Examining the Role of Knowledge Transfer Effect As a Mediator Variable Among Impact Factors in Knowledge Innovation

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ABSTRACT
To discover the factors that affect organizational outcome of knowledge innovation, the authors explore the relationship among the “knowledge transfer approach,” “active knowledge transfer,” “knowledge transfer effect,” and “knowledge innovation.” Based on statistical analysis and direct regression of data from their 26-item questionnaire administered online in Taiwan, they found that the “knowledge transfer effect” is an important mediator variable among the other three mentioned. Their results also show that, to inspire organizational “knowledge innovation,” it is important to incite an individual’s “active knowledge transfer” behavior, as well as enhance the “knowledge transfer effect.” Their results indicate, furthermore, that organizational knowledge innovation cannot be affected directly by an individual’s knowledge transfer approach and active knowledge transfer.

Keyword: Knowledge transfer approach, active knowledge transfer, knowledge transfer effects, knowledge innovation, mediator
1. INTRODUCTION

In today’s information age, knowledge is considered not only the major power driving economic development, but also the core value of both economics and society [Prahalad and Hamel, 1990; Zuboff, 1996]. There is a close relationship, therefore, between knowledge utility and transfer, and this relationship is a key factor in competition among organizations. Knowledge acquisition and transfer, therefore, have become the prerequisite and foundation of learning and innovation [Nonaka, 1994; Hamel and Prahalad, 1994; Spender and Grant, 1996].

Goodman and Darr [1999] argue that organizational environment and culture are critical factors that affect a person’s willingness to carry out knowledge transfer within an organization. They state, furthermore, that before conducting knowledge management in practice, an organization should create a positive culture in which information sharing is valued and encouraged. Knowledge acquisition and knowledge transfer are the priority conditions and foundations of learning and creativity in knowledge innovation within an organization. Indeed, knowledge transactions and knowledge uses among organizations have become the key point of the knowledge transfer effect. This situation is accomplished in organizations through knowledge transfer by the “best solution and experience transfer” [Szulanski, 1996; p. 29], “product research and development” [Hansen, 1999; p. 91], “learning speed” [Darr, Argote, and Epple, 1995; p. 1753], and “organization survival” [Head, Sorensen, Baum and Preston, 1998; p. 311].

Previous studies focus on knowledge transfer at the individual level within organizations. In many of these studies, a series of informal knowledge transfers among individuals is the key point of organization development and organization outcomes. Since personal social exchange depends on knowledge transfer approaches, studies show that the individual’s motivation for knowledge transfer will be affected by economic mechanisms. Some studies discuss the relationship among “knowledge transfer,” “knowledge management,” and “knowledge innovation in organizations.” Other studies discuss the effect of knowledge transfer on knowledge management and knowledge innovation in organizations. Li and Zhu [2009], for example, point out that knowledge innovation could be accomplished by organizations that enhance the connection and usability among individuals. Osterloh and Frey [2000] found that knowledge transfer is impacted
dramatically by organizations that drive and incite internal dynamics. Certainly, a compact knowledge transfer approach will encourage individuals to engage in knowledge transfer behavior through social networks that involve individual reciprocation and economic mechanisms.

In brief, the current study aims to determine the relationship and its impact among knowledge transfer approaches, active knowledge transfer, knowledge transfer effect, and knowledge innovation, using a research model discussed in the following sections.

2. THEORETICAL BACKGROUND

This section includes a discussion of the theoretical background of knowledge transfer, the knowledge transfer approach, active knowledge transfer, knowledge transfer effects, and knowledge innovation.

2.1. Knowledge Transfer

Nonaka and Takeuchi [1995] divide knowledge into two categories — explicit and tacit. They define explicit knowledge as data, scientific formulas, specifications, instructions, written guidance, manuals, and such, and point out that such knowledge is easy to share, express, and store. They define tacit knowledge, on the other hand, as highly personalized information deriving from a person’s norm, perspective, intuition, or presentiment, and point out that such knowledge is difficult to communicate or imitate and is therefore hard for other persons to comprehend. To define the interaction relationship between explicit knowledge and tacit knowledge during the knowledge transfer process, Nonaka and Takeuchi [1995] proposed the Socialization, Externalization, Combination, and Internalization (SECI) model shown in Figure 1 [Choi and Lee, 2003].

As shown in Figure 1, the SECI model consists of four types of knowledge transfer:

1. **Socialization**: From tacit knowledge to tacit knowledge: Socialization is the process leading from shared experiences to new tacit knowledge. In other words, the new tacit knowledge is established from previous tacit knowledge by the informal exchange of experiences among individuals. This approach, involving what is also called “resonant knowledge,” can enrich the experience and ability of an organization’s members.
2. **Externalization**: From tacit knowledge to explicit knowledge: Externalization is the process of depicting tacit knowledge by appropriate trope, assumption, or simulation and of transferring this tacit knowledge, also called “idealistic knowledge,” to explicit knowledge.

3. **Combination**: From explicit knowledge to explicit knowledge: Combination is the more complicated and systematic process of transferring explicit knowledge among individuals or organizations. Because it involves the concept of forming explicit knowledge through a systematic approach, this type of knowledge is also called “systematization knowledge.”

4. **Internalization**: From explicit knowledge to tacit knowledge: Internalization is the process of transferring explicit knowledge to tacit knowledge through language, description, operation, or explanation. “Learning by doing” is the major concern in this kind of knowledge transfer. The process can be viewed as a cycle to enrich the schemas.
constructed from learning in our brains. Such knowledge is called “operational knowledge.”

Figure 2 shows the continuous process that defines the relationship between explicit knowledge and tacit knowledge – a process that involves alternation, innovation, and transfer, which are exercised spirally. Organizations can improve their innovation ability during the transfer process that is presented by Nonaka [1991, as cited by Hildreth and Kimble, 2002].

![Figure 2. Nonaka’s Spiral of Knowledge](Source: Hildreth and Kimble, 2002)

While team members are discussing and sharing their perspectives and knowledge, especially explicit knowledge, the experience will generate diverse ideas. In the process, a conflict and opinionated situation may emerge. In general, this situation may be regarded as the knowledge innovation process. If individuals can share their tacit knowledge with one another during this process, creative concepts or ideas will emerge.
2.2. Knowledge Transfer Approach

Some scholars point out that the knowledge transfer process is impacted by explicit or tacit knowledge [Kogut and Zander, 1993; Simonin, 1999]. As discussed above, different knowledge attributions can be distributed via different approaches. Following is a summary of a four-step model for organization-internal knowledge transfer, divided into two dimensions: social network connection, and interaction feedback [Hedlund, 1994; Nonaka and Takeuchi, 1995; Gilbert and Gordey-Hayes, 1996; Sveiby, 1997].

1. **Two-way collaborative method**: This means a two-way communication approach is applied and individuals are interacting with one another frequently. Knowledge transfer is accomplished through individual collaboration; hence, personalization strategies will be implemented during the time of knowledge transfer.

2. **One-way teaching method**: This means a one-way communication approach is applied and individuals are interacting with one another frequently. Experience has been inherited through mentoring; meanwhile, personalization strategies will be implemented during the time of transferring knowledge as well.

3. **One-way implement method**: This means a one-way communication approach is applied, but individuals are less interactive. Information is distributed through implements. Further, a systemized implement strategy will be carried out during the time of transferring knowledge.

4. **Two-way implement method**: It means a two-way communication approach is applied, but individuals are less interactive. Information is notified through implements. Moreover, a systemized implement strategy will be carried out during the time of transferring knowledge as well.

Nowadays, internet users communicate and share information via e-mail, MSN, Yahoo messenger, QQ, Skype, and so on. Some organizations deliver information using such free communication software. For this reason, the current study explores how organizational knowledge innovation will be impacted by these diverse information distribution approaches.
2.3. Active Knowledge Transfer

Generally, the knowledge transfer approach depends on the attribution of knowledge. In particular, the degree of tacit knowledge decides the cost of knowledge transfer. Grant [1996] emphasized that knowledge transfer, knowledge accumulation, and knowledge specificity reflect the degree of tacit knowledge. Such knowledge is difficult to expatiate clearly in brief, and substances presented by texts or images are not easily redacted into formal documents or blueprints. Therefore, first, it is necessary to explain the complexity of knowledge. Second, knowledge specificity systematically comprises various domains highly connected with schemas. Besides, knowledge is hard to reuse, and it is not easy to teach new workers about learning know-how [Marcus, 2001]. Knowledge consists of explicit knowledge and tacit knowledge, and different knowledge attributions will be distributed via different approaches [Howells, 1996]. Finally, documents are a common inter-medium of knowledge transfer in organizations [Nonaka, 1994].

Some tacit knowledge, however, is difficult to document, file, or write – for example, personal beliefs, individual experiences, or the core values of a leader. On the other hand, particular organizational cultures or operation processes are diverse and complicated. Examples include research and development of main products, application of creative marketing strategies, use of innovative management strategies, and employees’ training and education. Tacit knowledge, which continues to change according to our environment or trends, is difficult to describe in texts or to share with other people. Such barriers increase the difficulties of knowledge transfer [Zander and Kogut, 1995]. Compared with explicit knowledge, tacit knowledge depends on active knowledge transfer within organizations to accumulate knowledge resources through encouragement of individual knowledge transfer or information shared [Leonard-Barton and Sensiper, 1998]. Evidence supports the fact that knowledge – especially the tacit-articulated dimension of knowledge – will be impacted by the knowledge transfer approach [Szulanski, 1996; Zander, 1991]. From the above discussion, we hypothesize:

\[ H1: \text{Knowledge transfer approach will positively affect employees' active knowledge transfer.} \]
2.4. Knowledge Transfer Effects

Knowledge attained from one’s work experience accumulates as the person ages. In this way, tacit knowledge becomes the core property of an organization. Hidding and Shireen [1998] argue that, if knowledge is stored only in an individual’s brain without being shared, such knowledge cannot be used and therefore loses its value to society. The fact is that knowledge can be used like a renewable resource and can thus be duplicated. Knowledge can be enriched through the knowledge interaction process and through feedback to an organizational system or operation process. This condition will enhance knowledge value dramatically and improve personal productivity and efficiency in a way that can benefit the organization and create high competitiveness.

The distribution will be impacted by the cost and barrier of transferring tacit knowledge. In addition, because the cost and barriers associated with the transfer of explicit knowledge are greater than those associated with tacit knowledge, members of organizations are often unwilling to engage in knowledge transfer [Nonaka and Takeuchi, 1995]. The absorption of individual knowledge, however, relies on the accumulated knowledge of an individual and the effectiveness of knowledge transfer [Cohen and Levinthal, 1990]. In general, the knowledge transfer process can establish specific core competency, enhance individual’s competitiveness, and affect organizational knowledge innovation. From the above discussion, therefore, we hypothesize:

\[H2: \text{Knowledge transfer approach will positively affect knowledge transfer effect.}\]

\[H3: \text{Active knowledge transfer will positively affect knowledge transfer effect.}\]

2.5. Knowledge Innovation

Knowledge innovation consists of innovations in concept, technique, system, management, culture, and so on. Concept innovation is one of the foundations of knowledge innovation since it leads decisions and execution of an organization. Knowledge innovation strongly supports technique development, and technique relies strongly on knowledge innovation.

Management innovation strongly affects knowledge innovation in that each executive officer seeks concrete effectiveness and systematic operations.
Furthermore, executive officers conduct leadership and collaboration through management innovation in order to obtain excellent performance during the knowledge transfer process [Chivu and Popescu, 2008]. The transfer from tacit knowledge to explicit knowledge becomes the initial model of knowledge innovation. Researchers have proved that active knowledge-sharing behaviors are important to an organization and its knowledge innovation [Lin, 2007]. In addition, the literature supports the fact that an organization’s knowledge innovation outcome is associated with the consequence of knowledge transfer by organization members [Adams et al., 1998; Cavusgil, Calantone, and Zhao, 2003]. The current study, therefore, assumes that the knowledge transfer approach, active knowledge transfer, and knowledge transfer effect are associated with organizational knowledge innovation.

\[ H4: \text{Knowledge transfer approach will positively affect organizational knowledge innovation}. \]

\[ H5: \text{Active knowledge transfer will positively affect organizational knowledge innovation}. \]

\[ H6: \text{Knowledge transfer effect will positively affect organizational knowledge innovation}. \]

3. RESEARCH DESIGN

This section describes the research framework and procedures, discusses development of the questionnaire and online survey, and presents an analysis of the data.

3.1. Research Framework

In keeping with the purpose of this study, a hypothesis model was developed, as shown in Figure 3. This model consists of four dimensions—namely, “knowledge transfer approach,” “active knowledge transfer,” “knowledge transfer effect,” and “knowledge innovation.” Each hypothesis path was established based on the literature review discussed in Section 2. The hypotheses paths were tested by statistical analysis described in Section 4.
3.2. Research Procedure

Figure 4 shows the research procedure used in this study.

Figure 4. Research Procedure for Current Study
The following questions were considered in developing the research procedure:

- What factors impacting knowledge innovation motivate us first?
- How do individuals transfer their knowledge actively?
- What approaches are used by individuals to transfer their knowledge?

The study questionnaire was developed, based on a review of related literature pertaining to knowledge transfer, knowledge management, and knowledge innovation. The convenience sampling approach was used for the survey. After the survey data was collected, a statistical process was used to analyze the information. Some conclusions and suggestions were made, as indicated in the discussion of research findings.

3.3. Questionnaire Development

A 26-item research questionnaire was developed, based on the review of literature regarding knowledge transfer, knowledge management, and knowledge innovation. The questionnaire consisted of four dimensions: knowledge transfer factor, active knowledge transfer factor, knowledge transfer effect, and knowledge innovation. Each domain consisted of five items. Those items were retrieved from Li and Zhu’s [2009] study. The knowledge innovation domain consisted of 12 items that were retrieved from Hsiao’s [2008] research as to knowledge innovation in organizations. The back-translation approach was used to establish validity of the research tool through the Teachers of English to Speakers of Other Languages (TESOL) Masters’ assistance. The assistance was considered in order to avoid a neutral answer that might influence the data analysis. A six-point Likert scale was used in the questionnaire: i.e.,

- “Absolutely Disagree” 1 point
- “Strongly Disagree” 2
- “Disagree” 3
- “Agree” 4
- “Strongly Agree” 5
- “Absolutely Agree” 6 points

Reliability

Table 1 shows reliability coefficients of the research tool in each dimension from 0.878 to 0.948, which indicates a high reliability.
Validity
Explore factor analysis (EFA) was used to demonstrate validity of the research tool. The analysis result shows that the KMO value was 0.892 and passed the required standard [Wu, 2006]. Bartlett test showing df was 325, and the chi-square was 1963.450 (p<0.001). The results showing the scale indicated it was appropriate to do factor analysis [Wu, 2006]. The factor analysis presented four factors, and its accumulated explained variance was 69.373%. The explained variance of each factor was as follows:

- “Knowledge transfer approach” 12.878%
- “Active knowledge transfer” 15.148%
- “Knowledge transfer effect” 27.120%
- “Knowledge innovation” 13.147%

The analysis results supported the construct validity of the research tool.

3.4. Online Survey
For purposes of efficiency and time, Google DOC was used to develop the 26-item questionnaire. The Web questionnaire was intended for informed samples, who could give their responses via the Internet from October 30, 2010, to November 20, 2010.

3.5. Data Analysis
Descriptive statistical analysis was used to analyze the demographic variables of the samples. Moreover, items were averaged in each factor and then factor means were put into direct regression analysis to carry out path analysis for testing the hypotheses. The results of the analysis are discussed in the following section.
4. **ANALYSIS RESULTS**

Analysis results are discussed in this section with regard to participants’ background, correlations among factors, the hypotheses test, and the mediator variable test.

4.1. **Participants’ Background**

The data for this study was gathered from 84 professional workers at Taiwanese companies. Those workers were asked serial questions regarding their background and career seniority. The average age of the responders was 33, and males (67.9%) were majority (female is 32.1%). Most had either a bachelor’s or master’s degree (61.9%). The main fields of specialization were engineers (44.0%) and MIS specialists (29.8%). With regard to seniority, most participants (46.6%) had 1 to 3 years’ experience. The average size of the organization that employed them was around 200 employees. The detailed results are shown in Table 2.

4.2. **Correlations Among Factors**

Table 3 shows correlations among factors, indicating a high positive correlation among the knowledge transfer approach, active knowledge transfer, knowledge transfer effect, and knowledge innovation.

4.3. **Hypotheses Test**

Figure 5 shows the hypothesis test results. The results show that:

- The “knowledge transfer approach” can predict “active knowledge transfer” positively ($\beta=0.71; p<0.001$).
- The “knowledge transfer approach” can predict the “knowledge transfer effect” positively ($\beta=0.43; p<0.001$).
- The “active knowledge transfer” can predict the “knowledge transfer effect” positively ($\beta=0.32; p<0.001$).
- The “knowledge transfer effect” can predict the “knowledge innovation” positively ($\beta=0.38; p<0.001$), as well.

Two paths, however, were rejected: from the “active knowledge transfer” to the “knowledge innovation” ($\beta=.17; p>0.05$), and from the “knowledge transfer approach” to the “knowledge innovation” ($\beta=.21; p>0.05$).
Table 2
Descriptive Statistical Summary of Demographic Variables
\( (N=84) \)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Group</th>
<th>Number</th>
<th>Percentage</th>
<th>Missing Value</th>
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</thead>
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<td>Gender</td>
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<td>32.1</td>
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<td></td>
<td>Male</td>
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<tr>
<td>Age</td>
<td>Under 22</td>
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<td>0</td>
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<tr>
<td></td>
<td>23-29</td>
<td>21</td>
<td>25</td>
<td></td>
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<td></td>
<td>30-36</td>
<td>51</td>
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<td></td>
<td>37-43</td>
<td>7</td>
<td>8.3</td>
<td></td>
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<tr>
<td></td>
<td>Over 44</td>
<td>2</td>
<td>2.4</td>
<td></td>
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<td>Education</td>
<td>High school or under</td>
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<td></td>
<td>Associate Bachelor</td>
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<td>Doctoral Degree</td>
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<td></td>
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<tr>
<td>Specialization</td>
<td>Frontline worker</td>
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<td>9.5</td>
<td>0</td>
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<td></td>
<td>Frontline supervisor</td>
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<td></td>
<td>Engineer</td>
<td>37</td>
<td>44.0</td>
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<td></td>
<td>MIS specialist</td>
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<td>29.8</td>
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<td></td>
<td>Mid-level Manager</td>
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<tr>
<td></td>
<td>Top-level Manager</td>
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<td>2.4</td>
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<td>4-5 years</td>
<td>29</td>
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<td></td>
<td>16-20 years</td>
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<td></td>
<td>More than 21 years</td>
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<td>Organization scale</td>
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<td>11-30</td>
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<td>17</td>
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<td></td>
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<td>25.0</td>
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Table 3
Correlation Coefficient Summary of Factors
(N=84)

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<th>KTA</th>
<th>AKT</th>
<th>KTE</th>
<th>KI</th>
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<tr>
<td>KTA</td>
<td>—</td>
<td></td>
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<tr>
<td>AKT</td>
<td>0.707**</td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KTE</td>
<td>0.660**</td>
<td>0.629**</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>KI</td>
<td>0.583**</td>
<td>0.558**</td>
<td>0.625**</td>
<td>—</td>
</tr>
</tbody>
</table>

*KTA=Knowledge transfer approach
AKT=Active knowledge transfer
KTE=Knowledge transfer effect
KI=Knowledge innovation
‘—’=1.0
** p<0.01

Figure 5. Hypotheses Test Results
4.4. Mediator Variable Test

The rejected paths were removed, and the model was re-calculated as shown in Figure 6. The results of the path analysis proved:

- The standard regression parameter of the “knowledge transfer approach” to the “active knowledge transfer” was $\beta=0.71$ (p<0.001).
- The standard regression parameter of the “knowledge transfer approach” to the “knowledge transfer effect” was $\beta=0.43$ (p<0.001).
- The standard regression parameter of the “active knowledge transfer” to the “knowledge transfer effect” was $\beta=0.32$ (p<.001).
- The standard regression parameter of the “knowledge transfer effect” to the “knowledge innovation” was $\beta=0.63$ (p<0.001).

The Sobel test was used to test the mediator variables, and the result supports the fact that “knowledge transfer effect” is an important mediator variable among the “knowledge transfer approach,” “active knowledge transfer,” and “knowledge innovation.” (The Sobel test statistic = 3.973; p<0.001.)

![Figure 6. Mediator Variable Test](image-url)
5. CONCLUSIONS AND SUGGESTIONS

Based on the research findings of this study, two conclusions were reached:

1. The research tool had highly reliability and validity and can therefore accurately predict “knowledge transfer approach,” “active knowledge transfer,” “knowledge transfer effect,” and “knowledge innovation” within organizations.

2. The regression model supports the fact that “knowledge transfer effect” is an important mediator variable among “knowledge transfer approach,” “active knowledge transfer,” and “knowledge innovation.” Briefly, in promoting knowledge innovation in an organization, it is necessary to set up the knowledge transfer approach openly and to drive individuals’ active knowledge transfer through useful motivation and reward. In this way, the knowledge transfer effect will occur accordingly.

Following are some suggestions regarding future research on this important topic:

1. The number of research samples should be increased to more than 1,000 in order to establish a norm for Taiwan.

2. A convenience sample was used in the current study, but we suggest that new surveys should seek the support of famous enterprises to test the accurateness of research tools.

3. Cross-sample validation should be conducted via structural equation modeling by multi-nation samples to establish the cross-validation globally.

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