TASK-TECHNOLOGY FIT FOR LOW-LITERATE CONSUMERS: IMPLICATIONS FOR IS INNOVATIONS IN THE DEVELOPING REGIONS

Research-in-Progress

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Abstract

More consumers in developing regions are using information systems (IS) to facilitate their work and increase productivity. This may imply that more low-literate populations in society are becoming the next billion IS consumers. Yet, how to adapt past IS literature in high-literate context to guide IS designs for low-literate consumers remains a gap. The current study, therefore, aims to apply and extend task-technology fit framework to investigate how IS can be designed to meet the needs and mitigate the constraints of low-literate consumers. Due to the novelty and complexity of the foci phenomenon, a mixed-method approach was adopted to gain in-depth understanding of the proposed research framework. The current paper is a research in progress that aims to make several major theoretical and practical contributions to the social innovation and IS design fields.

Keywords: Low-literate consumer, task-technology fit, media dependence, IS innovation

Introduction

Consumers in developing regions have escalated concerns about information system (IS) innovations to empower their productivity and profitability (Majchrzak et al. 2013). IS innovation is the process of creating, implementing and adapting new information systems to meet the need of a foci marketplace. While most IS innovation researchers concerned about the needs of privileged consumers, a large portion of consumers in the developing regions have been neglected for a long period. This portion of population is gradually being able to access and benefit from cost-effective information technologies, such as mobile information services (Chang et al. 2011; Deng et al. 2012). How to improve their productivity and profitability through successful IS innovations is thus warrant attention.

It has been widely proved that individual performance and dependence on an information system is closely related to its degree of task-technology fit (TTF) (e.g., Adipat et al. 2011; Goodhue and Thompson 1995; Junglas et al. 2008). TTF refers to the degree to which the design of a technology meets an individual's demand in performing his or her portfolio of tasks. The design of technology varies with different function or form design (Wong 1972). The demand of user task varies with different goals, complexity, or time criticality. These two aspects collectively influence the degree of TTF. However, the TTF literature mainly caters to the needs of privileged consumers in organizations, yet few implications exist on how to achieve the fit between technology and task while considering consumers' constraints.

Among these constraints, literacy is a critical one that has been overlooked in previous IS research (Wallendorf 2001). It reflects the ability to use reading, writing or related skills to accomplish daily tasks within a specific work context (Adkins and Ozanne 2005), which may affect consumer behaviors such as cognitive predilections, decision strategies, coping behaviors, or relational exchange norms (e.g., Deng et al. 2012; Goody 1999; Viswanathan et al. 2005). Consumers in the developing regions have comparatively lower literacy level than those in developed regions (Deng et al. 2012; Windham 1999). In this study, we scoped our research targets as low-literate consumers in the developing regions, such as farmers, free traders, labors, etc. The questions arose: will the literacy constraints influence the fit between technology design and task demand? If yes, how to mitigate the literacy impacts?

Our objective is to explore how TTF can be better achieved to enhance the performance improvement brought by information systems. Specifically, we aim to investigate (1) how the function and form of information systems could be designed to meet the demand of tasks while mitigating consumers' literacy constraints, (2) how the degree of fit predicts low-literate consumers' dependence on information systems and (3) how the degree of fit and dependence influence work performance of low-literate consumers. Given that low-literate consumers are a relatively new user group in IS research, we adopt a mixed-method approach with both interview and field survey to offer a rich understanding of them.

This study makes several major contributions. In theory, the majority of IS researchers assume that users are literate, while our study expand the user group to low-literate consumers. First, the study extends the literature of TTF from high-literate employees in organizations to low-literate consumers in communities, opening the black box of TTF by incorporating the context-specific antecedents. Second, we conceptualize and evaluate a key IS innovation success indicator - dependence on information systems. Third, we investigate the novel yet valuable phenomenon with a flexible approach using multiple comprehensive methodologies. In practice, our study mainly aims to provide guidelines for researchers and practitioners who devote to IS innovations for consumers in the developing regions.

Literature Review

In this section, we first discuss the scope of literacy, clarify the difference between low-literate and novice, and analyze low-literate consumers based on related works. We then present our theoretical lens of task-technology fit (TTF). After the review and evaluation of TTF literature, we summarize our visions and missions. In the last part, we elucidate two dependent variables: the IS dependence and the performance impacts.

Background: Low-Literate Consumers

The United Nations educational, scientific and cultural organization (UNESCO) defines literacy as the "ability to identify, understand, interpret, create, communicate and compute, using printed and written materials associated with varying contexts. It involves a continuum of learning in enabling individuals to achieve their goals, to develop their knowledge and potential, and to participate fully in their community and wider society" (Sector 2004). Given the previous definitions, we conceptualized a broad view of literacy with two dimensions: basic literacy (e.g., years of schooling, reading and writing skills) and functional literacy (e.g., domain task skills, IT skills) (Wallendorf 2001).

Low-literate consumer generally refers to people with less years of schooling or has difficulties in reading, writing or functional skills. Low-literate consumers are different from novice consumers. The latter refers to people who have less experience (i.e. length, frequency or breadth of usage) with a new technology but will gradually master it after a certain amount of practice (Fisher 1991). However, the constraints caused by literacy are hard to mitigate unless through a series of literacy training programs which will take years to obtain (Semali 1999). Thus, it is important to design suitable information technologies (e.g., Deng and Chang 2012; Kodagoda and Wong 2008; Medhi et al. 2011; Summers and Summers 2005) that can reduce literacy requirements, or in other words, have higher tolerance on limited literacy skills.

Despite the comparatively scarcity of low-literate consumer research in the IS literature, we referred to several studies in the marketing, consumer research and human-computer interaction (HCI) literature. A qualitative study reported that the stigma of lower literacy was a burden to the marketplace activities, which evoked market coping strategies that used personal, situational, and social resources (Adkins and Ozanne 2005). Another study found that low-literate consumers prefer concrete reasoning, pictographic thinking, single attribute decisions, risk avoidance, and problem and emotion focused (Viswanathan et al. 2005). By incorporating these characteristics into IS design, Medhi (2011) conducted a series of studies with novice and low-literate users in rural India and identified a list of design guidance, including the provision of graphic cues, voice annotations, and local language support, as well as avoiding complex navigation and inputs.

To summarize, there are three literacy impacts that should be considered for IS design: (1) low risk or error tolerance due to the stigma burden caused by insufficient education, (2) pictorial thinking due to limited skills with reading and writing, (3) low tolerance on redundant functions or data due to the limited experience with IS. The next question to address is: how shall we design appropriate IS to meet their needs and mitigate the specific literacy constraints with them? Our strategy to this issue is twofold: tracing back to one of the early theories that guide the IS design for high-literate consumers, and applying it by incorporating the needs and constraints specific to low-literate consumers.

Theoretical Lens: Task-Technology Fit

Among the early theories, task-technology fit is one of the most reputable ones that guide IS design. It is a critical predictor of individual performance and IS success since it reflects the degree to which a technology assists an individual in performing his or her portfolio of tasks (Goodhue and Thompson 1995). Several early IS researchers proposed that user performance depends on the correspondence between the functionality of information systems and the task requirements of users (e.g., Benbasat and Dexter 1986; Goodhue 1998; Hollingshead et al. 1993). An early empirical study by Goodhue and Thompson (1995) reported that user evaluation of TTF was a function of both system characteristics and task characteristics, and both TTF and system utilization rate were needed to predict individual performance.

With an in-depth review of Goodhue and Thompson (1995), we identify three major limitations. First, they evaluated technology characteristics by two functional factors - the particular system used and the user department, instead of the form design of IS. Adapting from Wong's (1972) two-dimensional design principle, both the function design (e.g., what content does it provide?) and the form design (e.g., how does it deliver the content?) are complementary dimensions of technology characteristics. Thus they called for further development of measureable dimensions for evaluating technology characteristics. Second, they evaluated task characteristics by three task specific factors (i.e. non-routineness, interdependence and job title), neglecting the use context, such as the mobility of users or environmental constraints. Third, despite the discussion of individual characteristics (e.g., training, computer experience, motivation, etc.), they are ignored in the reduced model evaluation. The assumption may be that

employees in organizations share similar training, experience and motivation. Yet, situations will be different if their model is applied to a different portion of populations in the society where individual needs and constraints vary from each other.

To extend the early findings and address their limitations, the TTF literature went into different streams of research. One common stream is the application of TTF to the research of group-level information systems (e.g., Dennis and Carte 1998; Maruping and Agarwal 2004; Tan et al. 1999; Zigurs and Buckland 1998), which is beyond the scope of the current study. In line with the individual-level IS research, the second main stream of research is to apply the rationale of fit between task and technology to investigate the effectiveness of human computer interaction (HCI) designs. For example, information presentation studies reported a significant moderating effect of task complexity on the effectiveness of various presentation formats or structures (e.g., Adipat et al. 2011; Jiang and Benbasat 2007; Lee et al. 2012). Researchers in the visualization field also emphasized the importance of the match between data visualization approach and task taxonomy (e.g., Card 2007; Shneiderman 1996). By investigating the fit between task demand and specific HCI components (e.g., data presentation, structure, or visualization), this stream of research opened the black box of form design for information systems.

Another stream of research is to apply the principle of TTF to guide and evaluate the design of mobile information systems. Junglas et al. (2008) conducted a wireless laboratory experiment to evaluate the fit between task location sensitivity and mobile technology locatability. They found that ideal-fit conditions (i.e. location sensitive task with locatable technology, and location insensitive task with non-locatable technology) outperform under-fit conditions (i.e. location sensitive task with non-locatable technology) in terms of individual performance, but did not reveal the same discrepancy between ideal- and over-fit condition (i.e. location insensitive task with locatable technology). Gebauer and Ginsburg (2009) proposed three dimensions of task-technology fit for mobile technology: task-related fit, context-related fit, and technology performance. Their follow-up study proposed four functionalities of mobile technologies based on the service functionality and direction: notification, communication, information access and data processing (Gebauer et al. 2010). This stream of research extended the TTF literature by investigating both function and form design of mobile technologies and the corresponding task context. A crucial limitation is the lack of empirical user evaluation of the fit model.

The above two streams of TTF research partially addressed the first two limitations regarding the technology characteristics and task use context. However, two gaps still remain inconclusive or open. First, the details of technology characteristics and how they correspond with task needs and context are still open for further exploration. Second, few studies explored the impact of individual characteristics, and particularly user constraints, on user evaluation of TTF and technology performance. To close the two gaps, this study proposes a systematical framework to investigating the task-technology fit for low-literate consumers. The investigation is based on in-depth analysis of three related antecedents: the function and form design of information systems, the task demand and use context, and literacy-related individual constraints. The objective of investigating task-technology fit is to ensure the success of IS innovation, the indicators of which are briefed in the following sub-section.

Dependent Variables: IS Dependence and Performance Impact

We conceptualize **IS dependence** as a novel indicator of IS success. It refers to the degree to which an individual depends on information systems as his or her work facilitator. This concept is adapted from Sparrow and colleagues (2011) who proposed that Internet has become a primary form of external memory, where information is stored collectively outside human memories. Their psychology experiments showed that: (1) people intuitively think of seeking knowledge from computer when needed; (2) people tend to remember information that they think will not be available, while forget information they think will be available; and (3) people seem better able to remember the location of information rather than the content itself, which is the evidence of computer dependence as an external memory. Another indicator of IS success is **performance impact**. In this study, it refers to the accomplishment of a portfolio of daily tasks with the help of IS by a low-literate consumer.

Given upon the above review, the success of IS are twofold: enhancing consumers' dependence on IS and improving work performance. In turn, the dependence and performance requires the information systems equipped with a good fit between technology design, task demand and user constraints. One special note regarding IS dependence is that excessive dependence, also known as addiction (Turel and Serenko 2010),

is beyond the scope of the current research context. As the penetration of IS is low among low-literate consumers, enhancing their dependence on IS will seldom result into addiction or other negative effect at the current stage. As such, we still treat IS dependence as a key success factor in the context of IS innovation for low-literate consumers.

Research Model and Hypotheses

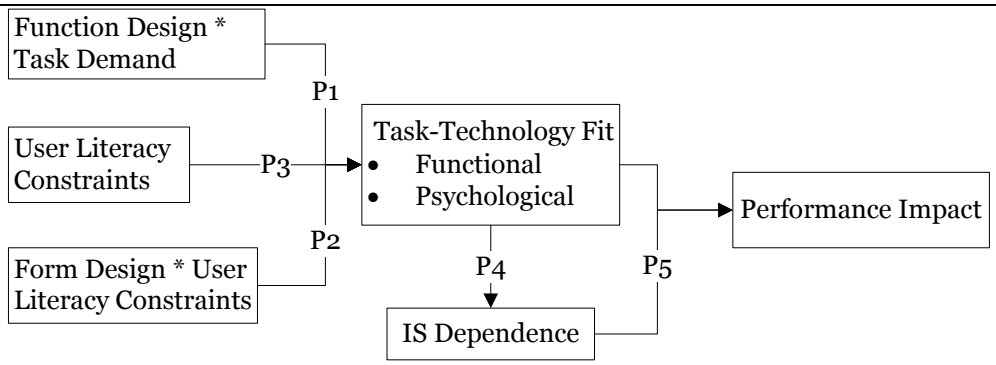

Figure 1. Research Framework

Figure 1 shows our proposed framework for understanding the TTF for low-literate consumers at the individual level. The major features and propositions of the framework are described below. **Tasks** are broadly defined as the actions carried out by individuals in turning inputs into outputs (Goodhue and Thompson 1995). Particularly, the task refers to IS-mediated daily tasks in this study. Task demands focus on those that might move an individual to rely more heavily on certain aspects of the IS. For example, the demand to seek product price distributions would move individuals to depend more heavily upon an information system's capacity to analyze and visualize data. **User** literacy constraints are defined as the difficulties in accomplishing a task which is caused by the level of literacy. For example, users who have difficulty with writing would not be able to interact with information systems that require complex text entry (Jae et al. 2011).

Technologies refer to the IS tools used by individuals in carrying out their daily tasks (Goodhue and Thompson 1995). We viewed the characteristics of technology from both the function and form design perspectives (Wong 1972). Function design refers to a focus on function rather than aesthetics, a concern with objectives rather than components. Form design focuses more on the user interface components. Both of the two dimensions may influence the experience of IS usage. **TTF** is the degree to which a technology assists an individual in performing his or her tasks portfolio. The correspondence between task, user and technology is often categorized into three fit conditions: under-, ideal-, and over-fit (e.g., Junglas et al. 2008). Some examples for the three fit conditions are presented in Table 1.

Table 1. Conceptual Task-Technology-User Combinations and Their Fit (Examples)

Example	Under-Fit	Ideal-Fit	Over-Fit
#1	Non-routine task with linear navigation structure.	Routine task with linear navigation structure. Non-routine task with parallel navigation structure.	Routine task with parallel navigation structure.
#2	High-interdependent task with one-way interaction.	High-interdependent task with two-way interaction. Low-interdependent task with one-way interaction.	Low-interdependent task with two-way interaction.

#3	Command selection for high-literate users.	Command selection for low-literate users. Test entry for high-literate users.	Text entry for low-literate users.

The Antecedents of TTF are the interactions between task, technology and user. Certain kinds of task require certain kinds of function and form design of technology, and certain constraints with users must considered as well (refer to ideal-fit examples in Table1). The evaluation of TTF focuses either on its functional or psychological satisfaction. As noted earlier, the function design of an IS focuses more on the functionality of it, thus it is supposed to affect more on the functional dimension of TTF. To increase a consumer's functional satisfaction with an information system, a better alignment between function design and task demand is critical. As the misalignment between the function design and task demand increases, chances are that the information system cannot fulfill consumers' requirements. Similarly, the form design which focuses on the usability of user interface will have more impact on the psychological evaluation of TTF. Psychologically satisfied user interface should be able to tolerate the constraints of users. Therefore, to increase a consumer's psychological satisfaction with an information system, a better alignment between form design and user literacy constraints is critical. In summary, we propose that

> *Proposition 1: An individual's functional evaluation of an information system's task-technology fit will be increased when its function design better addressed task demand (i.e. ideal-fit between function design and task demand).*
>
> *Proposition 2: User's psychological evaluation of an information system's task-technology fit will be increased when its form design better mitigated user constraints (i.e. ideal-fit between form design and user literacy constraints).*

In terms of the three fit conditions, previous studies supported the superiority of ideal- over under- but not over-fit conditions (Junglas et al. 2008). This result seems reasonable as their subjects are university students, a typical highly-educated population. Subjects' high tolerance of overwhelming information or function is one of the explanations for the good performance of over-fit situation. However, different from the highly-educated subjects, low-literate consumers may not have such tolerance of extra information or function (Summers and Summers 2005; Viswanathan et al. 2005). For instance, previous studies reported that the low-literate consumers have heavy reliance on pictorial information and would be easily overloaded by large volume or multiple formats of information (Jae and Viswanathan 2012; Viswanathan et al. 2009). Considering the low-literate impacts as noted earlier, we propose that

> *Proposition 3: For users with low literacy, the overall user evaluation on the ideal-fit condition is higher than both under- and over- fit conditions.*

The Impact of TTF on IS dependence is shown via the links between task-technology fit and three innovation resistance mechanisms proposed by Ram and Sheth (1989): usage, value and risk. Specifically, the level of TTF influences individuals' beliefs in the technology's compatibility with existing workflows, practices, or habits. It also predicts individual's attitudes on an information system's performance-to-price value. Lastly, it may reflect an individual's perceived risks with an information system, either physical, economic, functional or social risk (Laukkanen et al. 2007; Ram and Sheth 1989). These three mechanisms are important determinants of whether an information system is believed to be more specialized in its capability, more credible in its service, or easier to coordinate with. All of these related constructs have been shown to predict the individuals' dependence on their external memories (refer to literature on transactive memory, e.g., Lewis 2004; Moreland 2006). The following proposition is based on two important assumptions. First, TTF will strongly influence user beliefs on the usage, value and risk of an information system. Second, these user beliefs will have an effect on user dependence on it as external memory storage.

> *Proposition 4: User evaluation of an information system's task-technology fit will positively influence the dependence on it as an external memory.*

The Impact of IS Dependence and TTF on performance impact can be inferred from the literature of media dependence theory (Ball-Rokeach and DeFleur 1976) and task-technology fit (Goodhue and Thompson 1995). The first stream of literature claimed that an individual's dependence on a media is

highly associated with the importance of the media in fulfilling his or her information need. When an individual realize the importance of a media, he or she tend to explore more benefits from the media in order to improve their work performance. One underlying assumption is - dependence is due to the importance of the media rather than habit (refer to literature on repeated behavior, e.g., Kim 2009). This is realistic for low-literate consumers as they don't have substantial usage experience to cultivate strong habit on information systems. Hence, we inferred that an individual's degree of dependence on an information system may positively relate to his or her work performance. However, the second stream of literature, as reviewed extensively above, reported that the fit between task and technology predicts performance in terms of effectiveness and productivity since it more closely meets the task needs of the individual. The effect of the degree of TTF seem to be stronger than the degree of IS dependence on performance. In other words, at any level of IS dependence, higher TTF will lead to better performance as it meets both the task needs and the literacy constraints of the individual. Therefore, we propose that

> *Proposition 5: User evaluation of an information system's task-technology fit will have additional explanatory power in predicting performance impacts beyond that from IS dependence along.*

Methodology

To better understand the task-technology fit for low-literate consumers, we first investigated the current situation among existing consumers and the information systems they used. We adopted the mixed methodology approach for attaining a richer understanding of the novel phenomenon (Bartunek and Seo 2002; Venkatesh et al. 2013). Both semi-structure interview (Wengraf 2001) and oral-conducted field survey (Gau et al. 2012) were employed for the purpose of developmental and compensation (Venkatesh et al. 2013). First, the semi-structured interview aimed to qualitatively identify a list of daily tasks and information need, user literacy requirements and constraints, and popular information systems among our targeted subjects. Second, the oral conducted field survey intended to quantitatively evaluate the research framework based on a survey of existing information technologies and our proposed mobile application. Based on the experience from previous study on low-literate consumers, we conducted oral-survey instead of written ones (e.g., Gau et al. 2012; Viswanathan et al. 2009).

Research Subjects

Our inquiry focused on e-agriculture as the driving application area. E-agriculture refers to the provisions of farming related information services such as weather forecast, pest management, land management, harvesting and logistics, buying and selling via information systems. The agricultural sector constitutes a big portion of world population, especially in developing regions. Rural farmer community is one of the most representative low-literate communities that need the society's attention. As our vision is to provide implications for those social innovations to serve the underserved, we thus focus on stakeholders in farming community as our first research sample. The agriculture-related individual stakeholders generally include agricultural officers, rural brokers, owners and employees in commercial or family farms (Li 2005). Among which, most of the employees in both commercial and family farms and owners of family farmers in developing counties are considered as low-literate consumers of information systems, while the rest are relatively high literate (Li 2005; Zhu 2007).

Qualitative Design

In the semi-structured interview, we followed a free listing procedure outlined in Weller and Romney (1988) that requires subjects to identify relevant information regarding the given questions. We encourage the subjects to tell us their daily problem-solving tasks, information needs and constraints, and information technologies used. The first round interview constituted a one month field observation, a preliminary interview with 8 agricultural officers or rural brokers who are familiar with the farm works, and a main interview with 20 farm owners or employees. Field observation helped to built interpersonal rapport with the participants. Preliminary interview helped us to prepare expressive oral hints for low-literate farm owners and employees. Both interpersonal rapport and expressive oral hints are important factors while conducting the main interviewers with the low-literate consumers (Gau et al. 2012).

Quantitative Measurements

Most quantitative measures were adapted from previous research. Due to lack of adequate measurement scales, we also developed and refined some measures specifically for this study. We categorized the user evaluation of TTF into two dimensions: functional and psychological evaluation. The measurements for functional evaluations were adapted from Goodhue and Thompson (1995), including data quality, locatability, compatibility, and timeliness. The measurement for Psychological evaluations were adapted from existing usability measurements (Abran et al. 2003), including efficiency, effectiveness, satisfaction, and learnability. User task needs and their impact on information system use have been widely studied by a great many researchers. We adapted two common dimensions of task characteristics: routineness and interdependence (with other individuals). Five measures were adopted from previous studies (Goodhue 1998; Goodhue and Thompson 1995). User literacy constraints were measured by self-reported indicators, include basic and functional literacy. Measures were adapted from two International literacy survey instruments: ALL (Adult Literacy and Life Skill Survey) and IALS (International Adult Literacy Survey).

Technology characteristics were evaluated by two dimensions: function and form. Each of the function and form design were measured by several categorical factors. First, the function design of an information system was assessed by two factors: the direction of information service (one-way *vs.* two-way *vs.* multi-way) and the adaptability to varying circumstances (context adaptable *vs.* non-adaptable) (Balasubramanian et al. 2002; Gebauer et al. 2010). Second, the form design of an information system was assessed by four factors: data input modality (non *vs.* text entry *vs.* command selection), data output modality (pull *vs.* push), information display (text *vs.* graphic *vs.* audio), and navigational structure (linear *vs.* parallel) (Medhi et al. 2011; Summers and Summers 2005). A set of dummy variables were used to capture the potentially different impact of the various factors. Several technology-related confounding factors were also included in the analysis, such as network availability, bandwidth and stability.

Technologies that were under evaluation include both existing information systems and our proposed mobile application. First, we identified a list of major information systems the participants actually used based on the preliminary interview. Their characteristics were under content analysis and evaluation by domain experts (i.e. both technology designers and agricultural experts). Second, we proposed a mobile application during our IS innovation project for consumers in the farming industry. The core objective of the mobile application is to facilitate the agricultural pest management process for related stakeholders. In terms of the function design, this application provides a multi-way information service which enabled both two-way feedback loop (i.e. user input and system auto-generated output) and multi-way feedback loop (i.e. social networked information exchange). The application also enables the context adaptable information update (e.g., push alert based on the pest density around nearby farms). In terms of the form design, the application allows users to entry information by either icon-selection or photo-taking (i.e. command selection input modality). It pushes severe or time-critical information to users (i.e. push output modality), yet provides the rest information based on users' manual request (i.e. pull output modality). Both textual and graphical information are available in the application. Further, the application provides pure linear navigation for routine tasks (e.g., report a pest problem) and parallel navigation for non-routine tasks (e.g., search information from report timeline).

An ideal-fit condition holds when the function design best match to the task demand or the form design best match to the user literacy constraints. Examples of ideal-fits can be found from the design of the proposed mobile application discussed above. Any mismatch leads to over- or under- fit condition. In specific, a function design will be over fitted when the function exceed the actual demand of the task, such as providing multi-way information service for a direct information searching task (e.g., find weather information). Whereas a function design will be under fitted when the function is insufficient for accomplish the task, such as providing one-way information service for seeking experiential advices on a problem (e.g., inquiry either neighbors' experience or experts' suggestions on how to deal with an immigrated pest). Regarding the form design, an over-fit example is to provide audio input modality to consumers who have difficulties in orally explaining their problems or expressing their opinions. An under-fit example is to provide textual input modality to consumers who have difficulties in writing or reading words from a comparatively small screen. These examples discussed above serve as principles for categorizing information systems into the three fit conditions for further analysis.

The measurement of IS Dependence were developed based on the study of Sparrow and colleagues (2011). We designed 3 problem-solving tasks based on the daily tasks identified by the subject during interview. For each problem-solving task, subjects were required to list the information systems they often used. They were then required to mark their dependence on each one that they may seek help from to solve each of the problem (1=low dependence, 2=medium dependence, 3=high dependence). For each problem-solving task, the dependence on information systems was the sum of all the marks for each information system they listed. The overall IS dependence was the averaged dependence marks with the 3 problem-solving tasks. Performance impact was measured by both subjective and objective indicators. First, we refined the subjective measures in Goodhue and Thompson (1995). Three self-reported questions are used to measure the perceived impact of each information system on subjects' effectiveness, productivity and overall performance in daily work. Subjects are also encouraged to report the amount of their productivity and profitability of their farming work. Although hard to control the availability or accuracy, these indicators are partially served as the complementary performance indicators if available.

Conclusion

With the booming of computing technologies nowadays, more low-literate populations in the developing regions are becoming the next billion information system consumers. How to cater to their needs is more than a million dollar issue. To address this issue, our research expects to provide insights on low-literate consumers' needs, constraints, and demand on task-technology fit. First, this study takes an innovative step to open the black box of task-technology fit and customizes it to the context of low-literate consumers. Second, we propose that IS dependence is also important to improve consumers' work performance. Third, to gain a deeper insight into the novel phenomenon, we applied Venkatesh and colleagues' (2013) mixed-methods approach. Specifically, we use qualitative data collected from semi-structured interviews on relevant stakeholders to guide and compensate the quantitative approach.

In practice, our study expects to benefit those social innovators who conduct IS innovations for consumers in the developing regions. The insights and potential findings from our research provide a set of fine-grained IS design guidelines for serving low-literate consumers. Limitations also exist in this study. Since the data is still under collection, the research framework, propositions and the quantitative data collection procedures are contingent upon refinement based on the feedbacks from the first round qualitative interview. An iterative process of study design and refinement is crucial to ensure the validity.

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