



Perceived Cost of New Technology Adoption: Scale Development in the Context of Chinese Textile and Apparel Firm Managers

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The textile and apparel (T&A) industry has been fundamentally changed due to technology development. However, the rates of new technology adoption vary (Wang & Ha-Brookshire, 2018). Labor-intensive T&A activities, rather than technology-intensive, are more prevalent in developing countries (Stone & Farnan, 2018), while technology-intensive activities are in developed countries. Why firms in developing country have limited motivation for technical upgrades and what restrain their motivation are worth to study. Industry practitioners point out that the development of the T&A industry in developing country (e.g., China) is low cost-driven (Sun, 2017). Thus, a low cost in new technology adoption would lead to a high motivation to adopt new technologies. However, there is limited scale to measure firm managers' perceived cost of new technology adoption.

To build a valid scale of perceived cost possessed by decision makers of technology adoption in Chinese T&A firms, a scale development process using the psychometric method, namely Item Response Theory (IRT), was conducted. First, initial item bank of perceived cost was generated from the framework of expectancy-value theory (Eccles et al., 1983), diffusion of innovation (Rogers, 2003) and technology acceptance model (Davis, 1989). Items that have the potential to measure perceived cost were identified. Here, perceived cost is defined as the loss, suffering and effort given due to technology adoption (Eccles et al., 1983). A total of 41 items were included in the initial item bank representing three dimensions: effort cost (i.e., amount of effort given), opportunity cost (i.e., loss that adopting new technology prevents doing other valued activities), and psychological cost (i.e., mental suffering related to technology adoption).

Second, a series of qualitative sub-phases were conducted to organize and evaluate the items in initial item bank, including binning, winnowing, content expert validation, item revisions, and cognitive interviews (Revicki, Chen, & Tucker, 2014). In binning and winnowing process, items were systematically grouped (or binned), and items that were inconsistent with construct definitions or redundant in nature, were removed (or winnowed), resulting in 29 items left in the item bank. Next, 9 Chinese firm managers, who work in various T&A firms and have authority in the decision-making process of new technology adoption, were interviewed for content expert validation. They were asked about their perceptions regarding items' representability with real-life experiences, wording and vocabulary, and redundancy and missing in the item bank. As a result, a total of 18 items were left in the item bank. Given the initial items were in English, at this stage, all items were translated into Chinese for the participants' easy understanding in this

step. Next, all items were revised to four-point Likert style following IRT suggestion (Dalal, Carter, & Lake, 2014). Finally, 10 Chinese T&A firm managers were recruited in the cognitive interviews and asked to complete the survey questionnaire constructed by all perceived cost items. Their feedback of the questionnaire concluded that the overall items and survey design were clear and understandable, and the instruction of survey was considered appropriate and adequate. No major changes were made.

Third, a psychometric evaluation process was conducted to empirically test and evaluate the psychometric properties of the developed scale of perceived cost. A total of 2,147 Chinese T&A firm managers from various firm types were invited to finish the online research survey in January 2019, and 599 participants completed the survey within one month. The response rate was 27.9%. The graded response model was used to estimate item parameters within IRT analysis (Samejima, 1969). IRT assumptions, IRT model and item parameters, model fit, reliability, test-fairness and construct validity were assessed. Initial IRT analysis showed that two IRT assumptions— unidimensionality and local independence, were not met, indicating high correlation existed among items measuring other concepts rather than perceived cost. Thus, item pair with highest local dependence were flagged. Flagged item which had unacceptable item parameters or cross-loading on multiple dimensions, were deleted from the item pair. Then, IRT assumptions and model fit were checked again on the altered scale and identified local dependence item was deleted from the scale, again. This process iteratively repeated 10 times, until all IRT assumptions were met, resulting in the 8-item scale. The model fit for final scale was acceptable ($df(4) = 6.77, p = .19; RMSEA = .03, CFI = .97$). IRT parameters indicated a good discrimination ability of the scale. Reliability test showed that the final scale was reliable for measuring firm managers' perceived cost ranging from -2 to +2 standard deviation below and above average level, with Cronbach's alpha .85. Test-fairness test showed that final scale would generate similar results for managers with different age, gender, and from different firm types. Construct validity test showed significant association between the overall scores of perceived cost items and motivation to adopt new technology ($r = -.18, p < .01$). Final scale is shown in Table 1.

Table 1 Final scale of perceived cost of new technology adoption

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1. Adopting new technology demands too much of time. 采纳新技术需要大量的时间。
 2. Adopting new technology means too much of work. 采纳新技术意味着大量的工作。
 3. Adopting new technology demands too much of money. 采纳新技术需要大量的资金。
 4. It is hard to see the return in a short time when adopt new technology. 采纳新技术短期内很难看到回报。
 5. Adopting new technology will take time away from other activities my firm wants to pursue. 采纳新技术将挤占公司其他活动上的时间。
 6. I worry that my firm will waste money if the technology will be only used for a short time. 我担心如果新技术只能使用较短时间的话, 公司会浪费资金。
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7. I am concerned that people in my firm would not be able to handle the stress that working with new technology. 我担心公司内人员难以承担用新技术进行工作所带来的压力。

8. Adopting new technology is emotionally draining. 采纳新技术让人心力交瘁。

Note: both English version and Chinese version item provided; Chinese version used in IRT test.

The study created a reliable and valid scale to measure firm managers' perceived cost of new technology adoption, filling the critical gap in the literature. In this scale, money (item 3), time (item 1), workload (item 2), employees' and managers' mental pressure (items 6,7, and 8) related to new technology adoption were highlighted. Specifically, the discussion of return on technology investment (item 4) suggested new technologies with short time investment but quick time return would be preferable, and the discussion of pressure of working with new technology (items 6, 7, and 8) implied that accessible training and friendly technology-user interaction might be more effective in reducing perceived cost. Government could also make motivation plans based on these perceived cost concerns to help decrease the perceived cost of adopting new technology by the T&A firms.

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