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IS Use and Quality of Life: A Conceptualization and Empirical Investigation

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IS Use and Quality Of Life: A Conceptualization and Empirical Investigation

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Abstract

The nature of IS use and its impacts in everyday life settings are not yet well understood. Drawing on quality of life theory and evidence from the IS acceptance and IS impacts research, this study conceptualizes the relationship between IS use and quality of life as a process that involves vertical and horizontal spillover effects. We empirically investigate this relationship in the context of basic IT use among socio-economically disadvantaged individuals. The research participants received their initial basic IT skill training from community technology centers. The context of our study is the Thai community technology centers supported by Microsoft Unlimited Potential grants. The results strongly support that there are vertical spillover and horizontal spillover mechanisms that relate IS use to domain-specific quality of life and overall quality of life. Implications for research and practice are discussed.

Keywords: Social inclusion, quality of life, vertical spillover, horizontal spillover, IS use, IS impacts, community technology centers

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INTRODUCTION

Basic IT skills are necessary for a person to have a meaningful life in an information society. The Organization for Economic Co-operation and Development (OECD) defines basic IT skills as the ability to use “generic tools (e.g., Word, Excel, Outlook, and PowerPoint) needed for the information society, e-government and working life” (OECD, 2004, p. 219). Despite the increasing use of basic IT tools among the general population, the inequality in access and use of these tools is still a prevalent issue among the socio-economically disadvantaged (DiMaggio et al., 2004). Much of the prior digital inequality research focused on the inequality of access. It was only recently that several researchers (DiMaggio et al., 2004; Warschauer, 2004) called for a shift of research focus from the old concept of overcoming the inequality of access to the new concept of enhancing a process of social inclusion through IT use. Social inclusion refers to “the extent that individuals, families, and communities are able to fully participate in society and control their own destinies, taking into account a variety of factors related to economic resources, employment, health, education, housing, recreation, culture, and civic engagement” (Warschauer, 2004, p. 8). This new conceptualization calls for research to investigate IS use in everyday life and its impact on domain-specific and overall quality of life.

Although IS use and its impacts have long been studied in IS research, research has paid little attention to IS use in non-work settings and has largely ignored quality of life in IS impacts models. Building on quality of life theory from psychology and IS acceptance and IS impacts research in non-work settings, our overall goal in this paper is to investigate IS use in everyday settings and its relationship with quality of life. We first conceptualize the relationship between IS use and quality of life. Then, we empirically investigate IS use among the socio-economically disadvantaged to better understand the nature of IS use in everyday life and validate the contribution of IS use to quality of life. Because the conceptualization of IS use and quality of life is relatively new to IS, we adopt an exploratory theory development approach which focuses on discovery and rich representations of the relationships through strong conceptual foundations (Lee et al., 1997).

Our research questions are:

- What is the nature of IS use in everyday activities?
- What is the contribution of IS use to quality of life?

THEORY DEVELOPMENT

Despite evidence of its significance in helping us to understand life satisfaction across various contexts (Sirgy, 2002), the concept of quality of life has been largely overlooked in IS research. We argue that *quality of life* is a powerful explanatory construct that has the potential to make strong contributions to IS acceptance and IS impacts research. In particular, quality of life can be understood as an antecedent of usage (i.e., needs or expectations related to changes in quality of life from IS use) and a consequence of usage (i.e., perceived changes in quality of life). In this study, we focus our investigation on the notion of quality of life as a consequence of usage.

Quality of Life: A Multidimensional Construct

In this study, we will draw on quality of life theory from psychology¹ to conceptualize the relationship between IS use and quality of life in everyday settings. Quality of life (QoL) theory in psychology began in the 1960s with the seminal work of Wilson (1967), who presented a broad review of subjective well-being (i.e., quality of life) and concluded his research with several normative attributes associated with a happy person. Quality of life is defined as a subjective assessment of an affective component of happiness and a cognitive component of satisfaction (Rice et al., 1985). Happiness is an affective concept reflecting a state of mind associated with feelings of joy, serenity, and affection (Sirgy, 2002). Satisfaction involves cognition by requiring an individual to evaluate one's life conditions and accomplishments against what one thought to be an appropriate standard or goals (Diener et al., 1985).

Researchers have suggested that QoL is a multidimensional construct. More specifically, an individual's life can be segmented into several life domains (Andrews and Withey, 1976). Seeman (1967) suggests that life domains correspond to the major institutions in modern society which include work, family, leisure, health, community, social, and cultural, among others. Also, each life domain is organized around activities that satisfy various needs and expectations. Consider the work life domain, for example. This domain is comprised of mental, physical, and social activities related to work experiences (Igbaria et al., 1994; Sirgy et al., 2001). See Table 1 for additional explanation of major life domains and their activities.

Table 1: Life Domains and Related Activities in Each Domain

| Life Domain | Domain Activities | Examples |
|-------------|---|--|
| Consumer | Consumer experiences related to the purchase, preparation, consumption, possession, maintenance and disposition of goods and services | Sirgy et al. (2006) |
| Community | Activities to build social capital, community attachment and community involvement in a community | Kavanaugh and Patterson (2001) |
| Education | Learning and teaching activities including both formal and informal learning | Andrews and Withey (1976) |
| Family | Interactions with others in the family (e.g., spouse, children) | Staines and Pleck (1984) Rice et al. (1992) |
| Financial | Activities related to pay and revenues | Campbell (1976) |
| Friend | Interactions with friends | Andrews and Withey (1976) |
| Health | Activities related to physical and mental health | Yost et al. (2005) |
| Leisure | Spare time and non-working activities | Quinn and Staines (1979) |
| Self | Activities for self-representation, self-efficacy, personal growth and development | Sirgy (2002) |
| Social | Interactions with people other than family, colleagues, and friends | Greenley et al. (1997) |
| Work | Activities that a person does and what happens to a person at work | Rice et al. (1985) Igbaria et al. (1994) |

Quality of Life: A Process Perspective

Needs theory (Maslow, 1970; McClelland, 1961) provides a useful framework for conceptualizing the underlying process that explains domain-specific QoL and overall QoL. The premise of this theory is that people seek to fulfill basic needs in each life domain. Individuals derive satisfaction in a particular life domain when activities and experiences related to that domain fulfill their needs. Therefore, needs theory seems to suggest that people who are successful in satisfying their needs are likely to enjoy greater QoL than those who are less successful. For example, a person may report high quality of work life if she has a supportive work environment, positive supervisory behavior, and reasonable job requirements that satisfy her social, economic, and esteem needs (Sirgy et al., 2001). In contrast, another person with low quality of work life may have low job security, negative criticisms from supervisors, and excessive workloads that do not fulfill her basic needs.

According to Maslow (1970), different needs categories are organized hierarchically from low-order needs to high-order needs. These needs categories are biological needs (food, water, oxygen), safety needs (physical and psychological security), social needs (need for affiliation, friendship, family), esteem needs (need for success, achievement, recognition, respect), cognitive needs (need for knowledge, meaning), aesthetics (appreciation of beauty, balance, form), and self-actualization (need for creativity, self-expression, integrity). Research has reported that IS use is likely to fulfill users' higher order needs related to social relations, self-growth, and self-advancement which correspond to social needs, esteem needs, and cognitive needs in Maslow's need categories (Au et al., 2008).

Research suggests that QoL is a complex process that may involve vertical and horizontal spillover effects. Vertical spillover theory suggests relationships between domain-specific QoL and overall QoL (Andrews and Withey, 1976; Campbell, 1976; Diener, 1984). In particular, this theory builds on two premises: (1) the overall QoL is a function of QoL in various life domains (e.g., family, health, work, and education), and (2) domain-specific QoL is a function of the extent of satisfaction with activities and experiences related to that domain.

Horizontal spillover theory views that QoL in a particular life domain influences QoL in other life domains (Diener, 1984; Wilensky, 1960). For example, positive experiences one has in the leisure domain may spill over to the work domain, thus making the job less stressful. Sirgy (2002) explains that horizontal spillovers may occur between two life domains that have some overlap in activities supporting similar needs. For example, leisure activities may satisfy both aesthetics and social needs. Thus, it is reasonable to postulate that spillovers are likely to occur between the leisure and social life domains.

Much of QoL research (e.g., Choi et al., 2007; Diener, 1984; George and Landerman, 1984; Larsen, 1978; Near, 1986; Rahtz and Sirgy, 2000; Rice et al., 1980; Sirgy et al., 2006) has studied vertical spillover effects while a smaller number of studies (e.g., Crouter, 1984; Kremer and Harpaz, 1982; Sirgy et al., 2001; Shepard, 1974) have examined horizontal spillover effects. Further, most research conceptualizes horizontal spillover as a simple one-directional relationship between two life domains in which QoL in a life domain of interest influences QoL in another life domain. For example, Crouter (1984) studied spillover influence from the family life domain to the work life domain among mothers of young children. Although such a view of horizontal spillover effects may be reasonable for research that has a relatively narrow focus on a few closely related life domains, we believe that it may not depict accurate theorizing about the horizontal spillover process related to IS use in everyday activities. We elaborate on an expanded view of horizontal spillover effects from IS use in Section 2.5.

It is important to note that the concept of QoL is not entirely new to the IS field. Nevertheless, much of prior research has largely examined IT workers' QoL in the work domain (Ferratt et al., 2005; Igbaria et al., 1994). This line of research offers insights into the assessment of IT human resource management on several indicators of quality of work life such as job satisfaction, career satisfaction, and staff turnover rates, among others. However, such a narrow focus on the work domain does not provide precise and complete theorizing on QoL because other researchers suggest that events and conditions of non-work life may influence behaviors in work organizations, and experiences within work organizations may influence life outside of work (Rice et al., 1992). In other words, QoL impacts in various domains are inextricably interrelated and should not be studied in isolation from one another.

Next, we review the existing IS acceptance and IS impacts research with more emphasis on studies in non-work settings. Our review has two goals. First, we want to substantiate our proposition that IS use has implications on QoL in various life domains through theoretical reasoning and empirical evidence from these two literatures. Second, we intend to position QoL as an important antecedent to inform IS acceptance research about "user expectations" from IS use. Similarly, we highlight the importance of QoL as an indicator of "benefits" in IS impacts research.

IS Use: Outcome Expectancy and Motivation to Use

IS acceptance research has adapted theories from psychology to explain individuals' technology choices and use. Broadly speaking, these studies conclude that users are motivated to use a technology to fulfill specific goals or objectives. In other words, usage motivation suggests benefits sought by users. For example, several studies examine motivational influence in the form of utility on IS acceptance and use behaviors (Davis, 1989).

It should be noted that IS acceptance research has largely focused on explaining IS use in the workplace. More recently, a growing body of research has begun to examine various IS applications outside of workplace settings (Brown and Venkatesh, 2005; Buente and Robbin, 2008). Since our study considers IS use in everyday life, the examination of previous IS acceptance studies outside of workplace settings is a useful starting point to begin to understand the relation between IS use and QoL (see Table 2).

Studies in Table 2 span a number of technologies (e.g., e-Government, PCs, and the Internet) and include a wide range of user groups (e.g., household users, the elderly, and the socio-economically disadvantaged). In a broad sense, theoretical models and empirical results from these studies seem to suggest that IS use can contribute to satisfaction in some aspects of QoL. For example, users in Phang et al.'s (2006) study who were driven by self-actualization need may experience higher self-esteem after use, suggesting QoL in the self life domain. However, since most studies theorized about motivational factors at a task level (e.g., an information and entertainment usage preference and an interpersonal usage preference), it is likely that IS use to support these tasks may be mapped to activities in several life domains. As a result, these constructs offer too limited of an understanding of the contribution of IS usage behaviors to QoL. For instance, Buente and Robbin (2008) reported that an information utility preference is associated with a wide range of activities in various life domains, such as finding information about politics, health and medicine, sports, and leisure activities, among others. To investigate whether and to what extent IS use makes a difference in an individual's life, studies need to focus on more precise theory development that distinctively relates IS use with specific life domains.

Table 2: IS Acceptance Studies Outside of the Workplace Settings

| Study | Subjects & IS | Usage Motivation | Definition |
|----------------------------|--|--|--|
| Kraut et al. (1999) | Internet use among individuals in households in Pittsburgh, PA | Information and entertainment usage preference | Web usage that is associated with information acquisition and entertainment |
| | | Interpersonal usage preference | E-mail use for personal communications (e.g., with friends, family, and geographic communities) |
| Stafford et al. (2004) | General population of AOL Internet users in the U.S. | Internet process gratifications | Internet use for the enjoyment of usage experience |
| | | Internet content gratifications | Internet use for the content (e.g., information and entertainment) |
| | | Internet social gratifications | Internet use for interpersonal communication and social networking |
| Brown and Venkatesh (2005) | PC use among U.S. households | Applications for personal use | The extent to which using a PC enhances the effectiveness of household activities |
| | | Utility for children | The extent to which using a PC enhances children's effectiveness in completing homework and other activities |
| | | Utility for work-related use | The extent to which using a PC enhances the effectiveness of performing work-related activities |
| | | Applications for fun | The pleasure derived from PC use |
| | | Status gains | The increase in prestige that coincides with the purchase of a PC for home use |
| Hong and Tam (2006) | Mobile data services use among Hong Kong users | Perceived enjoyment | The extent to which the activity of using an innovation is perceived to be enjoyable in its own right |
| | | Need for uniqueness | The tendency to seek uniqueness through the adoption and use of symbolic products or innovations for the purpose of enhancing the self-concept |
| Phang et al. (2006) | e-Government use among senior citizens in Singapore | Self-actualization need | The motivation to achieve everything that one is capable of, including a sense of fulfillment, personal growth, and personal potential |
| | | Resource savings | The motivation to save time and money |
| Buente and Robbin (2008) | General population of Internet users in the U.S. | Information utility | Internet use for information acquisition and learning |
| | | Leisure and fun utility | Internet use for leisure and fun activities |
| | | Financial transaction utility | Internet use for purchasing products and services |
| Hsieh et al. (2008) | Internet TV use in Lagrange, GA, U.S.A. | Utilitarian outcomes | The extent to which performing the behavior enhances the effectiveness of personal related activity |
| | | Hedonic outcomes | The pleasure and inherent satisfaction from performing the behavior of interest |
| Dwivedi and Irani (2009) | Broadband use among U.K. households | Utilitarian outcomes | The extent to which using broadband enhances the effectiveness of household activities |
| | | Hedonic outcomes | The pleasure derived from broadband use |

IS Impacts: Implications from Use

We distinguish the IS impacts literature into two broad research streams. The first stream of research draws heavily from Goodhue and Thompson's (1995) task-technology fit model and DeLone and McLean's (1992, 2003) IS success model. Generally, these studies (Rai et al., 2002; Torkzadeh and Doll, 1999) focus their investigation on short-term impacts, the workplace dimension of impacts, and task-related outcomes with less emphasis on those outcomes related to users. They often use measures like effectiveness, productivity, and performance to relate the effect of IS use to the improvement of work related tasks. Obviously, these traditional organization-centric models seem to fit the goal of these studies, which is to explain benefits of IS in organizations. However, their narrow and limited view of the potential impacts of IS use on work-related outcomes is inappropriate for our context because our study has a much broader focus of IS use to satisfy both work and non-work needs in the everyday life context.

More recently, the widespread use of the Internet and mobile phone services among everyday users has prompted researchers to extend their investigation of IS impacts beyond the work setting. This second research stream focuses more on longer-term impacts, emphasizes user-related outcomes, and mostly uses multidimensional indicators of impacts (work- and non-work outcomes) as indicated in Table 3.

Table 3: IS Impact Studies with Work- and Non-work Outcomes

| Study | Subjects and IS | Usage Measure | Impacts Constructs | Selected Measures |
|--------------------------------|--|--|--|--|
| Kraut et al. (1998) | Internet use among individuals in households in Pittsburgh, PA | Duration of use (hours per week) | Psychological well-being | Loneliness, stress, depression |
| | | | Social involvement | Family communication, size of social networks, social support |
| Kavanaugh and Patterson (2001) | Internet use among residents in Blacksburg, VA | Internet access (yes/no) | Community involvement | Community involvement scale, community attachment, organizational membership |
| Jennings and Zeitner (2003) | Internet use among adults in a U.S. city | Internet access (yes/no), frequency of use | Political involvement | Interest in public affairs, political activity, political knowledge |
| | | | Volunteerism | Organizational membership, volunteer activities |
| Jackson et al. (2004) | Internet use among individuals in low-income households in a U.S. city | Duration of use (minutes per day) | Psychological well-being | Depression, stress, happiness, self-esteem |
| | | | Social involvement | Number of close friends and relatives, time spent with friends, relatives and family |
| Sirgy et al. (2006) | Internet use among college students in Korea and the U.S. | Did not directly measure use | Overall QoL and QoL in seven life domains | The degree of importance (5-point scale) in domain QoL and overall QoL |
| Choi et al. (2007) | Mobile data services use among users in Korea | Nature of usage activity | Overall QoL and QoL in eleven life domains | Satisfaction (7-point scale) in domain QoL and overall QoL |

The strengths of these studies are their broad theorizing of IS impacts beyond the workplace and their emphasis on those outcome constructs (e.g., social involvement, political activity) that are more meaningful to users. There are two key limitations to this research stream. First, with the exception of Choi et al. (2007), these researchers developed their research models with certain outcome constructs of interest before proceeding with data collection from users. Such study design prevents the opportunity to use other outcome variables as input for theorizing (Alvesson and Karreman, 2007). For example, Kraut et al. (1998) chose to examine the influence of Internet use on social involvement as measured by communication within the family and the size of people's local social networks. Although this study offers a way to observe whether social participation improves or declines after Internet use, it does not allow them to discover usage impacts in other life domains (e.g., leisure, education, and friend life domains) that may be important to the users. Thus, there is a need for studies that can depict accurate dimensions of QoL impacts from use. To develop a deeper understanding of IS use and its impacts in a real life context, we use a deductive inquiry similar to the approach used in Choi et al. (2007) to identify relevant measures of IS use and related life domains as informed by research participants.

The second limitation relates to the diversity of usage measures among these studies (e.g., duration of use, frequency of use, and a binary measure of access), which, according to Burton-Jones and Straub (2006), reflects the deeper problem, which is the lack of a strong theoretical basis underlying IS use. This may partly explain some conflicting results among Internet impacts studies: positive effects (Jennings and Zeitner, 2003), negative effects (Kraut et al., 1998), and insignificant results (Jackson et al., 2004). Thus, there is a strong need for a systematic and theoretically supported development of IS usage measures, which is the approach that we take in this study.

A Theoretical Model of IS Use and QoL and Propositions

Drawing on QoL theory, we extend the quality of life process reasoning to argue that vertical spillover and horizontal spillover effects are important underlying mechanisms that relate IS use to domain-specific QoL and overall QoL. Figure 1 presents a theoretical model of IS use and QoL.

At an abstract level, theory is viewed as a system of constructs that are related to each other by propositions. At a concrete level, theory is viewed as variables that are related to each other by hypotheses (Bacharach, 1989). At this early stage of theory development on IS use and its impacts on QoL, we will use conceptual reasoning from QoL theory and empirical evidence in the literature to construct theory at an abstract level using propositions to relate IS use to QoL.

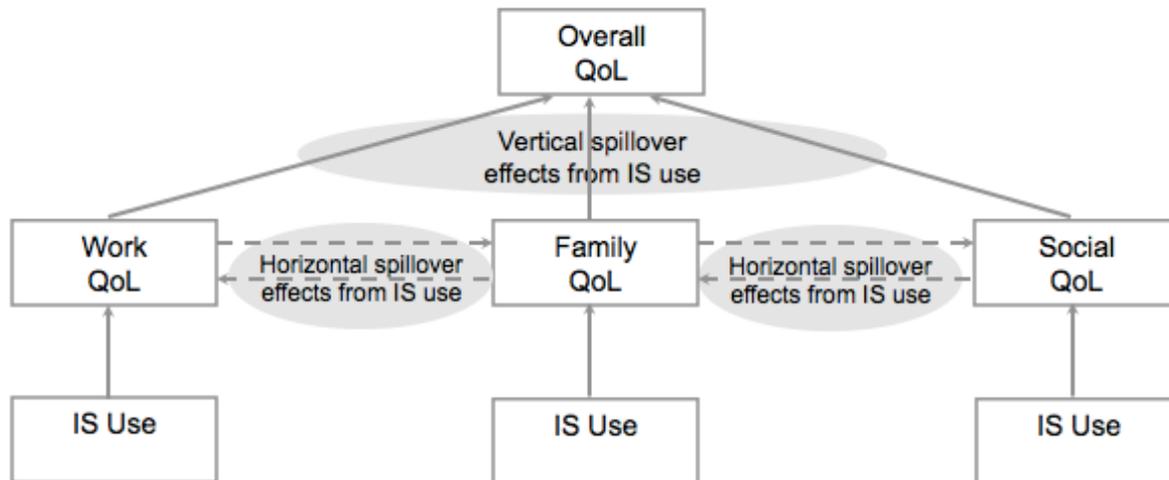


Figure 1: A Theoretical Model of IS Use and Quality of Life

Note: The diagram above uses the work, family, and social life domains to illustrate the contribution of IS use on QoL. In an empirical validation, the number of life domains involved may vary depending on how individuals use IS in their daily lives. Also note that horizontal spillover effects can flow between work and social life domains.

Contribution of IS Use to Domain-Specific QoL

Information technology, especially more recent technologies like the Internet and mobile phones, are multifunctional tools and can serve multiple usage purposes. According to needs theory (Maslow, 1970; McClelland, 1961), satisfaction from IS use is likely to be determined by the extent to which IS use fulfills innate needs. Three broad areas in which IS use can fulfill needs are work performance, relatedness, and self-development (Alderfer, 1972). As our earlier review suggests, several studies from the IS impacts domain found that IS use can promote work performance in areas of productivity and effectiveness (Goodhue and Thompson, 1995). Such evidence suggests that satisfaction from IS use contributes to QoL in the work life domain. Relatedness refers to all socially oriented needs that require interactions with other people (Au et al., 2008). Recent Internet use studies have found that Internet usage can enhance relatedness as measured by social and community involvement (Jackson et al., 2004; Kavanaugh and Patterson, 2001) and can contribute positively to QoL in the social and community life domains. Finally, there is empirical evidence that IS use can promote self-development fulfillment in areas such as personal growth and personal potential (Phang et al., 2006), suggesting improvements in QoL in the self life domain. Therefore, we propose the following:

- **Proposition 1 (Contribution of IS use to domain-specific QoL):** IS use in various life activities contributes positively to QoL in multiple life domains

Vertical Spillover Effects

Vertical spillover effects are the first mechanism through which IS use can influence QoL. This derived from the argument that affects in various life domains spill over to the most super-ordinate life domain (i.e., perceptions about life overall). Several studies have shown that overall life satisfaction can be explained by satisfaction in several life domains such as the health life domain (George and Landerman, 1984; Larsen, 1978), the self life domain (Diener, 1984), and the work life domain (Near, 1986; Rice et al., 1980).

More recently, a few researchers reported evidence of vertical spillover effects related to the contribution of IS use to QoL. In their study of mobile data services, Choi et al. (2007) reported that mobile data services usage contributes to QoL in eleven life domains ranging from cultural and leisure to social and self, and QoL in ten life domains contribute positively to the overall QoL of users. Another study by Sirgy et al. (2006) found that the perceived impact of the Internet on life overall is a function of the perception of impact in the consumer, work, leisure, social, education, community, and sensual life domains. Based on the theoretical argument from quality of life theory and empirical evidence in the literature, we propose the following:

- **Proposition 2 (Vertical spillover effects):** Domain-specific QoL from IS use contributes positively to overall QoL

Strength of Contribution of Domain-Specific QoL to Overall QoL

The strength of the vertical spillover effects of QoL from life domains to overall QoL may vary from one life domain to another, depending on each individual's value orientations. For example, for an individual who values social activities over other activities, satisfaction with his/her social life will strongly influence overall QoL (Oishi et al., 1999). Sirgy et al. (2006) found that the Internet plays a more important role in consumer, work, leisure, education, social, community, and sensual than other life domains.

Therefore, life domains with higher perceived importance should exert stronger influence on overall QoL when compared with other life domains that have lower perceived importance. These higher valued life domains are often referred to as salient life domains in the literature (Sirgy, 2002). By extending this logical argument and empirical evidence to the IS use context, we propose the following:

- **Proposition 3 (Strength of contribution of domain-specific QoL to overall QoL):** QoL derived from IS use in some life domains contributes more strongly to overall QoL than in other life domains

Horizontal Spillover Effects

Horizontal spillover effects are the second mechanism through which IS use can influence QoL. As discussed earlier, horizontal spillover effects have not been widely studied in the QoL and IS literatures, therefore, we will discuss at length why we should observe horizontal spillover effects as we think about impacts of IS use on QoL. To theorize how satisfaction from IS use in one life domain enhances experiences and outcomes in other life domains, we turn to Greenhaus and Powell's (2006) theory of work-family enrichment. The goal of their theory is to examine positive interdependencies between life roles with an emphasis on a mechanism in which participation in multiple roles (i.e., family roles and work roles) can produce positive outcomes for individuals. In particular, these authors view the concept of work-family enrichment as one of the important underlying mechanisms to enhance QoL. They defined work-family enrichment as "the extent to which experience in one role improves the quality of life in the other role" (p. 73). Note that other researchers use different terms such as positive spillover (Crouter, 1984) or enhancement (Ruderman et al., 2002) to refer to similar concepts.

Central to the work-family enhancement process are resources generated from one role that can be used to promote QoL in another role as indicated by high performance and positive affect. Five types of resources are distinguished: skills and perspectives, psychological and physical resources, social capital resources, flexibility, and material resources. There are two paths by which resources generated from one role can promote QoL in another role: the instrumental path and the affective path. The instrumental path is identified when a resource can be transferred directly from one role to another role, thus enhancing QoL in the latter role. The affective path is identified when a resource generated in one role can promote positive affect in that role, which, in turn, produces higher QoL (i.e., positive affect and high performance) in another role.

In the IS literature, several researchers have observed that IT, especially the Internet, is malleable and can be used to support a wide variety of activities, thus making these activities more efficient, more convenient, and more fun (Kraut et al., 1999; Orlikowski and Iacono, 2001). By broadening the conceptualization of work-life enrichment from Greenhaus and Powell (2006) to include multiple roles (e.g., family, community, and social), we can systematically theorize the process through which IS use in one role influences QoL in other roles in order to capture horizontal spillover effects of QoL from IS use.

Our review identifies several types of resources generated from usage activities in one role that may be used to enhance QoL in other roles. For instance, some studies recognized the value of psychological resources as measured by status gains (Brown and Venkatesh, 2005), uniqueness (Hong and Tam, 2006), and personal growth and development (Phang et al., 2006). Others identified the importance of social capital from Internet use (Jackson et al., 2004; Kavanaugh and Patterson, 2001; Kraut et al., 1998). Yet, improvement of IT skills from use (Lucas and Spittler, 1999) and material resources in terms of saving time by using IT to perform activities in one role can be used to enhance performance and positive affect in other life domains. In sum, we propose that IS use in one life domain can generate useful resources to improve QoL in other life domains.

However, the increased use of IT for fun may increase the complexity of the horizontal spillover mechanism. Several researchers used various measures related to hedonic motivation to capture the fun element in IS use (e.g., Brown and Venkatesh, 2005, Dwivedi and Irani, 2009, Hong and Tam, 2006, Hsieh et al., 2008, and Stafford et al., 2004). Fun is not only limited to leisure activities; individuals can experience fun while e-mailing friends and family members or searching for information on the Internet to finish homework. Such evidence suggests that there are some overlaps of activities across roles. Therefore, the horizontal spillover mechanism from IS use may involve resources generated from usage activities from overlapped roles to enhance QoL in other roles. In other words, horizontal spillover effects

from IS use may manifest themselves as resources generated from related domains to promote QoL in another domain. Thus, we propose the following:

- **Proposition 4 (Horizontal spillover effects):** QoL derived from IS use in a life domain contributes positively to QoL in another life domain

Next, we discuss our study's approach to examining the nature of IS use in everyday activities and validating the relationship between IS use and QoL.

METHODS

We used a two-step analysis to first develop contextualized IS use measures and then examine their contribution to QoL (see Figure 2). The goal of the first step was to develop rich descriptions of the nature of IS use among the target population (socio-economically disadvantaged individuals). Motivated by a lack of theory underlying measures of usage in past research, Burton-Jones and Straub (2006) recently proposed a systematic approach to define, conceptualize, and measure IS use. They defined system usage as an activity that involves three elements: a user, a system, and a task. According to Seddon (1997), a system is "either some aspect of an application of information technology, one individual application, a group of applications or an application of one type of IT" (p. 246). In this study, a system refers to a group of basic IT applications that includes the Internet and basic productivity software (Microsoft Word, Excel, and PowerPoint).

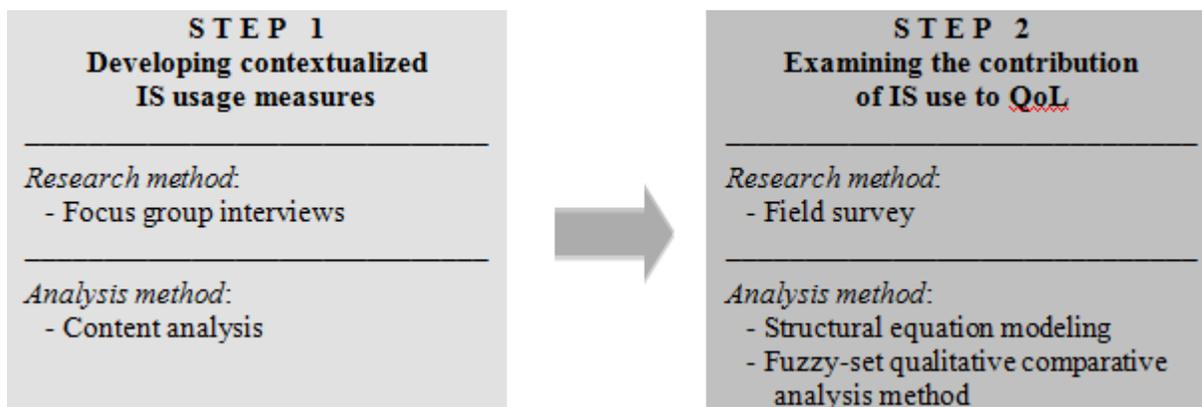


Figure 2: The Two-Step Analysis Approach: IS Use Measures and Their Contribution to QoL

Burton-Jones and Straub (2006) suggest that the first step is to select measures that capture one or more of the three elements of usage (i.e., the user, system, task) that are most relevant for the research context. They strongly encourage the use of rich measures (focusing on at least two elements) to increase explanatory power of IS use in a model. Because we are not interested in cognitive resources required to use IS, we conceptualize IS use through a rich usage measure that focuses on the task and system elements (i.e., the extent to which the system is used to carry out the task). Because no rich tools have been developed to measure IS use in a research context comparable to ours, and IS use is not the kind of construct with specific, known dimensions (Burton-Jones and Straub, 2006), we used focus group interviews with representative samples of our research population to develop contextualized IS use measures and identify their associated life domains. Babbie (1998) suggests that focus group interviews are appropriate for early theory development.

Our goal in the second analysis step was to examine the relationship between IS use and QoL. This goal fits with what Gregor (2006) called "theory for explaining," or a type of theory that focuses on explaining underlying causes as well as description of theoretical constructs and their relationships. Field surveys, among other research methods, are appropriate for developing this type of theory. As discussed earlier, vertical spillover and horizontal spillover effects are the two key underlying mechanisms that relate IS use in domain activities with domain-specific QoL and overall QoL. Structural equation analysis is an appropriate analysis method to evaluate the vertical spillover effects because these effects involve two sets of direct relationships, one between IS use and various domain-specific QoL and the other between domain-specific QoL and overall QoL. Our assertion about horizontal spillover effects in relation to IS use is more complex and less straightforward than those of vertical spillover effects. The fuzzy-set qualitative comparative analysis (Ragin, 2000), a method designed to capture causal complexity in a research model, can help us better understand horizontal spillover effects. More details on both steps of our analysis will be discussed in Sections 3.2 and 3.3. Next, we provide some details on the research setting and research participants.

Microsoft Unlimited Potential Community Technology Centers, Thailand

The context for this study was a set of Thailand community technology centers (CTCs) under the support from the Microsoft Unlimited Potential program. This program represents global efforts to enable social and economic empowerment through a number of initiatives including technology skills training, software and hardware donations, and low-cost laptops, among others. The program has the ambitious goal of bringing the benefits of IT to five billion people worldwide. The community technology skills program is one of the Unlimited Potential initiatives with the goal of broadening digital inclusion and workforce development by partnering with non-governmental organizations (NGOs) in CTC operations. Currently, more than 37,000 CTCs in 102 countries have been supported through grants (cash and software), instructor training, and Microsoft's software skill development curriculum (e.g., Word, Excel, PowerPoint, Web design, Database).

In Thailand, four awarded NGOs have set up 20 CTCs in 10 provinces throughout the country. We worked with 13 CTCs under the supervision of three NGOs. Five CTCs were under the Duang Prateep Foundation (DPT), three were under the Population and Community Development Association (PDA), and five were under the Kenan Institute Asia. These NGOs target different socio-economically disadvantaged communities including impoverished communities in Bangkok by the DPT, rural communities in Buriram by the PDA, and the suburban workforce in Pang-nga by the Kenan Institute Asia. All CTCs provide IT skill training to participants; however, some cover more software programs than others. Previous research suggests that effective use of IS requires significant training or experience (Warschauer, 2004). We controlled for such differences by examining individuals' IS use after they received basic software training (Microsoft Word, Excel, PowerPoint, and Internet skills) from these CTCs.

Analysis Step 1: Developing IS Use Measures

Because IS can be used across various life activities, we envision IS use as a formative construct. Following the guidelines for validating and analyzing formative constructs by Petter et al. (2007), our IS usage measure development was conducted in two steps: (1) item generation and (2) content validity assessment using Q-sorting. As discussed earlier, focus group interviews were used to generate use experiences and associated life domains. Rigorous analysis was also conducted to ensure content validity which is the most important aspect of instrument development for formative constructs (Diamantopoulos and Winklhofer, 2001; Jarvis et al., 2003). Item creation through focus group interviews is appropriate because participants are part of the research population and are excellent sources to inform various IS use activities (Fuller et al., 1993; Hughes and DuMont, 1993). Similar to previous PC (Brown and Venkatesh, 2005) and Internet (van Dijk and Hacker, 2003) use studies, we use a broader definition of computer and Internet use to include direct use of computer and Internet applications (e.g., using a spreadsheet application for personal bookkeeping), and indirect use of digital skills and information found on the Internet in meaningful ways across life activities (e.g., using information found on the Internet to help children complete homework).

The focus group interviews were conducted across gender, age, and occupation groups. The number of focus group interviews was not predetermined; however, no additional interviews are needed when no new activities related to IS use are identified from the most recently interviewed focus group. Thirty participants were interviewed including 10 males and 20 females in five age groups: 10-19 years old (13 participants), 20-29 years old (three participants), 30-39 years old (four participants), 40-49 years old (three participants), and over 50 years old (seven participants). The four occupation groups are middle-school and high-school students (12 participants), college students (two participants), working adults (12 participants), and retirees or stay-at-home parents (four participants). On average, the participants used computers around 85 minutes per day.

During the focus group sessions, participants were asked to talk openly about activities for which they use the software skills learned from CTCs. All interviews were audio-taped and transcribed. The transcripts were used to identify use experiences and their associated life domains. Guided by the definitions of life domains in the literature (refer to Table 1), the two authors independently coded use experiences and corresponding life domains. Inter-coder reliability was 0.846 ($p < .01$). Disagreements on use experiences or life domains were resolved through discussion. Overall, a total of 34 different use experiences in 10 life domains were identified. The life domains are work, education, family, friend, consumer, leisure, social, finance, self, and community.

Next, a two-step Q-sorting (Boudreau et al., 2001; Moore and Benbasat, 2001) was used to assess content validity. In the first round, four judges (not involved in the research) were asked to examine the 34 use experience items written on index cards and sort them into the 10 pre-specified life domains and an "ambiguous/does not fit" category. Two judges are IT professionals and the other two are public officials in a legal department. Fleiss's Kappa had an average value of 0.79, which is higher than the 0.75 threshold recommended as excellent agreement beyond chance (Fleiss et al., 2003). The overall placement ratio of items within the correct constructs was 90%, showing a high degree of construct validity and potential reliability. The authors and judges discussed and modified ambiguous items before proceeding to the second round.

During the second round, two new judges were asked to sort the 34 use experience items. This time, they were not given a list of life domains and were asked to define their own categories. These two judges are business school faculty (from a department outside IS). The first judge created eleven categories by differentiating between new friend and old friend life domains, while the other judge created nine categories by combining the friend and family domains. The judges' definitions of most categories were similar to our definitions and the Cohen's Kappa was 0.65, which is acceptable. We modified the ambiguous items according to feedback from the second round judges. Overall, the results from the Q-sorting suggest that the construct measures have content, convergent, and discriminant validity (Petter et al., 2007).

Analysis Step 2: Examining the Contribution of IS Use to QoL

We use three groups of constructs to study the contribution of IS use to QoL: "satisfaction from IS use," "domain-specific QoL contribution from IS use," and "overall QoL contribution from IS use." Consistent with previous studies that examined QoL in the IS and management literatures (Choi et al., 2007; Rice et al., 1992), we measured the "domain-specific QoL contribution from IS use" by asking respondents to rate changes (increase or decrease) in their domain specific QoL from IS use. We adapted the validated 5-item satisfaction with life instrument from Diener et al. (1985) to measure the "overall QoL contribution from IS use" construct. These five reflective items asked respondents to evaluate the contribution from IS use to QoL, for example, "Overall, my quality of life has improved to close to my ideal," "My quality of life is excellent," and "I am satisfied with my life."

We incorporated these three constructs into a field survey questionnaire. All items in the three key constructs were measured on a scale of 1 = "strongly agree" to 7 = "strongly disagree," with 4 being "neutral." The response "0" (never used) was added to the questions that asked respondents to reflect the extent of satisfaction from use experiences (see items from Table 5). The survey instrument was pretested with 10 subjects in Pang-nga province and minor modifications were made prior to the data collection.

In the summer of 2008, 400 questionnaires were distributed to individuals who took training courses from the participating CTCs. The questionnaires were collected by the authors in four CTCs in Pang-nga province. The rest of the questionnaires were collected by CTC staff and returned to the researchers via postal mail. In all, 308 individuals responded to the survey, yielding a raw response rate of 77%. After excluding cases with missing data or incomplete responses, 262 surveys were retained for data analysis. Descriptive statistics are shown in Table 4.

Table 4: Descriptive Statistics of Respondents²

| | Number of Respondents | Percent |
|------------------------|-----------------------|---------|
| Gender | | |
| Male | 98 | 37.4% |
| Female | 158 | 67.3% |
| Age group | | |
| 10 – 15 | 42 | 16.0% |
| 16 – 19 | 11 | 4.2% |
| 20 – 29 | 78 | 29.8% |
| 30 – 39 | 81 | 30.9% |
| 40 – 49 | 41 | 15.7% |
| > 50 | 8 | 3.0% |
| Education level | | |
| Some elementary school | 52 | 20.0% |
| Some high school | 20 | 7.6% |
| Finished high school | 113 | 43.1% |
| Vocational degree | 28 | 10.7% |
| College degree | 45 | 17.2% |
| Graduate degree | 1 | 0.38% |
| Monthly income | | |
| < 2,000 Baht | 40 | 15.3% |
| 2,001 – 6,000 Baht | 73 | 27.9% |
| 6,001 – 10,000 Baht | 78 | 29.8% |
| 10,000 – 20,000 Baht | 35 | 13.4% |
| > 20,000 Baht | 33 | 12.6% |

We conducted wave analysis to investigate possible non-response bias by comparing demographic profiles and indicators of IS use and QoL between early and late respondents. Our data collection efforts spanned a period of one

month. Early respondents and late respondents are those who responded within the first two weeks and the last two weeks of data collection respectively. The results of t-tests and chi-square tests to compare demographic profiles and other key variables did not reveal significant differences between early and late respondents. Therefore, non-response bias is not a serious concern in this study.

To further explore the possibility of bias from different data collection methods, we evaluated possible differences in key variables across data returned by postal mail and data collected on-site by the authors. Two-sample t-tests and chi-square tests did not show significant differences between responses from the two data collection methods, with one exception. On-site respondents reported slightly higher daily computer usage time than those respondents surveyed by mail ($t = 1.86, p < 0.05$). Thus, we conclude that there is little evidence of method bias for this study.

RESULTS

First, we analyze the survey respondents' patterns of IS use and satisfaction from IS use among the 34 IS use experience items. Next, we report results from using Partial Least Squares to evaluate Propositions 1-3. We also report results from using Qualitative Comparative Analysis to evaluate Proposition 4.

Table 5 presents descriptive statistics showing patterns of IS use and the extent of satisfaction from IS use. Overall, participants broadly integrated computer and Internet use in their lives and reported satisfaction from IS use across activities in all ten domains. The five activities with the highest satisfaction fall in the work and education life domains, and include using Microsoft Word to write reports for work, using the Internet to find information related to work, using the Internet to research information for class work, using the Internet to do self-learning, and using Microsoft Word to write class reports.

Previous research (Buente and Robbin, 2008; Kraut et al., 1999; Stafford et al., 2004) classified Internet use into a few categories, such as information use and communication use (Kraut et al., 1999). In contrast, we found at least five different categories of computer and Internet use: researching, relationship building, knowledge sharing, leisure and entertainment purposes, and self-actualization. Participants reported using computers and the Internet as research tools (e.g., using the Internet to search for information related to work, class work, and self-learning). They also reported using computer and Internet applications to enhance family relationships, reduce a generation gap in families, and enhance relationships with other community members. Knowledge sharing is evident because participants reported using knowledge and skills learned to offer advice to coworkers or supervisors and teach other family members and friends. Consistent with Buente and Robbin (2008), we found that participants enjoyed using the Internet to read news, watch movies, or engage in other relaxing activities. Finally, and perhaps most importantly for the socio-economically disadvantaged, we found evidence that using computers and the Internet enhances self-actualization. Self-actualization relates to an achievement of a sense of fulfillment, personal growth and personal potential (Maslow, 1970). For example, participants reported satisfaction from feeling proud that they can use computer programs and being less dependent on others for their computer needs.

Interestingly, a large number of participants (ranging from 21.84% to 35.50%) reported that they never use computers or the Internet to support activities in the consumer, social, and finance life domains. It is not surprising that several participants reported never using the Internet to purchase and sell products or search for information about products. This is because electronic commerce activities are not well established in Thailand. For example, based on their recent national user survey, NECTEC (2005) reported that viewing product information accounted for only 1.3% of all the activities conducted on the Internet, and a mere 20% of Internet users had purchased products via the Internet from 1999 to 2003. The strong need to see or feel products, lack of trust, a complex transaction process, and concerns about credit card fraud were cited as major reasons preventing people from engaging in on-line transactions. According to NECTEC's statistics (<http://internet.nectec.or.th>), Internet users in Thailand grew from 6 million users in 2003 to 16.1 million users in 2008. However, Thai Internet users still reported difficulty associated with on-line purchase as an important barrier to Internet shopping (Laohapensang, 2009).

Our findings of slightly low satisfaction with using IS to communicate with new people, find new friends, and get to know others who share similar interests in the social life domain are consistent with those from Kraut et al. (1998). Because our research participants are relatively novice users, they have not yet discovered how to use the Internet to connect with someone they do not already know in an off-line world.

Table 5: Satisfaction from Computer and Internet Use

| Life Domain | IS Use | Never Use | Mean | S.D. |
|-----------------------|---|-----------|------|------|
| Work life domain | Using Word to write reports for my job | 3.82% | 5.98 | 1.11 |
| | Using Excel to calculate numbers, create tables or graphs, or collect data for my job | 6.87% | 5.53 | 1.22 |
| | Using the Internet to find information related to my job | 3.45% | 5.78 | 1.40 |
| | Using the computer and Internet knowledge and skills to advise coworkers or supervisors | 16.41% | 4.40 | 2.27 |
| | Applying the computer and Internet knowledge and skills to better understand how to use other computer programs at work | 8.02% | 5.50 | 1.37 |
| Education life domain | Using PowerPoint for presentation in my class | 8.40% | 5.49 | 1.37 |
| | Using the Internet to research for information for class projects | 4.58% | 5.99 | 1.67 |
| | Using Word to write class reports | 8.81% | 5.93 | 1.24 |
| | Using the Internet to do self-learning | 4.60% | 6.03 | 1.18 |
| | Using Excel as a part of mathematics or science classes | 24.05% | 5.13 | 1.38 |
| Family life Domain | Using the topics related to computer programs to have conversations with family members | 12.21% | 4.93 | 1.48 |
| | Teaching computer programs learned from the CTC to family members | 16.79% | 5.16 | 1.37 |
| | The computer and Internet knowledge and skills enhance family relationships and reduce a generation gap | 15.38% | 5.17 | 1.41 |
| Friend life domain | Using the Internet to e-mail or chat with friends | 10.77% | 5.34 | 1.43 |
| | Teaching the computer and Internet knowledge and skills to friends | 12.69% | 5.39 | 1.21 |
| | Using the computer and Internet knowledge and skills to make special gifts (e.g., holiday cards, video clips, picture slides) for friends | 13.36% | 5.49 | 1.38 |
| Consumer life domain | Using the Internet to purchase products or services | 30.89% | 4.68 | 1.46 |
| | Using the Internet to search for information about products or services | 21.84% | 5.09 | 1.44 |
| | Using the computer and Internet knowledge and skills to sell products | 35.50% | 4.93 | 1.38 |
| Leisure life domain | Using the Internet to read news in my spare time | 13.13% | 5.57 | 1.29 |
| | Using the Internet to watch movies, listen to music or engage in relaxing activities | 9.58% | 5.67 | 1.37 |
| | Using the Internet to find information about vacation locations, restaurants, or entertainment activities | 8.40% | 5.71 | 1.25 |
| Social life domain | Using the Internet to communicate with new people | 29.12% | 4.64 | 1.55 |
| | Using the Internet to find new friends | 27.63% | 5.01 | 1.52 |
| | Using the Internet to get to know others who share similar interests | 24.9% | 5.15 | 1.49 |
| Finance life domain | Using Excel to manage my personal finance | 26.82% | 5.14 | 1.45 |
| | Using the computer and Internet knowledge and skills to increase my income | 23.64% | 5.37 | 1.32 |
| | Saving money from computer program training or hourly computer usage services | 10.38% | 5.70 | 1.34 |
| Self life domain | Using the computer and Internet knowledge and skills to represent myself | 11.92% | 5.22 | 1.37 |
| | Making me proud that I have the ability to learn and use computer programs | 4.98% | 5.54 | 1.33 |
| | Being able to use computer programs that I used to depend on others to do for me before my training at the CTC | 5.73% | 5.77 | 1.32 |
| Community life domain | Using Word to create reports related to community work | 16.09% | 5.47 | 1.35 |
| | Using the Internet to find out information about my own community (e.g., maps, community calendar) | 12.26% | 5.45 | 1.31 |
| | Enhancing my relationships with other community members from using computers at the CTC | 11.45% | 5.36 | 1.31 |

Structural Equation Analysis of The Vertical Spillover Effects

Partial Least Square (PLS) was used to evaluate vertical spillover theory. PLS simultaneously examines the measurement and structural model (Gefen et al., 2000), and is an appropriate approach for this research for a number of reasons. First, PLS is suitable for exploratory research which is the goal of this study (Gefen et al., 2000). Second, PLS employs a component-based approach and can handle both formative (satisfaction from IS use) and reflective (overall QoL contribution from IS use) constructs (Gefen et al., 2000). Third, PLS has a minimal restriction on the sample size and residual distributions (Chin et al., 2003). The data collected from several CTCs were pooled together for the analysis because the results from different samples were not significantly different (Wilk's lambda was 0.95 [$F = 1.48, p = 0.14$]). Thus, the results reported are based on the statistical analysis of the pooled data from all CTCs.

Measurement Model Validation

The measurement model has one reflective construct (overall QoL contribution from IS use) and ten formative constructs (satisfaction from IS use) in 10 life domains. In contrast to reflective constructs, formative indicators cause the latent construct, uniquely contribute to the latent construct and are not interchangeable, and do not necessarily need to covary (Jarvis et al., 2003). Since formative indicators do not need to be correlated, it is not appropriate to conduct the conventional construct consistency assessment that relies on common factor analysis (Petter et al., 2007). We followed the procedure suggested by Bollen and Lennox (1991) and Diamantopoulos and Siguaw (2006) to assess construct validity by examining item weights and evaluated reliability by examining multicollinearity. Although some item weightings are not significant, no evidence of multicollinearity was present since the highest variance inflation factor (VIF) was 2.03, well below the suggested cutoff of 3.3 (Diamantopoulos and Siguaw, 2006). Therefore, we did not remove the nonsignificant indicators to retain content validity (Bollen and Lennox, 1991). Appendix A shows the means and standard deviations of the formative indicators and their construct validity and reliability.

The convergent validity and reliability of the reflective construct (overall QoL contribution from IS use) were evaluated by examining the item loadings and composite reliability. The convergent validity and reliability are considered acceptable because all items are significant at $p < 0.01$ and the composite reliability is 0.85. Appendix B shows the convergent validity of the reflective construct.

The discriminant validity of all constructs was evaluated by examining item-construct loadings and cross-loadings, and average variance extracted (AVE). Discriminant validity is established when items load higher on their hypothesized construct than on other constructs and when the square root of a construct's AVE is larger than its correlations with other constructs (Gefen and Straub, 2005). As shown in Appendix C1 and C2, all items load higher on their constructs than on other constructs and the square root of AVE for QoL is much higher than its correlations with other constructs.

Data collection from self-report surveys is susceptible to common method bias and can threaten the validity of the study (Podsakoff et al., 2003). Common method bias relates to common method variance which refers to the spurious covariance shared among variables by the common method used in data collection (Buckley et al., 1990). We conducted two tests to assess common method variance in our data. First, we conducted Harman's single-factor test using exploratory factor analysis. Common method bias exists if a single factor is identified from the unrotated factor solution and the first factor explains the majority of the variance in the variables (Malhotra et al., 2006; Podsakoff et al., 2003). In our unrotated factor analysis results, the first factor accounted for 37.7% of the variance and the twelve factors together accounted for 77.6% of the variance³. Second, following Podsakoff et al. (2003), we performed a partial correlation procedure. The first factor from an exploratory factor analysis "is assumed to contain the best approximation of common method bias" (Podsakoff et al., 2003, p. 893). We added the first factor into our model as a control variable and did not find significant changes in the relationships of key variables in the model. Also, this first factor only explained an additional 1.5% of the variance for overall QoL. The results from these two tests suggest that common method bias is not a concern for this study.

Structural Model Testing

We tested vertical spillover theory by estimating the influence of satisfaction from continued IS use on domain-specific QoL and overall QoL (Propositions 1-3). A bootstrap analysis was performed with 200 subsamples in PLS Graph 3.0 to estimate the path coefficients and their significance. Figure 3 presents the path coefficients and the explained variances.

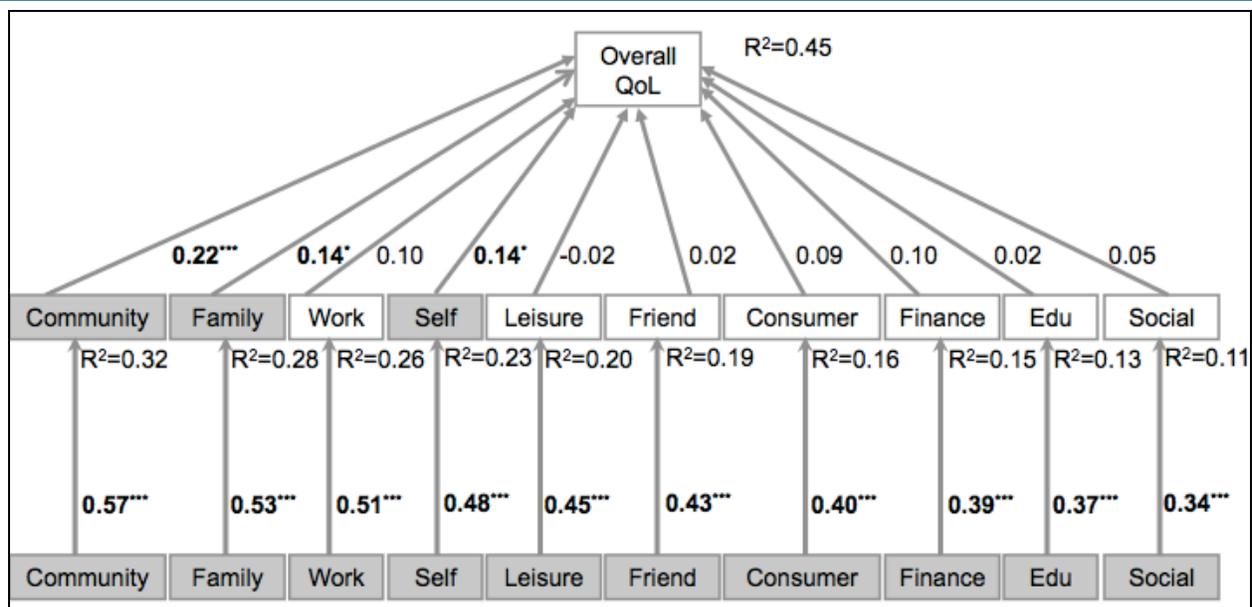


Figure 3: PLS Results for the Vertical Spillover Effects

Note: The highlighted constructs are those that demonstrate positive significant effects. The life domains are ordered by the strength of effects of IS use on domain QoL from the highest to the lowest. The significance levels are: * $p < .10$, ** $p < .05$, *** $p < .01$.

Path coefficients for satisfaction from IS use in each life domain had significant positive effects ($p < .01$) on domain-specific QoL across all ten life domains, providing strong support for Proposition 1. The highest estimated coefficient and explained variance are from the community domain ($b = 0.57$, $R^2 = 0.32$). The lowest estimated coefficient and explained variance are from the social domain ($b = 0.34$, $R^2 = 0.11$).

Next, we evaluated the contribution of domain-specific QoL on the overall QoL. Path coefficients from three life domains had positive significant effects on the overall QoL, suggesting support for Proposition 2 and Proposition 3. In particular, the three salient life domains are the community domain ($b = 0.22$, $p = .01$), the family domain ($b = 0.14$, $p = .07$), and the self domain ($b = 0.14$, $p = .06$). The overall explained variance (R^2) is 0.45.

Fuzzy-Set Qualitative Comparison of the Horizontal Spillover Effects

The fuzzy-set qualitative comparative method (fsQCA) was used to analyze data to evaluate horizontal spillover theory. Fuzzy-set QCA is a variant of qualitative comparative analysis methods and is designed to identify causal conditions among independent variables that relate to an outcome variable (Ragin 1987, 2000). The original QCA method (often referred to as the crisp-set QCA) requires that all variables are dichotomous variables (presence and absence). An example in the context of our study is when a person reports either satisfied or unsatisfied QoL in the work life domain. In contrast, fsQCA allows a variable to have a degree of membership with scores in the interval from 0 to 1 (Ragin, 2006). This feature fits with our QoL data that was measured using a degree of satisfaction. Therefore, we chose to use fsQCA instead of the original QCA method.

QCA is appropriate to use across studies that have a small, moderate or large number of cases. For example, Cress and Snow (2000) had a small number of 15 cases, Ishida et al. (2006) had a moderate number of 159 cases, and Sonnett (2004) had a large number of 1,606 cases. Our study, with a relatively moderate size of 262 cases, is therefore suitable for QCA.

QCA builds on two observed characteristics shared by most social phenomena: heterogeneity and causal complexity. Heterogeneity refers to the fact that a variety of causal conditions is likely to be related to the same outcome. For example, Öz (2004) identified four different paths to international competitiveness, two of which are strong local demand conditions and strong clusters combined with a favorable context for firm strategy and rivalry. Causal complexity refers to the fact that a relevant causal condition tends to include several variables rather than a single variable. For example, Roscigno and Hodson (2004), reported nine configurations of factors with more than three independent variables that link to strikes. The extent of conflicts on the shop floor, the presence of a union, and a bureaucratized work structure are among the variables included. We discuss the details of the QCA method and our analysis steps in Appendix D.

Horizontal Spillover Results

Fs/QCA 2.0 was used for the data analysis. Fuzzy-set QCA data can be analyzed using either the truth table algorithm or the inclusion algorithm. Since the inclusion algorithm is not available in fs/QCA 2.0, our analysis relies on the truth table approach. To examine the extent of horizontal spillover effects among life domains, our 10 outcome variables are the QoL in the work, education, family, friend, consumer, leisure, social, finance, self, and community domains. For each life domain, the independent variables are the QoL in the other nine life domains. Following Ragin (2007), our truth table analysis for each life domain follows the steps outlined in Appendix E.

Table 6 shows the causal combination of the horizontal spillover results in 10 life domains. We conducted one-tailed t-tests on consistency scores to compare the explanatory power of causal combinations on the satisfaction with domain QoL and dissatisfaction with domain QoL. All the t-test results are statistically significant ($p < .01$); therefore, the causal combinations relationships obtained are not ambiguous. Note that we cannot obtain results from the friend and finance domains because of the limited diversity of causal conditions in both cases. In other words, there are too few empirically relevant causal combinations with cases from the data set to derive valid results.

Table 6: Horizontal Spillover Effects Results

| Outcome (Y) | Causal combinations | Consistency score for Y | Consistency score for ~Y | t-test |
|-------------|-------------------------------------|-------------------------|--------------------------|----------|
| Work | EDU | 0.91 | 0.25 | 25.02*** |
| | LEISURE | 0.92 | 0.24 | 23.69*** |
| | EDU*FAMILY*LEISURE*SELF*SOCIAL | 0.98 | 0.29 | 26.26*** |
| Education | LEISURE | 0.90 | 0.25 | 21.34*** |
| | WORK | 0.91 | 0.25 | 21.94*** |
| | FAMILY*LEISURE*SELF*SOCIAL*WORK | 0.99 | 0.29 | 23.29*** |
| | LEISURE*SELF*SOCIAL*WORK*COMMUNITY | 0.97 | 0.29 | 22.28*** |
| Family | EDU | 0.83 | 0.36 | 14.00*** |
| | LEISURE | 0.83 | 0.36 | 13.88*** |
| | WORK | 0.82 | 0.37 | 14.41*** |
| | CONSUMER*EDU*WORK | 0.94 | 0.41 | 14.77*** |
| | EDU*LEISURE*SELF*SOCIAL*WORK | 0.93 | 0.43 | 16.78*** |
| Consumer | EDU | 0.83 | 0.37 | 13.82*** |
| | LEISURE | 0.80 | 0.38 | 12.45*** |
| | WORK | 0.82 | 0.38 | 13.99*** |
| | COMMUNITY | 0.86 | 0.41 | 14.25*** |
| | EDU*WORK | 0.87 | 0.40 | 14.73*** |
| | LEISURE*COMMUNITY | 0.89 | 0.42 | 14.49*** |
| | EDU*FAMILY*LEISURE*SELF*SOCIAL*WORK | 0.94 | 0.46 | 14.62*** |
| Leisure | EDU | 0.89 | 0.26 | 20.07*** |
| | WORK | 0.90 | 0.26 | 19.96*** |
| | COMMUNITY | 0.93 | 0.28 | 21.16*** |
| | CONSUMER*EDU*WORK | 0.95 | 0.30 | 19.50*** |
| | EDU*FAMILY*SELF*SOCIAL*WORK | 0.97 | 0.30 | 21.67*** |
| Social | EDU | 0.89 | 0.29 | 21.40*** |
| | LEISURE | 0.90 | 0.29 | 21.38*** |
| | WORK | 0.89 | 0.29 | 22.15*** |
| | EDU*FAMILY*LEISURE*SELF*WORK | 0.99 | 0.34 | 23.92*** |
| Self | LEISURE | 0.90 | 0.29 | 20.70*** |
| | CONSUMER | 0.92 | 0.33 | 19.54*** |
| | EDU | 0.88 | 0.30 | 20.77*** |
| | WORK | 0.88 | 0.29 | 20.94*** |
| | LEISURE*COMMUNITY | 0.97 | 0.33 | 22.70*** |
| | EDU*FAMILY*LEISURE*SOCIAL*WORK | 0.99 | 0.35 | 22.93*** |
| Community | EDU | 0.85 | 0.33 | 18.33*** |
| | LEISURE | 0.86 | 0.33 | 17.89*** |
| | WORK | 0.87 | 0.33 | 19.20*** |
| | LEISURE*SELF*SOCIAL*WORK | 0.96 | 0.37 | 20.38*** |
| | FAMILY*LEISURE*SELF*WORK | 0.97 | 0.39 | 19.69*** |

The results strongly support Proposition 4 and suggest that there are complex relationships of horizontal spillover effects of IS use on QoL. Since the focus of our work is to offer empirical evidence to illustrate that horizontal spillover effects are important to help us understand the contribution of IS use to QoL, we will not offer detailed explanation of the horizontal spillover effects in all life domains. Instead, we will highlight the findings using the work life domain as an example.

The work QoL demonstrated spillover effects under two conditions: (1) the direct spillovers from the QoL in the education and leisure domains, and (2) the interaction spillover from the QoL in the education, family, leisure, self, and social domains. Similar patterns of spillovers from one domain or multiple domains are observed in other life domains as well. We also observed the bi-directional horizontal spillover between QoL in the work domain and the education domain. Therefore, we conclude that strong empirical evidence supports our position that horizontal spillover effects are complex and extensive.

DISCUSSION

This study theoretically conceptualizes the contribution of IS use on QoL, empirically evaluates the relationship and develops rich measures of IS use among the socio-economically disadvantaged who initially learned IS skills from CTCs. The results of the study indicate that satisfaction from IS use influences domain-specific QoL across a number of important life domains (e.g., community, education, and family). This is consistent with previous research findings (Jackson et al., 2004; Sirgy et al., 2006) and implies that expanding IS use across life domain activities has significant potential to improve overall QoL.

We found that IS use positively contributes to an increase in the quality of social life. Our results are inconsistent with Kraut et al. (1998), whose findings appear to suggest that Internet use was associated with a decline in the quality of social life. There are two plausible explanations. First, our research setting and participants are different from those used in Kraut et al. (1998). Their study was based on users in an urban area in a developed country. Also, their users were in the socio-economically advantaged group compared to the socio-economically disadvantaged group in our study. A recent study suggests that these two groups of users have very different IS usage behaviors (Hsieh et al., 2008). Second, since the time of their study, there have been significant parallel developments in broadband technology and new Internet services (e.g., opinion blogs, video sharing services, and online games). As suggested in a recent report by OECD (2008), usage patterns are changing as a result of greater access to PCs and the Internet and the spread of broadband.

We found that the community, family, and self life domains are among the salient domains that significantly contribute to overall QoL. This result is consistent with the explanation from needs theory that individuals may place emphasis on different needs and life domains. Digital inequality research suggests that social support through close ties (i.e., family and community) is important for the socio-economically disadvantaged (van Dijk and Hacker, 2003). In particular, social interaction with friends and others in the community should help fulfill the need of belonging and commitment to groups, thus enhancing the sense of meaning in life for the socio-economically disadvantaged. Also, the dominant role of the community and family life domains mirrors the trend of using the Internet to build social capital and to stay in touch with friends (DiMaggio and Hargittai, 2001).

We found evidence of horizontal spillover effects from IS use. In particular, our results suggest that horizontal spillover effects from IS use in one domain (e.g., work) improve QoL in other domains (e.g., education, family, consumer, leisure, social, self, and community). For example, participants in our focus groups use Internet skills (from the work domain) to teach children to research for information to finish homework, thus enhancing quality of family life. Consistent with findings in organizational studies, our results suggest that spillover effects are bidirectional (Greenhaus and Powell, 2006). For example, IS use in the education domain (e.g., using the Internet for self-learning) promotes quality of work life (e.g., using knowledge learned through Internet use to make suggestions to improve work processes) and IS use in the work domain promotes QoL in the education domain. Finally, we also found evidence to suggest complex relationships among life domains as reflected in the interactive horizontal effects of multiple life domains (e.g., leisure and community) on QoL in another domain (e.g., self). However, additional research is needed to explain the mechanism underlying such relationships.

Limitations

As with any research, this study has some limitations. The vertical and horizontal spillover theories seem to suggest causality between domain-specific QoL and overall QoL; however, our data is cross-sectional in nature. Longitudinal research is needed to establish causality. Also, longitudinal research that tracks domain-specific QoL and the overall QoL over time may yield richer insights into the dynamic relationship between IS use and vertical and horizontal spillover effects.

Another limitation is related to the potential memory biases of QoL measurements. Studies (e.g., Schwarz and Strack, 1991) found that an individual's response to the extent of overall QoL is influenced by frequency and recency of one's experiences. In other words, a person is likely to use more recent and more frequent affective experiences in a certain life domain to respond to overall QoL than less recent and less frequent affective experiences from other life domains. Our research adapted Diener et al.'s (1985) satisfaction with life scale to measure overall QoL. Diener and Suh (1999) reported that this scale shows convergent validity and reliability, and covaries with ratings of the number of positive and negative memory recalls. Therefore, we conclude that memory biases are not a serious concern.

There are a few limitations to keep in mind when interpreting and generalizing the findings from this study. First, our research results did not compare QoL changes between individuals who received training from CTCs and those who did not. Although we found that individuals who continued to use computers and the Internet after receiving training from CTCs reported positive changes in QoL, there is not enough evidence to suggest the effectiveness of CTC training courses. Second, the research findings were derived from a single study in a single developing country context with a focus on a specific set of technologies. Research suggests that individuals' perceptions of a technology are shaped by general technology characteristics (i.e., perceived usefulness and perceived ease of use) and unique characteristics related to usage contexts and the IT artifact under study (Hong and Tam, 2006). Researchers may want to examine if country-specific and technology-related factors play a part in explaining IS use and QoL.

Implications and Directions for Future Research

Orlikowski and Iacono (2001) viewed IS as a field "which is premised on the centrality of information technology in everyday life" (p. 121). Yet, very little is known about IS use and its impacts on everyday life. Recently, Burton-Jones and Straub (2006) suggested that IS use is a dynamic and complex phenomenon. Because several IS (e.g., productivity software, the Internet, and mobile data services) can serve multiple purposes depending on their use, their impacts can be hard to predict. Kraut et al. (1999) argued that we can only anticipate the social impact of a technology if we understand how people are using it. We take their suggestion one step further and argue that, in addition to understanding usage patterns there is a need to understand the relationship between technology usage behaviors and their impact at an individual level to make a more accurate inference about the social impact of a technology. This study represents an attempt to theorize about the multitude of IS uses in everyday life and its individual impacts in areas related to QoL. We also offer empirical evidence in the context of basic IS (productivity software and the Internet) use among the socio-economically disadvantaged to support our theoretical conceptualization.

Since research on the relationship between IS use and QoL is relatively new, there are ample opportunities to broaden this line of investigation to further theory development in both the IS acceptance and IS impacts domains. As discussed earlier, needs, expectations related to these needs, and need fulfillment are instrumental in promoting QoL, therefore, IS acceptance studies should include variables associated with perceived needs in their research models to reveal more insights and additional information to explain acceptance and usage behaviors. Our suggestion is consistent with the criticisms from other researchers (e.g., Taylor and Todd, 1995) concerning the limited utility of the widely used perceptions about technology (i.e., perceived usefulness and perceived ease of use) for making practical guidelines on how to increase acceptance. A recent study on senior citizens' acceptance of e-Government services by Phang et al. (2006) is an example showing how to include variables related to perceived needs (e.g., self-actualization) in IS acceptance models.

Our review suggests that IS impact studies, especially those that have examined outcomes related to QoL, either focus broadly on quality of work life (e.g., Ferratt et al., 2005; Igbaria et al., 1994) or on specific life domains such as the community domain (e.g., Kavanaugh and Patterson, 2001) or the social domain (e.g., Kraut et al., 1998). In their extensive review of IS impacts research with an emphasis on IS success, Petter et al. (2008) argue that "measurement of IS success is both complex and illusive" (p. 236), which may explain why this research area "has seen little improvement over the past decade" (p. 258). Based on these limitations, they suggest that research must "create comprehensive, replicable, and informative measures" (p. 258) of IS impacts. The two-step analysis approach used in this study answers their calls to develop a broader understanding of the key IS impacts dimension at an individual level.

One avenue for future research is to develop an understanding of the dynamics of IS use and QoL. In relation to QoL, Maslow's (1970) hierarchy of needs suggests that the dynamics of motivation as people age. For instance, self-actualization motivation (the need to realize a sense of fulfillment and personal growth) is more salient in older people, and such motivation, in part, explains why individuals use specific IS applications (Phang et al., 2006). Also, Brown and Venkatesh (2005) found that household characteristics explain differences in PC adoption for home use, suggesting varying needs depending on household members and their interactions. So, one way to develop a refined understanding of the dynamics of IS use and QoL is by incorporating household characteristics such as marital status, age, and presence/age of children from household life cycle models (Gilly and Enis, 1982) and/or needs in different age groups from the individual life cycle model (Erikson et al., 1986) into the IS use and QoL model.

Most IS acceptance and impacts research has been defined and operationalized for workplace settings. In recent years, the growing use of IT among individuals and households strongly suggests that the everyday life context is an important aspect of theorizing about technology and its use. Also, recent research findings (Brown and Venkatesh, 2005; Hsieh et al., 2008; Phang et al., 2006; Stafford et al., 2004) provide strong evidence that theories conceptualized in workplace situations are not directly applicable to studies outside the workplace context. This is because everyday life differs from the workplace in several dimensions such as the socio-economic conditions (Hsieh et al., 2008) and psychological and physiological conditions of users (Hong and Tam, 2006; Phang et al., 2006) as well as the complexity of interactions and types of tasks (Brown and Venkatesh, 2005). Since "IT and individuals" has been found to be one of the intellectual cores of IS research (Sidorova et al., 2008), theorizing about IS use and its impact in everyday life settings should be one of the areas in which IS researchers can make a significant contribution.

Although the Internet has transformed the global economy and enriched the lives of individuals, some studies suggest that its use and impacts are not always positive. For example, Bocij (2006) discussed the dark side of the Internet including malicious software use by terrorists, frauds, spam, and cyberstalking. Researchers should investigate these and other negative aspects of the Internet to develop a better understanding of the extent of the impacts and risks to individuals. Study findings can also help promote Internet safety to the general public.

Contributions to Practice

Community technology centers are considered to be an important policy instrument to promote better life opportunities for the socio-economically disadvantaged. Yet, to date, most CTC evaluations are based on case studies and anecdotes (Hudson, 2001). What is clearly needed is a systematic evaluation of CTC initiatives that could provide insights on their operations, outcomes, and impacts. For instance, formative evaluation provides concrete feedback to suggest changes and improvements while summative evaluation determines whether a CTC achieves its intended goals. At the broader level, these evaluations are critical to inform broader policy decisions regarding the role of CTCs and to answer the concern of funding agencies as to whether their investments have created any impacts.

We strongly encourage CTCs to incorporate quality of life as an important measure in their longitudinal formative and summative evaluation plans. In particular, an evaluation team should measure expectations related to quality of life in terms of needs in their formative evaluation programs. CTCs can then use the evaluation results to adjust their operations, training programs, and perhaps resources to better meet users' needs. In the summative evaluation program, actual use and quality of life should be measured for a better understanding of the benefits of CTCs. Results from a well-designed longitudinal evaluation plan not only provide invaluable means to better understand the contribution of CTCs, but also give policy makers adequate confidence about the causal relationship between usage and outcomes (i.e., quality of life).

Another practical implication from this study may help CTCs to plan their training programs more effectively. In particular, training activities should be contextualized according to usage patterns. Incorporating users' needs as a part of training activities can encourage usage during daily activities after training. For example, our findings suggest that users like to use the Internet to read news, watch movies, or listen to music for their leisure activities. Teachers may want to ask training participants for their favorite newspapers and show them web sites that allow them to enjoy reading newspapers online. Also, since some of these users do not have computers at home and have to use computers at CTCs, it may be helpful to conduct meetings where users can share their usage experiences and exchange useful information (e.g., new restaurant web sites). Such informal information sharing can enhance relationships among community members.

CONCLUSION

This study represents a first step in the development of a theory of IS use and quality of life. Drawing on quality of life theory, we conceptualized the relationship between IS use and QoL as a process that involves vertical spillover and horizontal spillover effects. We then examined this relationship among socio-economically disadvantaged individuals who received basic IT skill training from community technology centers. Through an inductive inquiry, we developed rich measures of IS use and found support for their contributions in a number of life domains. We also observed horizontal spillover effects among several life domains. With the increasing use of technology among individuals and households, the present work serves as a starting point for future scientific investigations of technologies in everyday life. The results provide insights for policymakers to develop effective and concentrated efforts and interventions that aim to improve life opportunities through IS use.

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REFERENCES

- Alderfer, C.P. (1972) *Existence, Relatedness and Growth*. New York: Free Press.
- Alvesson, M. and D. Kärreman (2007) "Constructing Mystery: Empirical Matters in Theory Development," *Academy of Management Review*, 32(4), pp. 1265-1281.
- Andrews, F.M. and S.B. Withey (1976) *Social Indicators of Well-Being: America's Perception of Life Quality*. New York: Plenum Press.
- Au, N., E.W.T. Ngai, and T.C.E. Cheng (2008) "Extending the Understanding of End User Information Systems Satisfaction Formation: An Equitable Needs Fulfillment Model Approach," *MIS Quarterly*, 32(1), pp. 43-66.
- Babbie, E. (1998) *The Practice of Social Research*, 8th Ed. Belmont, CA: Wadsworth Publishing.
- Bacharach, S.B. (1989) "Organizational Theories: Some Criteria for Evaluation," *Academy of Management Review*, 14(4), pp. 496-515.
- Bocij, P. (2006) *The Dark Side of the Internet: Protecting Yourself and Your Family from Online Criminals*. Westport, CT: Praeger Publishers.
- Bollen, K. A. and R. Lennox (1991) "Conventional Wisdom on Measurement: A Structural Equation Perspective," *Psychological Bulletin*, 110, pp. 305-314.
- Boudreau, M.C., D. Gefen, and D.W. Straub (2001) "Validation in Information Systems Research: A State-of-the-Art Assessment," *MIS Quarterly*, 25(1), pp. 1-26.
- Brown, S.A. and V. Venkatesh (2005) "Model of Adoption of Technology in Households: A Baseline Model Test and Extension Incorporating Household Life Cycle," *MIS Quarterly*, 29(3), pp. 399-426.
- Buckley, M.R., J.A. Cote, and S.M. Comstock (1990) "Measurement Errors in Behavioral Sciences: The Case of Personality/Attitude Research," *Educational and Psychological Measurement*, 50(3), pp. 447-474.
- Buente, W. and A. Robbin (2008) "Trends in Internet Information Behavior, 2000-2004," *Journal of the American Society for Information Science and Technology*, 59(11), pp. 1743-1760.
- Burton-Jones, A. and D.W. Straub (2006) "Reconceptualizing System Usage: An Approach and Empirical Test," *Information Systems Research*, 17(3), pp. 228-246.
- Campbell, A.C. (1976) "Subjective Measures of Well Being," *American Psychologist*, 31, pp. 117-124.
- Chin, W., B.L. Marcolin, P.R. Newsted (2003) "A Partial Least Squares Latent Variable Modeling Approach for Measuring Interaction Effects: Results from a Monte Carlo Simulation Study and an Electronic Mail Adoption Study," *Information Systems Research*, 14(2), pp. 189-217.
- Choi, H., K.S. Im, M. Lee, and J. Kim (2007) "Contribution to Quality of Life: A New Outcome Variable for Mobile Data Service," *Journal of the Association for Information Systems*, 8(12), pp. 598-618.
- Cress, D.S. and D.A. Snow (2000) "The Outcomes of Homeless Mobilization: The Influence of Organization, Disruption, Political Mediation, and Framing," *The American Journal of Sociology*, 105(4), pp. 1063-1104.
- Crouter, A.C. (1984) "Spillover from Family to Work: The Neglected Side of Work-Family Interface," *Human Relations*, 37, pp. 425-442.
- Davis, F.D. (1989) "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," *MIS Quarterly*, 13(3), pp. 319-339.
- DeLone, W.H. and E.R. McLean (1992) "Information Systems Success: The Quest for the Dependent Variable," *Information Systems Research*, 3(1), pp. 60-95.
- DeLone, W.H. and E.R. McLean (2003) "The DeLone and McLean Model of Information Systems Success: The Ten-Year Update," *Journal of Management Information Systems*, 19(4), pp. 9-30.
- Diamantopoulos, A. and J.A. Siguaw (2006) "Formative Versus Reflective Indicators in Organizational Measure Development: A Comparison and Empirical Illustration," *British Journal of Management*, 17, pp. 263-282.
- Diamantopoulos, A. and H.M. Winklhofer (2001) "Index Construction with Formative Indicators: An Alternative to Scale Development," *Journal of Marketing Research*, 38(2), pp. 269-277.
- Diener, E. (1984) "Subjective Well-Being," *Psychological Bulletin*, 95(3), pp. 542-575.

- Diener, E., R.A. Emmons, R.J. Larsen, and S. Griffin (1985) "The Satisfaction with Life Scale," *Journal of Personality Assessment*, 49, pp. 71-75.
- Diener, E. and E. Suh (1999) "National Differences in Subjective Well-Being," in D. Kahneman, E. Deiner, and N. Schwartz (eds.) *Well-being: The Foundations of Hedonic Psychology*. New York: Russell-Sage, pp. 434-452.
- DiMaggio, P. and E. Hargittai (2001) "From the 'Digital Divide' to 'Digital Inequality': Studying Internet Uses as Penetration Increases," Working paper 15, Center for Arts and Cultural Policy Studies, Woodrow Wilson School, Princeton University, Princeton, New Jersey.
- DiMaggio, P., E. Hargittai, C. Celeste, and S. Shafer (2004) "From Unequal Access to Differentiated Use: A Literature Review and Agenda for Research on Digital Inequality," in K. Neckerman (ed.) *Social Inequality*. New York: Russell Sage Foundation, pp. 355-400.
- Dinev, T. and P. Hart (2006) "An Extended Calculus Model for E-Commerce Transaction," *Information Systems Research*, 17(1), pp. 61-80.
- Dinev, T. and Q. Hu (2007) "The Centrality of Awareness in the Formation of User Behavioral Intention toward Protective Information Technologies," *Journal of Association for Information Systems*, 8(7), pp. 386-408.
- Dwivedi, Y. and Z. Irani (2009) "Understanding the Adopters and Non-adopters of Broadband," *Communications of the ACM*, 52(1), pp. 122-125.
- Erikson, E., J. Erikson, and H. Kivnick (1986) *Vital Involvement in Old Age*. New York: Norton.
- Ferratt, T.W., R. Agarwal, C.V. Brown, and J.E. Moore (2005) "IT Human Resource Management Configurations and IT Turnover: Theoretical Synthesis and Empirical Analysis," *Information Systems Research*, 16(3), pp. 237-255.
- Fleiss, J.L., B. Levin, and M.C. Paik (2003) *Statistical Methods for Rates and Proportions*, 3rd ed. New York: Wiley.
- Fuller, T. D., J.N. Edwards, S. Vorakitphokatorn, and S. Sermsri (1993) "Using focus groups to adapt survey instruments to new populations: Experience from a developing country," in D.L. Morgan (ed.) *Successful focus groups: Advancing the state of the art*. Newbury Park, CA: Sage, pp. 89-104.
- Gefen, D. and D. Straub (2005) "A Practical Guide to Factorial Validity Using PLS-Graph: Tutorial and Annotated Example," *Communications of the AIS*, 16, pp. 91-109.
- Gefen, D., D. Straub, and M-C. Boudreau (2000) "Structural Equation Modeling and Regression," *Communications of the AIS*, 4(7), pp. 1-70.
- George, L.K. and R. Landerman (1984) "The Economic Instrumentality of Work: An Examination of the Moderating Effects of Financial Requirements and Sex on the Pay-Life Satisfaction Relationship," *Journal of Vocational Behavior*, 37, pp. 357-368.
- Gilly, M. and B. Enis (1982) "Recycling the family life cycle: A proposal for redefinition," *Advances in Consumer Research*, 9, pp. 271-276.
- Goodhue, D.L. and R.L. Thompson (1995) "Task-Technology Fit and Individual Performance," *MIS Quarterly*, 19, pp. 213-236.
- Greenhaus, J.H. and G.N. Powell (2006) "When Work and Family Are Allies: A Theory of Work-Family Enrichment," *Academy of Management Review*, 31(1), pp. 72-92.
- Greenley, J.R., J.S. Greenberg, and R. Brown (1997) "Measuring Quality of Life: A New and Practical Survey Instrument," *Social Work*, 42(3), pp. 244-254.
- Gregor, S. (2006) "The Nature of Theory in Information Systems," *MIS Quarterly*, 30(3), pp. 611-642.
- Hess, T., M. Fuller, and D. Campbell (2009) "Designing Interfaces with Social Presence: Using Vividness and Extraversion to Create Social Recommendation Agents," *Journal of Association for Information Systems*, 10(12), pp. 889-919.
- Hong, S. and K.Y. Tam (2006) "Understanding the Adoption of Multipurpose Information Appliances: The Case of Mobile Data Services," *Information Systems Research*, 17(2), pp. 162-179.
- Hsieh, J.J., A. Rai, and M. Keil (2008) "Understanding Digital Inequality: Comparing Continued Use Behavioral Models of the Socio-Economically Advantaged and Disadvantaged," *MIS Quarterly*, 32(1), pp. 97-126.
- Hudson, H.E. (2001) "Telecentre Evaluation: Issues and Strategies," in C. Latham and D. Walker (eds.) *Telecentres: Case Studies and Key Issues*. Vancouver, BC: The Commonwealth of Learning, pp. 169-181.
- Hughes, D. and K. DuMont (1993) "Using Focus Groups to Facilitate Culturally Anchored Research," *American Journal of Community Psychology*, 21(6), pp. 775-803.
- Igbaria, M., S. Parasuraman, and M.K. Badawy (1994) "Work Experiences, Job Involvement, and Quality of Work Life among Information Systems Personnel," *MIS Quarterly*, 18(2), pp. 175-201.
- Ishida, A., M. Yonetani, and K. Kosaka (2006) "Determinants of Linguistic Human Rights Movements: An Analysis of Multiple Causation of LHRs Movements Using a Boolean Approach," *Social Forces*, 84(4), pp. 1937-1955.
- Jackson, L.A., A. von Eye, G. Barbatsis, F. Biocca, H.E. Fitzgerald, and Y. Zhao (2004) "The Impact of Internet Use on the Other Side of the Digital Divide," *Communications of the ACM*, 47(7), pp. 43-47.

- Jarvis, C. B., S.B. MacKenzie, and P.M. Podsakoff (2003) "A Critical Review of Construct Indicators and Measurement Model Misspecification in Marketing and Consumer Research," *Journal of Consumer Research*, 30(2), pp. 199-218.
- Jennings, M.K. and V. Zeitner (2003) "Internet Use and Civic Engagement," *Public Opinion Quarterly*, 67(3), pp. 311-334.
- Kavanaugh, A.L. and S.J. Patterson (2001) "The Impact of Community Computer Networks on Social Capital and Community Involvement," *The American Behavioral Scientist*, 45(3), pp. 496-509.
- Kraut, R., T. Mukhopadhyay, J. Szczypula, S. Kiesler, and B. Scherlis (1999) "Information and Communication: Alternative Uses of the Internet in Households," *Information Systems Research*, 10(4), pp. 287-303.
- Kraut, R., M. Peterson, V. Lundmark, S. Kiesler, T. Mukopadhyay, and W. Scherlis (1998) "Internet Paradox: A Social Technology that Reduces Social Involvement and Psychological Well-Being?" *American Psychologist*, 53(9), pp. 1017-1031.
- Kremer, Y. and I. Harpaz (1982) "Leisure Patterns among Retired Workers: Spillover or Compensatory Trends," *Journal of Vocational Behavior*, 21, pp. 183-195.
- Kuklys, W. and I. Robeyns (2005) "Sen's Capability Approach to Welfare Economics," in W. Kuklys (ed.) *Amartya Sen's Capability Approach: Theoretical Insights and Empirical Applications*. Berlin: Springer-Verlag, pp. 9-29.
- Laohapensang, O. (2009) "Factors Influencing Internet Shopping Behavior: A Survey of Consumers in Thailand," *Journal of Fashion Marketing and Management*, 13(4), pp. 501-513.
- Larsen, R.J. (1978) "Thirty Years of Research on the Subjective Well Being of Older Americans," *Journal of Gerontology*, 33, pp. 109-125.
- Lee, B., A. Barua, and A.B. Whinston (1997) "Discovery and Representation of Causal Relationships in MIS Research: A Methodological Framework," *MIS Quarterly*, 21(1), pp. 109-136.
- Lucas, H.C. and V.S. Spitzer (1999) "Technology Use and Performance: A Field Study of Broker Workstations," *Decision Sciences*, 30(2), pp. 291-311.
- Malhotra, M.R., S.S. Kim, and A. Patil (2006) "Common Method Variance in IS Research: A Comparison of Alternative Approaches and a Reanalysis of Past Research," *Management Science*, 52(12), pp. 1865-1883.
- Maslow, A.H. (1970) *Motivation and Personality*. New York: Harper.
- McClelland, D.C. (1961) *The Achieving Society*. New York: The Free Press.
- Moore, G. C. and I. Benbasat (2001) "Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation," *Information Systems Research*, 2(3), pp. 192-222.
- Near, J.P. (1986) "Work and nonwork Attitudes Among Japanese and American Workers," in R.N. Farmer (ed.) *Advances in International Comparative Management*. Greenwich, CT: JAI Press, Inc., Vol. 2.
- National Electronics and Computer Technology Center (NECTEC) (2005) *Thailand ICT Indicators 2005: Thailand in the Information Age*. Bangkok, Thailand.
- OECD (2004) *OECD Information Technology Outlook 2004*. Paris, France: OECD Publications.
- OECD (2008) *OECD Information Technology Outlook 2007-2008*. Paris, France: OECD Publications.
- Oishi, S., E. Diener, E. Suh, and R. Lucas (1999) "Value as a Moderator in Subjective Well-Being," *Journal of Personality*, 67(1), pp. 157-184.
- Orlikowski, W. and C.S. Iacono (2001) "Desperately Seeking the 'IT' in IT Research: A Call to Theorizing the IT Artifact," *Information Systems Research*, 12(2), pp. 121-134.
- Öz, O. (2004) "Using Boolean- and Fuzzy-Logic-Based Methods to Analyze Multiple Case Study Evidence in Management Research," *Journal of Management Inquiry*, 13(2), pp. 166-179.
- Pavlou, P.A. and D. Gefen (2004) "Building Effective Online Marketplaces with Institution-Based Trust," *Information Systems Research*, 15(1), pp. 37-59.
- Petter, S., M. DeLone, and E. McLean (2008) "Measuring Information Systems Success: Models, Dimensions, Measures and Interrelationships," *European Journal of Information Systems*, 17, pp. 236-263.
- Petter, S., D. Straub, and A. Rai (2007) "Specifying Formative Constructs in Information Systems Research," *MIS Quarterly*, 31(4), pp. 623-656.
- Phang, C.W., A. Kankanhalli, and R. Sabherwal (2009) "Usability and Sociability in Online Communities: A Comparative Study of Knowledge Seeking and Contribution," *Journal of Association for Information Systems*, 10(10), pp. 721-747.
- Phang, C.W., J. Sutanto, A. Kankanhalli, Y. Li, B.C.Y. Tan, and H. Tep (2006) "Senior Citizens' Acceptance of Information Systems: A Study in the Context of e-Government Services," *IEEE Transactions on Engineering Management*, 53(4), pp. 555-569.
- Podsakoff, P.M., S.B. MacKenzie, N.P. Lee, and N.P. Podsakoff (2003) "Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies," *Journal of Applied Psychology*, 88(5), pp. 879-903.
- Quinn, R. and G. Staines (1979) *Quality of Employment Survey*. Ann Arbor, MI: Institute for Social Research.

- Ragin, C.C. (1987) *The Comparative Method: Moving Beyond Qualitative and Quantitative Strategies*. Berkeley, CA: University of California Press.
- Ragin, C.C. (2000) *Fuzzy-set Social Science*. Chicago, IL: University of Chicago Press.
- Ragin, C.C. (2006) "Set Relations in Social Research: Evaluating their Consistency and Coverage," *Political Analysis*, 14(3), pp. 291-310.
- Ragin, C.C. (2007) "Qualitative Comparative Analysis Using Fuzzy Sets (fsQCA)," in B. Rihoux, and C. Ragin (eds.) *Configurational Comparative Methods: Qualitative Comparative Analysis (QCA) and Related Techniques*. Thousand Oaks, CA: Sage Publications, pp. 87-122.
- Rahtz, D.R. and M.J. Sirgy (2000) "Marketing of Health Care within a Community: A Quality-of-Life/Needs Assessment Model and Method," *Journal of Business Research*, 48, pp. 165-176.
- Rai, A., S.S. Lang, and R.B. Welker (2002) "Assessing the Validity of IS Success Models: An Empirical Test and Theoretical Analysis," *Information Systems Research*, 13(1), pp. 50-69.
- Reddy, S.G., S. Visaria, and M. Asali (2006) "Inter-Country Comparisons of Income Poverty Based on a Capability Approach," SSRN Working Paper.
- Rice, R.W., M.R. Frone, and D.B. McFarlin (1992) "Work-nonwork Conflict and the Perceived Quality of Life," *Journal of Organizational Behavior*, 13, pp. 155-168.
- Rice, R.W., J.P. Near, and R.G. Hunt (1980) "The Job- satisfaction/life-satisfaction Relationship: A Review of Empirical Research," *Basic and Applied Social Psychology*, 1(1), pp. 37-64.
- Rice, R. W., D.B. McFarlin, R.G. Hunt, and J.P. Near (1985) "Organizational work and the perceived quality of life: Toward a conceptual model," *Academy of Management Review*, 10, pp. 296-310.
- Roscigno, V.J. and R. Hodson (2004) "The Organizational and Social Foundations of Worker Resistance," *American Sociological Review*, 69, pp. 14-39.
- Ruderman, M.N., P.J. Ohlott, K. Panzer, and S.N. King (2002) "Benefits of Multiple Roles for Managerial Women," *Academy of Management Journal*, 45, pp. 369-386.
- Schischka, J., P. Dalziel, and C. Saunders (2008) "Applying Sen's Capability Approach to Poverty Alleviation Programs: Two Case Studies," *Journal of Human Development*, 9(2), pp. 229-246.
- Schwarz, N. and F. Strack (1991). "Evaluating one's life: A judgment model of subjective well-being," in F. Strack, M. Argyle, and N. Schwarz (eds.) *Subjective well-being: An Interdisciplinary perspective*. United Kingdom, Oxford: Pergamon Press, pp. 27-48.
- Seddon, P.B. (1997) "A Respecification and Extension of the DeLone and McLean Model of IS Success," *Information Systems Research*, 8(3), pp. 240-253.
- Seeman, M. (1967) "On the Personal Consequence of Alienation and Job Satisfaction," *Industrial and Labor Review*, 23, pp. 207-219.
- Sen, A. K. (1999) *Commodities and Capabilities*. Oxford: Oxford University Press.
- Shepard, J.M. (1974) "A Status Recognition Model of Work-Leisure Relationships," *Journal of Leisure Research*, 6, pp. 58-63.
- Sidorova, A., N. Evangelopoulos, J.S. Valacich, and T. Ramakrishnan (2008) "Uncovering the Intellectual Core of the Information Systems Discipline," *MIS Quarterly*, 32(3), pp. 467-482.
- Sirgy, M.J., D. Efraty, P. Siegel, and D-J. Lee (2001) "A New Measure of Quality of Work Life (QWL) based on Need Satisfaction and Spillover Theories," *Social Indicators Research*, 55, pp. 241-302.
- Sirgy, M.J. (2002) *The Psychology of Quality of Life*. Boston, MA: Kluwer Academic Publishers.
- Sirgy, M.J., D. Lee, and J. Bae (2006) "Developing a Measure of Internet Well-Being: Nomological (Predictive) Validation," *Social Indicators Research*, 78, pp. 205-249.
- Sonnett, J. (2004) "Musical Boundaries: Intersections of Form and Content," *Poetics*, 32(3-4), pp. 247-264.
- Staines, G.L. and J.H. Pleck (1984) "Nonstandard Work Schedules and Family Life," *Journal of Applied Psychology*, 69, pp. 515-523.
- Stafford, T.F., M.R. Stafford, and L.L. Schkade (2004) "Determining Uses and Gratifications for the Internet," *Decision Sciences*, 35(2), pp. 259-288.
- Taylor, S. and P. Todd (1995) "Assessing IT Usage: The Role of Prior Experience," *MIS Quarterly*, 19(4), pp. 561-570.
- Tiwana, A. (2009) "Governance-Knowledge Fit in Systems Development Projects," *Information Systems Research*, 20(2), pp. 180-197.
- Torkzadeh, G. and W.J. Doll (1999) "The Development of a Tool for Measuring the Perceived Impact of Information Technology on Work," *Omega International Journal of Management*, 27, pp. 327-339.
- van Dijk, J. and K. Hacker (2003) "The Digital Divide as a Complex and Dynamic Phenomenon," *The Information Society*, 19, pp. 315-326.
- Warschauer, M. (2004) *Technology and Social Inclusion: Rethinking the Digital Divide*. Cambridge, MA: MIT Press.
- Wilensky, H. (1960) "Work, Careers, and Social Integration," *International Social Science Journal*, 12, pp. 543-560.

- Wilson, W. (1967) "Correlates of avowed happiness," *Psychological Bulletin*, 67, pp. 294-306.
- Yost, K.J., M.N. Haan, R.A. Levine, and E.B. Gold (2005) "Comparing SF-36 Scores across Three Groups of Women with Different Health Profiles," *Quality of Life Research*, 14, pp. 1251-1261.
- Zheng, Y. and G. Walsham (2008) "Inequality of What? Social Exclusion in the e-society as Capability Deprivation," *Information Technology & People*, 21(3), pp. 222-243.

¹ Quality of life has also been studied in welfare economics by drawing on Sen's (1999) capability theory. Sen emphasizes functionings (i.e., actual activities in leading one's life) and capabilities (i.e., combinations of functionings that one can achieve). Sen's capability theory, although illuminating, is not well suited to our research for two reasons. First, the capability theory has been predominantly theorizing from philosophical and conceptual reasoning, thus making it difficult to derive meaningful constructs and their relationships (Zheng and Walsham, 2008). Second, our study focuses on quality of life at an individual level, while capability theory is more appropriate when examining quality of life issues at a broader societal level such as inequality, poverty, and development (Reddy et al., 2006; Schischka et al., 2008). We refer the reader to Kuklys and Robeyns (2005), pp. 38-41 for studies that apply the capability approach to study poverty and inequality.

² According to the federal reserve statistical release (<http://www.federalreserve.gov/releases/g5a/current/>), the 2008 exchange rate was 33 Baht per U.S. dollar. According to the Thailand National Statistical Office (<http://web.nso.go.th>), the average monthly income in 2009 was 21,135 Baht. Therefore, the majority of our respondents are classified as socio-economically disadvantaged.

³ Harman's single-factor test offers a general guideline that common method bias can be a serious concern when a first factor explains the majority of variance in the variables. There is no consensus on the cutoff variance to warn researchers that common method bias is problematic. We examined survey studies in leading IS journals that used Harman's single-factor test and reported explained variance from factor analysis. Some studies reported 12% - 18% of variance explained by a first factor (e.g., Dinev and Hart, 2006; Dinev and Hu, 2007; Pavlou and Gefen, 2004; Tiwana, 2009). Other studies reported higher variance between 35% and 36% from a first factor (e.g., Hess et al., 2009; Phang et al., 2009) and concluded that common method bias is not substantially present. A few studies reported 72% - 76% total variance explained by all factors (Dinev and Hart, 2006; Dinev and Hu, 2007; Tiwana, 2009). In our data, we found 37.7% variance from the first factor and 77.6% total variance explained. These values are within range of those reported in other studies.

APPENDICES

Appendix A: Formative Construct Validity and Reliability

| Construct | Item | Mean | S. D. | Weight | t-stat |
|-----------|------------|------|-------|--------|---------|
| Work | Work1 | 5.75 | 1.58 | 0.12 | 0.88 |
| | Work2 | 5.15 | 1.83 | 0.08 | 0.53 |
| | Work3 | 5.58 | 1.73 | 0.43 | 3.79*** |
| | Work4 | 4.40 | 2.27 | 0.11 | 0.86 |
| | Work5 | 5.06 | 2.00 | 0.56 | 3.80*** |
| Edu | Edu1 | 5.03 | 2.01 | 0.05 | 0.26 |
| | Edu2 | 5.72 | 1.69 | 0.48 | 2.25** |
| | Edu3 | 5.41 | 2.06 | 0.08 | 0.41 |
| | Edu4 | 5.75 | 1.71 | 0.53 | 2.97*** |
| | Edu5 | 3.90 | 2.51 | 0.19 | 1.05 |
| Family | Family1 | 4.32 | 2.13 | 0.04 | 0.31 |
| | Family2 | 4.29 | 2.30 | 0.32 | 2.38** |
| | Family3 | 4.38 | 2.28 | 0.73 | 6.00*** |
| Friend | Friend1 | 4.76 | 2.14 | 0.51 | 3.33** |
| | Friend2 | 4.71 | 2.13 | 0.27 | 1.50 |
| | Friend3 | 4.76 | 2.27 | 0.53 | 3.44** |
| Consumer | Consumer1 | 3.24 | 2.48 | 0.16 | 0.81 |
| | Consumer2 | 3.98 | 2.46 | 0.40 | 1.92 |
| | Consumer3 | 3.18 | 2.61 | 0.60 | 2.76** |
| Leisure | Leisure1 | 4.84 | 2.24 | 0.23 | 1.52 |
| | Leisure2 | 5.12 | 2.12 | 0.45 | 2.61** |
| | Leisure3 | 5.23 | 1.98 | 0.55 | 3.37** |
| Social | Social1 | 3.29 | 2.49 | 0.18 | 0.60 |
| | Social2 | 3.63 | 2.59 | 0.37 | 1.06 |
| | Social3 | 3.87 | 2.58 | 0.57 | 2.41** |
| Finance | Finance1 | 3.76 | 2.60 | 0.14 | 0.72 |
| | Finance2 | 4.10 | 2.56 | 0.77 | 4.33*** |
| | Finance3 | 5.11 | 2.15 | 0.24 | 1.31 |
| Self | Self1 | 4.60 | 2.13 | 0.31 | 2.28** |
| | Self2 | 5.26 | 1.77 | 0.54 | 2.73** |
| | Self3 | 5.44 | 1.86 | 0.31 | 1.81 |
| Community | Community1 | 4.59 | 2.36 | 0.23 | 1.85 |
| | Community2 | 4.78 | 2.17 | 0.34 | 2.79** |
| | Community3 | 4.74 | 2.11 | 0.66 | 5.53*** |

Note: The significance levels are: * $p < .10$, ** $p < .05$, *** $p < .01$

Appendix B: Reflective Construct Convergent Validity

| Construct | Item | Mean | S. D. | Loading | t-stat |
|-----------|------|------|-------|---------|----------|
| QoL | QoL1 | 5.39 | 1.21 | 0.79 | 26.29*** |
| | QoL2 | 5.43 | 1.11 | 0.87 | 54.20*** |
| | QoL3 | 5.90 | 1.01 | 0.66 | 11.34*** |
| | QoL4 | 5.48 | 1.29 | 0.79 | 21.88*** |
| | QoL5 | 4.76 | 1.88 | 0.54 | 8.07*** |

Note: The significance levels are: * $p < .10$, ** $p < .05$, *** $p < .01$

Appendix C: Construct Discriminant Validity

C1: Correlations among Latent Constructs and AVE (shown in diagonal)

| | Work | Edu | Family | Friend | Consumer | Leisure | Social | Finance | Self | Community | QoL |
|-----------|------|------|--------|--------|----------|---------|--------|---------|------|-----------|-------------|
| Work | n/a | | | | | | | | | | |
| Edu | 0.65 | n/a | | | | | | | | | |
| Family | 0.63 | 0.41 | n/a | | | | | | | | |
| Friend | 0.70 | 0.53 | 0.70 | n/a | | | | | | | |
| Consumer | 0.51 | 0.45 | 0.63 | 0.65 | n/a | | | | | | |
| Leisure | 0.59 | 0.59 | 0.43 | 0.60 | 0.52 | n/a | | | | | |
| Social | 0.47 | 0.39 | 0.57 | 0.67 | 0.80 | 0.52 | n/a | | | | |
| Finance | 0.58 | 0.40 | 0.73 | 0.72 | 0.77 | 0.43 | 0.68 | n/a | | | |
| Self | 0.71 | 0.45 | 0.64 | 0.61 | 0.50 | 0.39 | 0.38 | 0.60 | n/a | | |
| Community | 0.59 | 0.45 | 0.68 | 0.66 | 0.65 | 0.45 | 0.55 | 0.72 | 0.64 | n/a | |
| QoL | 0.47 | 0.40 | 0.42 | 0.42 | 0.36 | 0.39 | 0.35 | 0.40 | 0.42 | 0.46 | 0.55 |

C2: Item-Construct Loadings and Cross Loadings

| | Work | Edu | Family | Friend | Consumer | Leisure | Social | Finance | Self | Community | QoL |
|------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Work1 | 0.54 | 0.49 | 0.19 | 0.31 | 0.15 | 0.33 | 0.10 | 0.17 | 0.26 | 0.25 | 0.29 |
| Work2 | 0.57 | 0.45 | 0.27 | 0.49 | 0.35 | 0.33 | 0.36 | 0.33 | 0.32 | 0.31 | 0.23 |
| Work3 | 0.75 | 0.61 | 0.37 | 0.43 | 0.32 | 0.54 | 0.33 | 0.30 | 0.34 | 0.33 | 0.30 |
| Work4 | 0.67 | 0.40 | 0.68 | 0.73 | 0.59 | 0.42 | 0.52 | 0.61 | 0.64 | 0.56 | 0.35 |
| Work5 | 0.87 | 0.44 | 0.62 | 0.63 | 0.47 | 0.44 | 0.40 | 0.61 | 0.77 | 0.58 | 0.43 |
| Edu1 | 0.45 | 0.57 | 0.30 | 0.42 | 0.36 | 0.28 | 0.36 | 0.30 | 0.26 | 0.38 | 0.33 |
| Edu2 | 0.42 | 0.80 | 0.13 | 0.25 | 0.17 | 0.38 | 0.16 | 0.09 | 0.18 | 0.16 | 0.30 |
| Edu3 | 0.46 | 0.60 | 0.32 | 0.36 | 0.28 | 0.42 | 0.30 | 0.25 | 0.29 | 0.26 | 0.32 |
| Edu4 | 0.55 | 0.81 | 0.39 | 0.48 | 0.37 | 0.51 | 0.29 | 0.38 | 0.45 | 0.44 | 0.26 |
| Edu5 | 0.52 | 0.55 | 0.51 | 0.55 | 0.64 | 0.47 | 0.63 | 0.61 | 0.46 | 0.53 | 0.35 |
| Family1 | 0.43 | 0.35 | 0.61 | 0.49 | 0.44 | 0.33 | 0.42 | 0.43 | 0.37 | 0.37 | 0.25 |
| Family2 | 0.60 | 0.42 | 0.84 | 0.68 | 0.59 | 0.44 | 0.52 | 0.62 | 0.57 | 0.56 | 0.36 |
| Family3 | 0.58 | 0.36 | 0.97 | 0.64 | 0.59 | 0.39 | 0.52 | 0.70 | 0.61 | 0.67 | 0.40 |
| Friend1 | 0.48 | 0.43 | 0.41 | 0.73 | 0.40 | 0.56 | 0.56 | 0.36 | 0.30 | 0.33 | 0.29 |
| Friend2 | 0.65 | 0.42 | 0.74 | 0.77 | 0.54 | 0.39 | 0.47 | 0.65 | 0.64 | 0.58 | 0.35 |
| Friend3 | 0.54 | 0.38 | 0.55 | 0.78 | 0.56 | 0.39 | 0.48 | 0.68 | 0.53 | 0.61 | 0.33 |
| Consumer1 | 0.47 | 0.34 | 0.54 | 0.63 | 0.76 | 0.44 | 0.63 | 0.62 | 0.39 | 0.49 | 0.30 |
| Consumer2 | 0.50 | 0.44 | 0.48 | 0.50 | 0.82 | 0.53 | 0.57 | 0.60 | 0.43 | 0.53 | 0.27 |
| Consumer3 | 0.40 | 0.36 | 0.59 | 0.58 | 0.92 | 0.40 | 0.78 | 0.72 | 0.45 | 0.61 | 0.35 |
| Leisure1 | 0.54 | 0.47 | 0.49 | 0.52 | 0.52 | 0.63 | 0.43 | 0.48 | 0.36 | 0.38 | 0.17 |
| Leisure2 | 0.47 | 0.45 | 0.36 | 0.51 | 0.41 | 0.85 | 0.50 | 0.37 | 0.29 | 0.34 | 0.26 |
| Leisure3 | 0.47 | 0.52 | 0.28 | 0.45 | 0.40 | 0.87 | 0.35 | 0.29 | 0.32 | 0.38 | 0.42 |
| Social1 | 0.41 | 0.35 | 0.42 | 0.54 | 0.69 | 0.48 | 0.83 | 0.54 | 0.29 | 0.45 | 0.31 |
| Social2 | 0.37 | 0.32 | 0.46 | 0.60 | 0.66 | 0.47 | 0.88 | 0.59 | 0.29 | 0.46 | 0.32 |
| Social3 | 0.46 | 0.38 | 0.57 | 0.62 | 0.76 | 0.46 | 0.94 | 0.65 | 0.39 | 0.53 | 0.32 |
| Finance1 | 0.52 | 0.32 | 0.56 | 0.65 | 0.73 | 0.44 | 0.66 | 0.72 | 0.52 | 0.55 | 0.29 |
| Finance2 | 0.53 | 0.36 | 0.68 | 0.68 | 0.74 | 0.38 | 0.67 | 0.97 | 0.51 | 0.68 | 0.37 |
| Finance3 | 0.47 | 0.35 | 0.59 | 0.54 | 0.45 | 0.36 | 0.34 | 0.67 | 0.59 | 0.53 | 0.36 |
| Self1 | 0.59 | 0.32 | 0.61 | 0.61 | 0.57 | 0.37 | 0.49 | 0.61 | 0.77 | 0.57 | 0.29 |
| Self2 | 0.62 | 0.42 | 0.52 | 0.49 | 0.39 | 0.34 | 0.29 | 0.47 | 0.93 | 0.53 | 0.40 |
| Self3 | 0.64 | 0.43 | 0.56 | 0.52 | 0.38 | 0.30 | 0.25 | 0.51 | 0.86 | 0.58 | 0.37 |
| Community1 | 0.44 | 0.42 | 0.52 | 0.47 | 0.56 | 0.31 | 0.46 | 0.59 | 0.45 | 0.73 | 0.37 |
| Community2 | 0.43 | 0.43 | 0.33 | 0.44 | 0.50 | 0.56 | 0.50 | 0.43 | 0.32 | 0.70 | 0.39 |
| Community3 | 0.52 | 0.31 | 0.68 | 0.60 | 0.53 | 0.28 | 0.41 | 0.66 | 0.64 | 0.90 | 0.37 |
| QoL1 | 0.50 | 0.36 | 0.36 | 0.42 | 0.35 | 0.44 | 0.29 | 0.39 | 0.43 | 0.40 | 0.79 |
| QoL2 | 0.43 | 0.34 | 0.38 | 0.38 | 0.36 | 0.35 | 0.35 | 0.38 | 0.38 | 0.45 | 0.87 |
| QoL3 | 0.26 | 0.24 | 0.24 | 0.23 | 0.12 | 0.17 | 0.15 | 0.17 | 0.22 | 0.25 | 0.66 |
| QoL4 | 0.23 | 0.30 | 0.28 | 0.23 | 0.23 | 0.20 | 0.22 | 0.22 | 0.26 | 0.32 | 0.79 |
| QoL5 | 0.16 | 0.16 | 0.25 | 0.18 | 0.21 | 0.12 | 0.26 | 0.25 | 0.10 | 0.20 | 0.54 |

Appendix D: The Fuzzy-Set QCA Method (fsQCA)

In QCA, cases are treated as different combinations of relevant attributes. To prepare data for QCA, membership scores need to be assigned to all variables (independent and outcome variables). The original QCA method (often referred to as the crisp-set QCA) requires that all variables are simple dichotomies (presence and absence). The fuzzy set extends the original QCA by allowing a variable to have varying degrees of membership in the set ranging from 0 (non-membership) to 1 (full membership). A higher value indicates that the case is more “in” than “out” of a set, while a lower value indicates that the case is more “out of” than “in” a set.

Boolean algebra and set theory are the analytical logic to derive relevant causal conditions in the data. The Boolean approach provides a systematic method for identifying logically relevant combinations of conditions among the cases. Negation (\sim), logical or ($+$) and logical and ($*$) are the primary Boolean algebra operations to represent the combinations of conditions associated with a certain outcome. The subset relation is then used to derive causal conditions that exhibit the outcomes. Table D1 summarizes the Boolean algebra and subset relations in fsQCA.

D1: Boolean Algebra and Fuzzy Subset

| Boolean operation | Description | Calculation |
|--------------------------------------|---|---|
| Negation of fuzzy set A ($\sim A$) | Membership in set not-A | $\sim A = 1 - A$ |
| Logical and (e.g., $A * B$) | Membership in a combination of set A and set B | Min (A, B) |
| Logical or (e.g., $A + B$) | Membership in set A or set B | Max (A, B) |
| Fuzzy subset | Description | Assessment |
| Sufficient condition | A specific combination of causal conditions among multiple cases that exhibit the same outcome. Such combination of causal conditions constitutes a subset of the outcome and may be interpreted as sufficient for the outcome. | In fuzzy sets, a subset relation is established when membership scores in one set (e.g., combination of causal conditions) are consistently less than or equal to membership scores in another set (e.g., the outcome). |

As discussed earlier, our conceptualization of horizontal spillover effects may involve the influence of one domain on another domain or the influence of multiple domains on another domain. Multiple regression analysis appears to be a potential method to evaluate this theory. However, as the number of independent variables increases, the interaction terms in a regression model can increase exponentially and easily exhaust the degrees of freedom in the data. If we want to fully test the horizontal spillover effects of nine life domains on a focal domain, 502 interaction terms are needed in a regression model. In contrast to the common variance explanation in regression, QCA applies set theory and Boolean logic in deriving causal conditions. Therefore, it is not limited by the requirement of a large number of degrees of freedom. Ragin (1987) suggested that QCA is a powerful analytical method “for addressing questions about outcomes resulting from multiple and conjunctural causes – where different conditions combine in different and sometimes contradictory ways to produce the same or similar outcomes” (p. x). Also, multicollinearity does not seem to be a problem with this approach (Ragin, 2000). Therefore, fsQCA is well suited for analyzing the horizontal spillover effects in this study.

Appendix E: Truth Table Analysis

E1: Fuzzy Set QCA Analysis using the Truth Table

| Step | Description | Application to this study |
|--|--|--|
| (1) Calibrate membership scores for all variables | Fuzzy set membership scores for all independent and outcome variables have to be between 0 and 1. | Our domain specific QoL variable is measured on a 7-point Likert scale. The 7-point scale from 1 to 7 was recoded to seven membership scores including 0, 0.17, 0.33, 0.50, 0.67, 0.83, and 1. |
| (2) Identify the empirically relevant causal conditions | This step identifies relevant causal conditions found in the data set. A relevant causal combination has a membership score greater than 0.5. By applying this rule, a list of relevant causal combinations and the number of cases is identified. | To illustrate this step, we use an example of the analysis of work QoL as an outcome variable. By applying this step, we identified 9 causal combinations with a membership score greater than 0.5. For example, the causal combination in which all other 9 domains are present has 105 cases. |
| (3) Use frequency threshold to retain relevant cases | Identify the cut-off frequency threshold (number of cases) to determine if a causal combination has empirical significance to be retained for further analysis. | Since our study is exploratory, we are interested in identifying as many relevant causal conditions as possible. We set the frequency threshold to be at least 1 case. |
| (4) Evaluate the subset relation of causal combinations (Which causal combinations link to the outcome?) | Consistency score ¹ is used to evaluate the degree to which empirical evidence is consistent with the subset relation. | We used the consistency score of at least 0.85 to determine causal conditions that relate to the outcome. Then, the outcome variables are coded "1" for these rows and "0" for rows below the consistency score cut-off. |
| (5) Use the Quine-McCluskey algorithm to identify the minimum combinations of causal conditions necessary to trigger the outcome | The Quine-McCluskey algorithm applies Boolean minimization to reach the parsimonious solution. | To illustrate Boolean minimization, consider two causal conditions that involve A, B, and C and the outcome variable E. The first causal condition is A = 1, B = 0, C = 1, and E = 1. The second causal condition is A = 1, B = 1, C = 1, and E = 1. By applying Boolean minimization, we reach a more parsimonious causal combination of A = 1, C = 1 because B has no effect on the outcome. |

Note: ¹ Consistency score $(X_i \leq Y_i) = \sum_{i=1}^n \frac{\min(X_i, Y_i)}{X_i}$; X_i = membership scores in a causal combination, Y_i =

membership scores in the outcome, i = case. A consistency score of 1 means that all of the X_i values are less than or equal to their corresponding Y_i values or a perfect theoretical subset relation. A higher consistency score is desired because it means that most cases in the data fit the subset relation. Cut-off values of 0.85 or higher are recommended (Ragin, 2006).

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