence was positively related to aggressiveness ($F(1,199) = 48.84$, $p < .001$), analysis ($F(1,199) = 12.88$, $p < .001$), and

Figure 1. Final research model*



* The CEO and CIO responded to identical items about IS contribution. Thus, the paths between the alignment variables and operational IS contribution and between operational IS contribution and financial IS contribution show path coefficients for both CEO and CIO assessments of IS contribution.

innovativeness alignment ($F(1,199) = 19.99, p < .001$). Thus H1, H2, and H8 were supported. Convergence was not related to internal defensiveness, external defensiveness, and proactiveness alignment at a statistically significant level. Thus H3, H4, and H6 were not supported. H5 and H7 were not tested because the futurity and riskiness dimensions were dropped from the model during the validation procedure.

H9 – H16 stated that the IT strategic alignment dimensions would be positively related to IS contribution as assessed by both the CEO and CIO. However, factor analyses clearly indicated that the IS contribution construct contained two dimensions, IS Operational Contribution and IS Financial Contribution.

The process-oriented approach to the evaluation of IT business value suggests that the first-order contribution of IT occurs at the operational or process level and that the greater the impact on individual processes, the greater the contribution of IT to firm financial performance (Barua *et al.* 1995; Mooney *et al.* 1996). Thus, IS Operational Contribution is thought to mediate the relationship between alignment and IS Financial Contribution. Hence, the research model was revised to indicate that IT strategic alignment dimensions were positively related to IS Operational Contribution, and IS Operational Contribution was positively related to IS Financial Contribution.

Multiple regression analysis was used to test the relationship between the IT strategic alignment variables and IS Operational Contribution. When the CEO responses were used, analysis (H10a, $t = 1.94, p < .05$) and innovativeness alignment (H16a, $t = 2.78, p < .01$) were positively related to IS contribution to operational efficiency. When the CIO responses were used, aggressiveness (H9b, $t = 3.13, p < .01$), external defensiveness (H12b, $t = 2.78, p < .01$), and proactiveness alignment (H14b, $t = 2.07, p < .05$) were positively related to IS contribution to operational efficiency.

Support was not found for H11 when CEO or CIO responses were used. Thus, internal defensiveness alignment was not related to IS operational contribution. H13 and H15 were not tested because the futurity and riskiness dimensions were dropped from the model during the validation procedure.

Simple regression analysis showed that IS operational contribution was positively related to IS financial contribution for CEO ($F(1,200) = 12.23, p < .01$) and CIO ($F(1,200) = 18.05, p < .001$) assessments of IS contribution.

DISCUSSION: CONVERGENCE PREDICTS ALIGNMENT

This study supported the expectation that convergence between an organization's CEO and CIO about the role of IT would predict IT strategic alignment for three of the six dimensions of strategy, namely aggressiveness (H1), analysis (H2), and innovativeness (H8). Confirmation of those hypotheses was consistent with the general notion that more alignment would exist in organizations where the CEO and CIO had a shared understanding about the role of IT.

Convergence between the CEO and CIO did not predict IT strategic alignment for three of the other dimensions: internal defensiveness (H3), external defensiveness (H4), and proactiveness (H6). (H5 and H7 were not tested.)

Failure to confirm H3 and H4 may have occurred because mutual understanding with the CEO is insufficient for internal and external defensiveness alignment. Both dimensions addressed the extent to which IT is used to support specific areas of the organization (probably more so than the other dimensions). Perhaps, convergence between the CIO and other members of the firm's management team, rather than between the CIO and CEO, facilitates the defensiveness alignments. For example, convergence between the CIO and department managers, who are more knowledgeable about their own requirements for efficiency improvements in their specific departments, might better predict internal defensiveness alignment. Similarly, convergence between the

CIO and customer service and purchasing managers, who are more knowledgeable about their specialties, might predict it.

Failure to confirm H6 (CEO/CIO convergence predicts proactiveness alignment) might have occurred because the extent to which the CEO and CIO communicate about the organization's search for new market opportunities, business ventures, or acquisitions (i.e., the items within the proactiveness dimension) is perhaps limited. It may be reasonable to expect that the CEO would communicate more about the proactiveness items with the vice presidents directly involved with those items, and hence less with the CIO. The CEO might do this both to capitalize on the expertise of the appropriate executives, and simultaneously to protect the confidentiality of the initiatives. If the CIO is not so knowledgeable about proactiveness, then convergence with the CEO might not necessarily predict proactiveness alignment.

DISCUSSION: ALIGNMENT PREDICTS IS OPERATIONAL CONTRIBUTION

The study supported the expectation that alignment would be positively related to IS operational contribution for analysis and innovativeness alignment when the CEO assessed that contribution. In contrast, when the CIO assessed it, aggressiveness and external defensiveness alignment predicted it. Confirmation of these hypotheses was consistent with the theory that IT strategic alignment facilitates IS contribution to the organization, and particularly at the operational level, because such alignment enables the development of information systems critical to the organization.

Perhaps more interesting than those supported hypotheses are those not supported. For example, failure to support a relationship between internal defensiveness and operational IS contribution when both the CEO and CIO assessed such contribution might have occurred because the IS role in achieving that alignment might be transparent. That is, the contribution might be attributed to the functional department whose internal activities improve as a result of IS. Thus, internal defensiveness would not predict IS contribution to operational efficiency.

Another possibly surprising finding was the negative relationship between proactiveness alignment and IS operational contribution. That might have occurred because the use of IS resources to support the identification of new business opportunities and potential acquisitions (i.e., proactiveness dimension items that might demand data non-existent on current corporate databases) could draw IS resources from operational improvements, thus adversely affecting the IS ability to contribute to operational efficiency. Thus, proactiveness alignment might actually inhibit that contribution.

In addition to the unexpected findings for internal defensiveness and proactiveness alignment, the CEO and CIO results diverged for each of the other dimensions. That is, analysis and innovativeness alignment predicted IS operational contribution when the CEO assessed that contribution ($p < .05$ for both), whereas when the CIO assessed it, alignment for those same dimensions did not predict it. At the same time, external defensiveness and aggressiveness alignment predicted IS operational contribution when the CIO assessed it ($p < .05$ and $p < .01$ respectively), but not when the CEO did.

Analysis alignment (i.e., support for providing detailed facts and figures for decision-making) and innovativeness alignment (i.e., the generation of new solutions for business problems) were perhaps traditional IS responsibilities, whereas external defensiveness alignment (i.e., support for the development of strong customer and supplier relationships) and aggressiveness alignment (i.e., helping the organization stay ahead of the competition and gain market share) represent more contemporary IS responsibilities. Perhaps, in terms of alignment, the CEO perceives IS contribution when IS assumes the traditional alignment role (i.e., supporter of current strategy), whereas the CIO perceives such contribution when IS assumes a more initiating alignment role (i.e., creator of strategy).

DISCUSSION: IS OPERATIONAL PREDICTS IS FINANCIAL CONTRIBUTION

This study supported the expectation that IS operational contribution would predict IS financial contribution. Such support was consistent with the notion that the contribution of IS is first experienced at the operational or process level of an organization and that such contribution positively impacts financial performance.

IMPLICATIONS FOR RESEARCHERS

This study confirmed that CEO/CIO convergence about the role of IT predicted IT strategic alignment for the aggressiveness, analysis, and innovativeness dimensions. These results might stimulate further research about other aspects of CEO/CIO convergence that could influence alignment.

Convergence did not predict alignment for the internal defensiveness, external defensiveness, and proactiveness dimensions. We suggested that convergence between the CIO and other members of the firm's management team, rather than between the CEO and CIO, might be needed to facilitate defensiveness alignment, and that communication between the CEO and CIO about new market opportunities, business ventures, or acquisitions (i.e., proactiveness) might be limited. Further research is needed to test these explanations or identify other reasons for the lack of support.

The study found a negative relationship between the proactiveness dimension and operational IS contribution. We suggested that perhaps the use of IS resources to support proactiveness draws them from operational improvements. Future research is needed to test this explanation or find an alternative.

Internal defensiveness alignment did not predict operational IS contribution when the CEO and CIO assessed such contribution. We speculated that the IS role in achieving that alignment might be transparent and perhaps attributed to the department whose internal activities are improved as a result of IS. Future research is needed to confirm or refute that speculation.

CEO and CIO results diverged for the relationship between the other alignment dimensions and IS operational contribution. We speculated that differences in CEO and CIO perceptions of IS (i.e., traditional versus contemporary) may have been responsible for the divergence. Additional research is needed to test that speculation or identify other reasons for the results.

The study supported the notion that IS operational contribution predicted IS financial contribution. These results might motivate researchers to identify more specific areas in the organization where IT might contribute to operational efficiency. For example, researchers might find that the operational efficiencies from some types of IT applications facilitate greater IS financial contribution than do others.

IMPLICATIONS FOR PRACTITIONERS

CEO/CIO convergence about the role of IT predicted IT strategic alignment for the aggressiveness, analysis, and innovativeness dimensions. Organizations might thus consider providing more chances for CEOs and CIOs to develop mutual understanding about the IT role.

On the other hand, CEO/CIO convergence about the role of IT did not predict IT strategic alignment for the internal defensiveness, external defensiveness, and proactiveness dimensions. Organizations might therefore consider other activities to facilitate alignment in those areas. For example, convergence with other members of the management team might be helpful for internal and external defensiveness alignment. Additionally, rather than simply communicating about the role of IT, CEOs and CIOs might consider communicating specifically about the organization's search for new market opportunities, business ventures, or acquisitions. Such communication might help to enable strategic alignment for proactiveness.

The study found a negative relationship between proactiveness alignment and IS operational contribution. If IS resources are scarce and if heavy IS resources are required for firm operations, then managers might want to be especially cautious about dedicating those resources to organizational activities aimed at helping the firm search for new market opportunities, business ventures, or acquisitions.

Internal defensiveness alignment did not predict IS operational contribution. If the IS role in achieving that alignment is transparent, as suggested herein, IT managers might want to make their contribution to internal defensiveness more visible to the organization.

Finally, the CEO and CIO results diverged for the other dimensions. That is, analysis and innovativeness alignment predicted IS operational contribution when the CEO assessed it, but not when the CIO did so, while external defensiveness and aggressiveness alignment predicted it when the CIO assessed it, but not when the CEO did so. Both the CEO and CIO might benefit from understanding that the other perceives the effect of alignment in a diametrically opposing manner, and therefore might take actions to respond to that difference in perspectives.

CONCLUSION

This study confirmed the impact of CEO and CIO convergence on aggressiveness, analysis, and innovativeness alignment. Such common understanding is deemed a strength because it can enable the organization to link its information technology to business strategy on those three important dimensions. At the same time, the study portrayed the CEO and CIO in great disagreement as to how analysis, innovativeness, external defensiveness, and aggressiveness alignment actually do affect the IS operational contribution. This latter disagreement might reflect a weakness because it can prevent those executives from gaining the greatest possible advantage from their information systems.

REFERENCES

- Armstrong, C. P., and Sambamurthy, V. "Information Technology Assimilation in Firms: The Influence of Senior Leadership and IT Infrastructures," *Information Systems Research* (10:4), Dec 1999, 304-327.
- Barua, A., Kriebel, C.H., and Mukhopadhyay, T. "Information Technologies and Business Value: An Analytic and Empirical Investigation," *Information Systems Research*, (6:1), 1995, 3-23.
- Broadbent, M., and Weill, P. "Improving Business and Information Strategy Alignment: Learning from the Banking Industry," *IBM Systems Journal* (32:1), 1993, 162-179.
- Burn, J.M., and Szeto, C. "A Comparison of the Views of Business and IT Management on Success Factors for Strategic Alignment," *Information & Management* (37:4), 2000, 197-216.
- Chan, Y. E., Huff, S. L., Barclay, D. W., and Copeland, D. G. "Business Strategic Orientation, Information Systems Strategic Orientation, and Strategic Alignment," *Information Systems Research* (8:2), June 1997, 125-150.
- Feeny, D. F., Edwards, B. R., and Simpson, K. M. "Understanding the CEO/CIO Relationship," *MIS Quarterly*, Dec 1992, 435-448.
- Galliers, B. "Information Technology, Management's Boon or Bane?" *Journal of Strategic Information Systems* (1), 1992, 50-56.
- Hatcher, L. *A Step-by-Step Approach to Using the SAS System for Factor Analysis and Structural Equation Modeling*. SAS Institute. Cary: NC, 1994.
- Henderson, J. C., and Venkatraman, N. "Strategic Alignment: Leveraging Information Technology for Transforming Organizations," *IBM Systems Journal* (32:1), 1993, 2-16.
- Karlgaard, R. "CEOs Talk Tech," *Forbes* (172:1), 2003, 33-34.
- Lind, M. R., and Zmud, R. W. "The Influence of a Convergence in Understanding Between Technology Providers and Users on Technology Innovativeness," *Organization Science* (2:2), May 1991, 195-217.
- Mooney, J. G., Gurbaxani, V., and Kraemer, K. L. "A Process Oriented Framework for Assessing the Business Value of Information

- Technology," *Data Base for Advanced Information Systems*, (27:2), 1996, 68-81.
- Premkumar, G., and King, W. R. "An Empirical Assessment of Information Systems Planning and the Role of Information Systems in Organizations," *Journal of Management Information Systems* (9:2), 1992, 99-125.
- Raghunathan, B., Raghunathan, T. S., and Qiang, T. "Dimensionality of the Strategic Grid Framework: The Construct and its Measurement," *Information Systems Research* (10:4), Dec 1999, 343-355.
- Reich, B. H., and Benbasat, I. "Measuring the Linkage Between Business and Information Technology Objectives," *MIS Quarterly* (20:1), 1996, 55-81.
- Reich, B. H., and Benbasat, I. "Factors that Influence the Social Dimension of Alignment Between Business and Information Technology Objectives," *MIS Quarterly* (24:1), Mar 2000, 81-113.
- Ross, J. W. and Weill, P. "Six IT Decisions Your IT People Shouldn't Make," *Harvard Business Review* (80:11), November 2002, 84-91.
- Sabherwal, R., and Chan, Y. E. "Alignment Between Business and IS Strategies: A Study of Prospectors, Analyzers, and Defenders," *Information Systems Research* (12:1), Mar 2001, 11-33.
- Seddon, P. B., Graeser, V., and Willcocks, L. P. "Measuring Organizational IS Effectiveness: An Overview and Update of Senior Management Perspectives," *Database for Advances in Information Systems* (33:2), Spring 2002, 11-28.
- Stepanovich, P. L., and Mueller, J. D. "Mapping Strategic Consensus," *Journal of Business and Management* (8:2), Spring 2002, 147-163.
- Tallon, P. P., Kraemer, K. L., and Gurbaxani, V. "Executives' Perceptions of the Business Value of Information Technology: A Process-Oriented Approach," *Journal of Management Information Systems* (16:4), Spring 2000, 145-173.
- Vedder, R.G., Guynes, C. S. CIOs perspectives on competitive intelligence, *Information Systems Management* (19:4), Fall 2002, 49-55.
- Venkatraman, N. "Strategic Orientation of Business Enterprises," *Management Science* (35:8), August 1989a, 942-962.
- Venkatraman, N. "The Concept of Fit in Strategy Research: Toward Verbal and Statistical Correspondence," *Academy of Management Review* (14:3), 1989b, 423-444.

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