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Social Participation among the Elderly: Moderated Mediation Model of Information and Communication Technology (ICT)

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Abstract:

Researchers have identified social participation for the elderly as a salient activity that benefits their wellbeing. Along that vein, prior studies have reported that ICT use increases the extent to which the elderly participate socially with one another. However, the literature remains silent on the mechanisms by which ICT use leads to social participation. In this paper, we draw on two prominent IS theories, actor-network theory (ANT) and activity theory (AT), to develop a conceptual framework by incorporating four social participation-oriented factors: ICT use, social participation, social isolation, and loneliness. We used a quantitative approach based on the cross-sectional survey to collect data from 240 elderly people. We analyzed the data using structural equation modeling based on SmartPLS 3.0. We found that the size of the social network constituted the critical factor in the association between ICT use and social participation. The outcome of the model suggests that ICT use does not impact the social participation directly. Rather, social isolation (absence of social network) mediates the relationship between the ICT use and social participation. Additionally, loneliness, one of the commonly observed psychological states in the elderly, weakens the influence of ICT use on social isolation. Our research advances our theoretical understanding about social participation among seniors and helps governments and businesses prepare ICT plans for the elderly appropriately.

Keywords: ICT Use, Social Isolation, Social Participation, Loneliness.

1   Introduction

Continuous improvements in medical science has contributed to increasing the number of elderly people alive today compared to any other time in history (Anderson & Hussey, 2000; Imam, 2015). A larger elderly population changes the population pyramid's existing structure such that it features a heavy top and weak bottom (rather than the reverse). Demographists address this changing structure   as a demographic transition that any society cannot just overlook. Indeed, all countries observe this phenomenon (Lesthaeghe, 2010). As an age group, the elderly in the industrial nations comprise around 20-25 percent of the total population (Higo & Khan, 2014). In developed countries, the elderly population typically refers to people over 65 years old (Shanmugasundaram, Rough, & Alpert, 2010). In developing countries, the elderly population typically refers to people over 60 years old due to the fact that these countries have a lower overall life expectancy (Hoque & Sorwar, 2017). For that reason, in this study, we define the elderly as people over 60 years old.

Elderly experience extensive stress that arises due to the changes associated in the social environment (DeBerry, 1982; Gaffey, Bergeman, Clark, & Wirth, 2016). The elderly commonly experience phenomena such as a loss of status and social role, bereavement, fewer friends, a decline in cognitive and physical ability, reduced longevity, and rapid social changes (DeBerry, 1982; Berezin, 1980; Palmore, 1973; Brittain et al., 2017). Accordingly, the elderly can find themselves socially excluded, which can lead to social isolation and, thus, a reduction in the size of their social network (Steptoe et al. 2013). This social isolation means the elderly are less likely to participate less in social activities (Ferraro, 1984). Social participation represents an essential requirement for people of all age groups; however, the elderly need it even more since it may substantially improve their wellbeing (Takagi, Kondo, & Kawachi, 2013; Chen & Chen, 2012; Li, Xu, Min, Chi, & Xi, 2016). In this paper, we define wellbeing as people's positively evaluating their lives such that they feel positive emotions, fulfilled, and satisfied with life (Diener & Biswas-Diener, 2005). Considering the importance of social participation among elderly, we investigate whether and how ICT use among the elderly enhances their wellbeing.

The umbrella term information and communication technology (ICT) describes applications and services of various communication means such as televisions, telephones, mobile phones, computers, and the Internet (Ejaz & Imtiaz, 2015). For our study, we define socialization as "the activity of mixing socially with others" (Francis & Jin Jiang, 2017). Since social participation relates to socialization, in our research, we specifically focus on ICT media that involve socialization such as social media and term such media social ICT. Other than social media, researchers often regard ICT as a unique solution to take care of problems that the elderly face (Cotten, Anderson, & McCullough, 2013). Researchers have also found Social ICT to positively influence the elderly's life. It helps the elderly maintain family connectedness (Cornejo, Tori, & Favela, 2013) and obtain timely care from their family members (Spagnoletti, Resca, & Saebo, 2015). In this paper, we investigate the underlying mechanisms by which ICT influences socialization-specific issues among the elderly such as social isolation and social participation. Broadly, we ask the following research question:

  RQ: How does the elderly's ICT use contribute to their socialization?

This paper proceeds as follows: in Section 2, we review the literature. In Section 3, we discuss the theoretical foundation for the study. In Section 4, we discuss our hypotheses. In Section 5, we discuss the research methods we followed, how we collected data, and how we developed our instruments. In Section 6, we discuss how we analyzed the data and present our findings. In Section 7, we discuss our findings and their implications. Finally, in Section 8, we conclude the paper.

2   Literature Review

The social participation literature classifies individuals' participatory activities under three categories: social, productive, and leisure (Hsu, 2007; Kahn, 1984). Studies define social participation as sharing individual resources for socialization purpose (Bukov, Maas, & Lampert, 2002). Many activities relate to social participation, such as sharing one's time, effort, and money with family members, friends, various social groups, and the public (Hsu, 2007). In contrast, productive participation refers to an individual's participation in work activities, while leisure participation refers to the individual's participation in leisure activities. Studies that have examined social participation among the elderly have found that it positively influences their functional skills, cognitive skills, wellbeing, health-related quality of life, and survival (Dahan-Oliel, Gelinas, & Mazer, 2008; Francis & Jin Jiang, 2017; Hsu, 2007; Bukov et al., 2002).

Existing studies on social participation among the elderly have mostly examined its consequences (Tomioka, Kurumatani, & Hosoi, 2016; Li, Jiang, Li, & Zhang, 2017; Tomioka, Kurumatani, & Hosoi, 2017). These studies come mostly from the medical science (Cacioppo, Catherine, Decety, Monteleone, & Nusbaum, 2009; Cotton et al., 2013; Luo, Hawkley, Waite, & Cacioppo, 2012) or social science fields (Baarsen, 2002; Fry & Debats, 2002; Şar, Göktürk, Tura, & Kazaz, 2012) and consider social participation as an independent variable that leads to various health-related outcome variables (Cornwell & Waite, 2009; Luo et al., 2012) or psychological wellness (Tiikkainen & Heikkinen, 2005). Studies have infrequently examined the contributing factors of social participation. Studies also need to examine social participation as the outcome variable since social participation may bring positive changes to the elderly. The fact that many elderly people withdraw from society further establishes the need to study social participation as an outcome variable (Cumming, Dean, Newell, & Mccaffrey, 1960). As such, as a recent socialization tool, social ICT represents a likely technology solution for helping the elderly socially participate with other people.

Studies that have focused on technology as the influencing variable have adopted a generalist approach to studying technology and done so in aggregate rather than studying what effect specific technologies have (Bijker, Hughes, & Pinch, 1987; MacKenzie & Wajcman, 1985). We found studies that examined the social impact of specific technologies after mid-1990s. Similar to technology as an aggregate object, studies that have examined the impact that technology has on society have considered society a single unit but scarcely explored its impact on specific population groups. Technological impact studies that focus on a specific social group, such as individuals with a specific disadvantageous, would be much more useful than studies that focus on society as a whole. Studies have also infrequently examined the impact that ICT has on the elderly. With that said, some studies have examined Internet use and its impact on the elderly's psychological wellbeing. Table 1 illustrates recent studies that associate specific ICTs with various social impacts. Over the years, many innovative ICT applications that are relevant, influential, and useful for elderly people have emerged, though research on the social ICT use and its impact on elderly life remains limited.

The elderly's self-withdrawal from society results in their social isolation, reduced social participation, and, ultimately, a state of loneliness (Hall, Havens, & Sylvestre, 2003; McGuire & Norman, 2005). In our research, we define social isolation as the absence of a social network; social participation as sharing one's time, efforts, and money with one's family members, friends, various social groups, and the public; and loneliness as the perception that the nature and number of one's social relationships do not fulfill one's social needs (Hawkley & Cacioppo, 2010). While social isolation, social participation, and loneliness relate to one another, they do differ. These three concepts illustrate different voids in elderly people's social life. Past studies have found direct relationship of social ICT on social isolation, social participation, and loneliness. However, the literature remains silent on the mechanism(s) that bolsters social participation. Reduced social participation occurs in elderly ages (Dahan-Oliel, Gelinas, & Mazer, 2008; Hsu, 2007) and results in multiple multidimensional issues (Forsman & Nordmyr, 2017) that one can categorize as a negative feeling (psychological dimension), smaller social network (social dimension), and reduced social participation (physical dimension) (Cattan, Newell, Bond, & White, 2003). These dimensions interconnect and influence one another (Loucks, Berkman, Gruenewald, & Seeman, 2006; Shankar, McMunn, Banks, & Steptoe, 2011; Steptoe, Shankar, Demakakos, & Wardle, 2013). Elderly people commonly suffer from negative feelings (Baarsen, 2002; McWhirter, 1990; Şar et al., 2012). They also commonly experience restricted physical movements, which decreases their social activities and further escalates their psychological distress (Fry & Debats, 2002; Luo et al., 2012). Moreover, the elderly's tendency to socially withdraw often reduces the size of their social network and leads them to social isolation (Baker & Bugay, 2011). From the extant literature, we found that negative feelings, social isolation, and social participation are associated (Steptoe et al., 2013), but research has explored how they influence each other less often.

In our study, we investigate the influence that social ICT has on the elderly's feelings, networks, and activities. In Table 1, we show some studies that have found an association between social ICT and wellbeing constructs. One can show that few studies have found that social ICT influences the elderly's participatory activity. Researchers consider participatory activities such as social participation at old age an important factor in the elderly's wellbeing (Diggs, 2008), and the literature in Table 1 suggests that other constructs such as social isolation and loneliness also represent important factors in the elderly's wellbeing. Considering all these facts, we study the impact of ICT use, loneliness, and social isolation at the social-participation level.

Table 1. Mapping Elderly Wellbeing and Relevant Theories and Antecedents

Authors	Theory used	ICT use	Feeling type	Network type	Activity type (participatory activity)	Wellbeing type
Cotten (2013)	None	Internet	Loneliness	Social isolation	None	None
Carpenter (2007)	Diffusion theory	Computer	Loneliness	None	None	Physical health
Song (2014)	None	Facebook	Loneliness	Social support	None	None
Sum (2009)	None	Internet	None	Sense of community	None	Personal wellbeing
Sar (2012)	None	Internet	Loneliness	None	None	None
Lissitsa (2016)	None	Social media Email Online Shopping Games	Feeling Lonely	Number of children	The frequency of meeting / talking to friends	Life satisfaction
Luo (2012)	None		Loneliness Depression	Relative and friends	Physical exercise	Health
Forsman (2015)	Activity theory	Internet	Loneliness	None	None	Wellbeing
Steptoe (2013)	None	None	Loneliness	Social isolation	None	Mortality

2.1 Elderly and ICTs

Our study has two elements: the elderly and ICT. We categorize the elderly—the human element—as the first actor. We define actor following Scheuer (2008) as an "actant": a living or non-living source of action (Scheuer, 2008). Following the same definition, we also categorize social ICT as an actor. Although a non-human element, ICT is a source of socialization-related actions and, hence, suits the definition for actor we provide. In this paper, we term an activity any action that these actors take. An increasing number of non-human actors, such as new ICT products and services that have a short lifespan, makes the environment for elderly/senior challenging. In such scenarios, the elderly struggle to adjust and, hence, resist adopting technological innovations. However, not being able to use ICT as other age groups do excludes the elderly from society. The fact that other age groups continue to increasingly adopt new ICT aggravates the situation. We can address this issue by using ICT as a tool for socialization in and out of their group. However, among all the age groups, the elderly use ICT (especially smartphones, the Internet, and social media) the least (Niehaves & Plattfaut, 2014).

More than ever before, people today require social connections to overcome resource constraints (Cass, Shove, & Urry, 2005). ICT allows information to flow symmetrically despite borders, and, therefore, affiliation to a community does not require a physical presence (Wilding, 2009). Thus, individuals of various age groups (except the elderly) have progressively come to use in ICT-facilitated social networks. Older people resist new technologies such as social media and ICT due to their earlier experience and habits that they find difficult to change (Venkatesh, Thong, & Xu, 2012). This resistive behavior restricts their presence in social networks and further increases their isolation. ICT enables them to reduce their social isolation and more easily communicate with family and friends located elsewhere. Figure 1 depicts the way in which ICT, people, social networks, and activity relate to one another.

In summary, the literature contains several gaps. First, few studies have used ICT as an independent variable. Second, few studies have examined the elderly and even fewer have examined the association between ICT and the elderly. Third, we found no studies based on a strong theoretical background. Considering the positive effect that ICT can have and the increasing number of elderly people in both developed and developing nations, this study focuses on a pertinent issue. Therefore, we address the following research question (RQ):

RQ 1: How does ICT influence the elderly's social-participation activities?

3   Theoretical Foundation

Elderly people are less proficient, less eager to learn, and find it more difficult to use ICT compared to other adults (van Deursen & Helsper, 2015). This fact illustrates the fundamental difference between elderly ICT interaction and non-elderly ICT interaction and demands that we employ theories that pertain to the elderly population to gain deeper insights into why. Therefore, we ground our study in theories from gerontology amd information systems (IS). Specifically, from gerontology, we draw on disengagement theory, continuity theory, and activity theory of aging to comprehend the elderly's tendency to experience loneliness, social isolation, and reduced social participation. Disengagement theory is first of its kind to study elderly issues. Disengagement theory states that decreased interaction among elderly occurs because they withdraw themselves from the social system (Cumming & Henry, 1961; DeLiema & Bengtson, 2017). Many elderly people accept withdrawal from society as common and natural (Ebersole, Hess, Touhy, & Jett, 1995; Christensem & Pilling, 2018). Consequently, the disengagement results in loneliness, social isolation, and a reduced activity level (social participation) (Hall et al., 2003; Shankar et al., 2011; Steptoe et al., 2013). Also, the elderly often reluctantly adopt new developments due to their emotional attachment to the events and objects that belong to their past. The continuity theory of aging explains this emotional closeness to the past (Atchley, 1989; Mohd, Senadjki, & Mansor, 2017). Continuity theory of aging concerns the social behavior that the elderly seek to maintain in their later years. The theory states that elders are likely to pursue the same activities and continue with same habits and relationships as in their earlier years. This theory further states that the past experiences of older adults play a vital role in their future conduct. The continuity theory views aging via a lifespan viewpoint and, hence, builds a strong ground for our research. The elderly often resist ICTs due its newness and prefer non-ICT solutions to problems they have used in the past. The activity theory of aging evidences ICT's benefits for the elderly (Havighurst, 1961; Anderson et al., 2014). This theory demonstrates that older adults need to conduct activities for their wellbeing (Diggs, 2008). This theory proposes that individuals need two things to maintain their wellbeing: 1) maintain a high activity level and 2) become more involved in social interactions. By fulfilling these two requirements, individuals prolong their lives and improve their quality of life. Bernice Neugarten further affirmed that satisfaction level in old age also depends on activities level (Neugarten, Havighurst, & Tobin, 1996).

The above theories explain distinct realities of old age. Disengagement theory concerns behavioral changes that individuals experience compared to their younger years. Continuity theory concerns the elderly's liking or disliking certain things. Continuity theory explains commonly observed aging behavior among the elderly, whereas activity theory of aging focuses on how the elderly can lead more fulfilling and healthy aging by remaining active. The gerontology literature shows that an increased activity level among the elderly is positively associated to wellbeing.

As we state above, we also examine ICT in this study. We bring relevant theories from the IS area to further explore the social-participation phenomenon. ICT inherently constitutes a means to communicate with others and allows networks to form. To understand the network characteristics of human or other actors, social scientists widely use actor-network theory (ANT). At the same time, activity theory (AT) (not the activity theory of aging) provides insight to understand the triggers that culminate into various activities. Using ANT and AT, we identify the role of ICT for the elder's social participation. We explain how we formulate our conceptual framework based on these two theories in Sections 3.1 and 3.2.

3.1   Actor-network Theory

According to ANT, both humans and non-humans play a role in creating social forces. In today's social context, information and communication technology (ICT) represents the most influential non-human actor (Reyes & Kheng 2015). As an actor, ICT can reinforce existing social rubrics or profoundly change it (Gholami, Lee, & Heshmati, 2006). ANT helps one to understand the social phenomenon in which both humans and non-humans have importance. Originally, researchers used ANT to understand innovation and knowledge-creation processes in science and technology fields. Subsequently, researchers began to use it widely across all social sciences areas. By nature, actors form networks. In these networks, ICT use becomes an important mediator. ICT non-use reduces network size, whereas ICT use increases it. By using ANT, we shed light on how actors and networks connect to each other.

3.2 Activity Theory

The activity theory that we explain here differs from the activity theory of aging that we discuss above. Activity theory focuses on the mechanisms by which individuals conduct activities. The theory postulates about those factors that serve as antecedents to the activities that humans perform. Higher mental activities are an important reason for higher physical activities (Vygotsky, 1978), and individuals' social group and regular contacts guide such mental endeavors (Nardi, 1996). An individual with a larger social network size leads to significant increase in various activities. Therefore, an individual's ICT network size has a direct and positive relationship with the activities that the individual performs. In this study, we map social isolation to a smaller network. We define social participation as engagement in various social activities. Activity theory focuses on three activity dimensions: how, what, and why (Baerentsen & Trettvik, 2002). In our study, we explore "how much". We hypothesize that a higher network size among the elderly leads to higher mental activities, which result in more social activities. We represent our conceptual model for the activity-generation process in Figure 1.
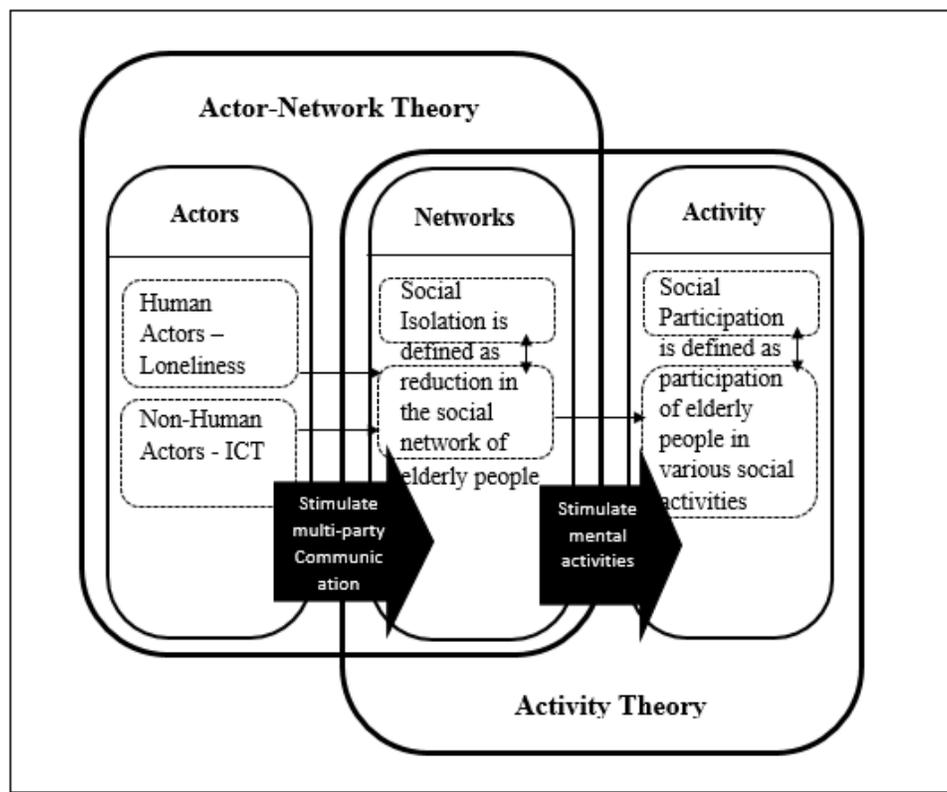

Figure 1. Integrative Framework

With input from ANT and AT, we investigate the relationship that loneliness, social isolation, and social participation have with ICT use. We further reiterate that these concepts differ from one another relate to the isolation that the elderly commonly experience. Loneliness involves isolation at the feeling level, social isolation involves isolation at the network level, and social participation involves isolation at activity and role-accomplishment level.

4   Conceptual Foundation: Model Hypotheses

We conceptualize ICT as a means for socialization (Venkatesh et al., 2012). Individuals carry social isolation in their minds: they perceive a reduction in their (objective and quantifiable) social network and number of social contacts (Steptoe et al., 2013). According to ANT, non-human actors (ICT in our context) act to form a network as equally as human actors. If a non-human actor participates at a low level in an individual's day-to-day life, the individual will likely have a reduced network size, which will lead to increased social isolation. Conversely, if a non-human actor uses ICT at a high level in an individual's day-to-day life, the individual will likely have lower social isolation. This rationale concurs with previous studies

that show that the elderly that use ICT more tend to feel less socially isolated (Cotten, Anderson, & McCullough, 2012). Thus, we hypothesize:

H1:   ICT use has an adverse effect on the elderly's social isolation.

Social participation refers to the level at which individuals involve themselves in their daily activities and accomplish social roles (Levasseur, Desrosiers, & Noreau, 2004). Disengagement theory suggests that, with age, elderly people gradually disengage from their previous activities and social functions. However, ICT engagement facilitates their engagement in various activities and roles even without their personal presence. People also participate in newer activities due to ICT use (e.g., learning and coaching each other for to potentially use new ICT. Thus, ICT use causes a higher level of mental activities that motivates elderly people to participate in other activities (Christensen & Mackinnon, 1993). Hence, ICT use will likely have a positive impact on the elderly's social participation. Thus, we hypothesize:

H2:   ICT use has a positive effect the elderly's social participation.

Other than ICT use's direct effect on elderly's social participation, we also investigate an indirect effect mediated through social isolation. By its nature, ICT constitutes a tool that two or more individuals can use to communicate and connect with one another. Connecting with more individuals decreases one's social isolation and increases one's social network size. According to activity theory, an increase in a social network leads to increased social participation. Increased network size results in a higher activity level. First, a larger social network is directly related to a higher level of an individual's mental process due to influences from multiple people (Nardi, 1996). The higher mental process has a direct and positive relation to an individual's activity level (Vygotsky, 1978). Thus, we hypothesize:

H3:   Social isolation has a negative effect on the elderly's social participation.

Loneliness is a negative feeling in which one perceives that the quantity or quality of one's social relationships do not meet one's social needs (Hawkley & Cacioppo, 2010). Older people are more susceptible to loneliness (Dury, 2014). Growing old brings forth various age-related losses that make it difficult to maintain relationships, which can result in negative feeling such as loneliness (Kumari, 2015). Negative feelings are far more powerful and influential than positive feelings (Tsui & Barry, 1986). Negative feelings that loneliness generates can make people insensitive to their other relationships (Yamaguchi, Smith, & Ohtsubo, 2017). In their cognitive neuroscience study, Cacioppo, Catherine, Decety, Monteleone, and Nusbaum (2009) found that lonely individuals respond less actively to socialization than non-lonely people. In the present paper, we study ICT as a socialization medium. Based on prior findings (Cacioppo et al., 2009) we argue that ICT use causes the elderly to become less lonely. Thus, we hypothesize:

H4:   Loneliness moderates the influence that ICT use has on social isolation.

Building on the same argument, we hypothesize that social isolation has a weak influence on social participation in lonely elderly people. Thus, we hypothesize:

H5:   Loneliness moderates the influence that social isolation has on social participation.

We show the full conceptual model for our elderly activity network theory (EANT) in Figure 2.
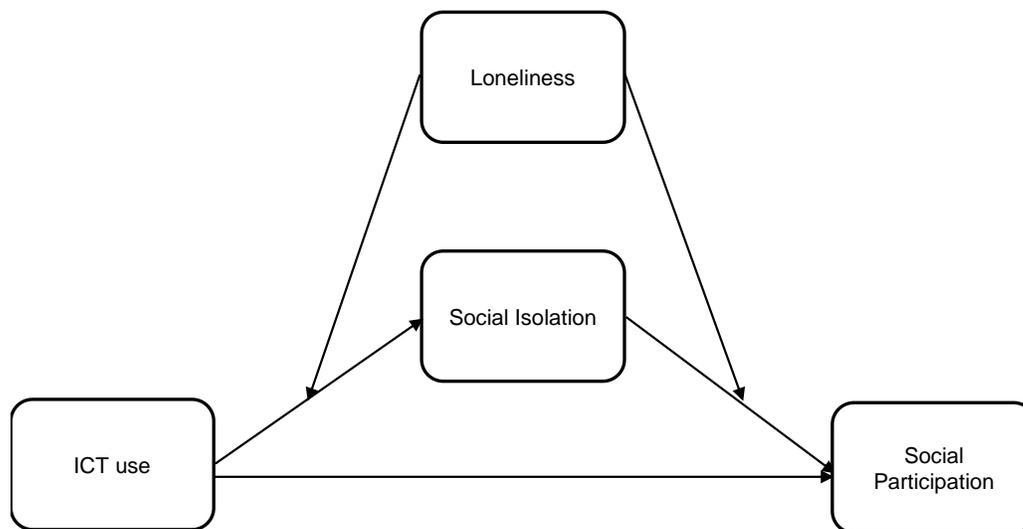
Figure 2. Proposed Model

5 Research Methodology

5.1 Target Participants

To test our hypotheses, we conducted a survey among elderly people from India. Specifically, we targeted individuals over 60 years old. However, one cannot easily collect data from the elderly (Azir, Zulisman, & Naim, 2014). Answering survey questionnaire requires a certain amount of involvement and intelligence from the participant. With aging, various faculties of human intelligence gradually deteriorate, which causes memory loss, a slower information–processing speed, and a decreased ability to learn (Krikorian, 2009). Declining vision and hearing capacity further enhance their difficulty in processing information. Further, answering survey questions requires individual to focus, but elderly people often have poor vision (due either to natural aging or eye diseases such as cataracts, glaucoma, and so on), which makes it difficult for them to do so (Stuen & Faye, 2003). As a result, we found that elderly people, especially elderly people with a declining health condition, often do not wish to participate in surveys. Accordingly, in our initial data-collection phase, we collected data at a slow rate. Later on, we realized that, due to their frequent social isolation, elderly people enjoy talking since it temporarily decreases their isolation. Accordingly, we changed the data-collection strategy from a survey questionnaire to face-to-face interviews. We asked them the same questions as in the questionnaire. In this data-collection method, the interviewer personally visit respondents, asks questions, and records the respondents' responses on questionnaire forms (Bethlehem 2009). Researchers have found this data-collection method to have a good response rate, produce high-quality responses, and reduce non-response bias (Hox & De Leeuw 1994). Face-to-face interviews typically demand a larger number of interviewers. As such, the face-to-face method can be expensive, laborious, and time consuming. However, due to the early restrictions we faced in obtaining responses, we had no other choice. We spent 50-60 minutes with each participant and noted their responses during the interviews. Since we targeted people over 60 years old, we approached locations with many elderly people, such as old age homes, temples, Gurudwara (a place of worship), and so on. In total, it took around nine months to complete the data-collection process from January to September, 2017. Table 2 presents the descriptive statistics for the survey participants.

Table 1. Descriptive Statistics of Survey Participants

Demographic variables		Data
Gender	Male	(76%)
	Female	(24%)
Age (years) (mean = 69, s.d. = 4.7)	60-70	(44%)
	71-80	(37%)
	80+	(19%)
Education	Primary	(7%)
	Secondary	(17%)
	Graduate	(48%)
	Graduate +	(28%)
Urban/ Rural	Urban	(87%)
	Rural	(13%)
Total		**240 (100%)**

5.2   Data-collection Process

Although one should use a random sample for survey-based research, we could not use such a sample due to the time and resources constraints. Consequently, we decided for convenience and used snowball sampling. However, we tried our best to represent India as a whole by including various age groups over 60 and people from various regions (e.g., North, South, East, and West India). We collected samples from people from the following cities: India, Indore, Jabalpur, Raipur, Rajnandgaon, Chennai, Dehradun, Lucknow, Kolkata, Narsinghpur, and Hyderabad. We used Soper's (2017) a priori sample size calculator to determine the sufficient sample size for our research. This calculator builds on Cohen's (1988) and Westland's (2010) work. We used five types of information from our pilot study in the calculator to calculate the sample size: effect size (0.25), probability level (0.05), number of latent variables (4), number of observed variables (20), and desired statistical power level (0.8). The calculator produced 209 as the appropriate sample size for the study. To determine the appropriate effect size, we followed the procedure that Preacher and Kelley (2011) suggest.

5.3   Instrument Development

We adopted the measurement scales for the constructs in our study from established instruments from similar constructs published in past studies. In some cases, we rephrased the language of some items to fit our context (see Table 3). To measure the items in the "ICT use", we considered the frequency with which individuals used various ICT media to interact with other individuals or groups (Venkatesh et al., 2012). We adopted the measurement items for social isolation construct based on our definition that captures the number of members in a social group (Cornwell & Waite, 2009). Similar to previous studies, we conceptualized social participation as a single-dimensional construct that focuses on participants' (not participations) group activities (Cornwell & Waite, 2009). The measurement items we used for loneliness construct have their foundations in the well-known UCLA scale (Luo & Waite, 2011).

Because elderly people can have cognitive difficulty in answering questions, which we experienced in our earlier interactions, we measured the items in our constructs on a five-point Likert scale (1 = strongly disagree; 5 = strongly agree). We validated the instrument with a pilot study before conducting the final study. Table 3 shows the questionnaire.

5.4   Non-response and Common Method Bias

We pre-tested the measurement scale with two external researchers before we collected data from all the targeted respondents. Accordingly, from their feedback, we made few minor changes in language and context of the research instruments. We collected data from respondents in different elderly locations such as old age homes, retired employee organizations, yoga clubs, and religious organizations because we could find a large number of potential survey participants at such locations. We addressed non-response bias (NRB) at the item level and unit level by ensuring that respondents answered all questions and by

interviewing as many people as possible. As Podsakoff, Mackenzie, Lee, and Podsakoff (2003) suggest, we took precaution measures before we collected data to address common method variance (CMV).

Table 3. Measurement Instrument

Construct	Item	Wording	Reference
ICT use		Please choose your usage frequency for each of the following:	Venkatesh et al. (2012)
	ICT1	SMS	
	ICT2	Whatsapp	
	ICT3	MMS (sending video, image, and audio)	
	ICT4	Facebook	
	ICT5	E-mail	
	ICT6	Browse websites	
	ICT7	Talk on mobile	
Social isolation	SOI1	What is your social network range (relationships in the network; range = 0, 5) with your spouse, family, relatives, friends, colleagues?	Cornwell & Waite (2009)
	SOI2	How regularly do you interact with network members?	
	SOI3	How many family members would you say you have?	
	SOI4	How many relatives would you say you have?	
	SOI5	How many close friends would you say you have?	
	SOI6	How many colleagues would you say you have?	
Social participation	SOP1	Frequency of attending meetings of an organized group	Cornwell & Waite (2009)
	SOP2	Frequency of socializing with friends	
	SOP3	Frequency of socializing with relatives	
	SOP4	Frequency of volunteering	
Loneliness	LON1	How often do you feel that you lack companionship?	Luo & Waite (2011)
	LON2	How often you feel that you are left out (ignored)?	
	LON3	How often you feel that you are isolated from others?	

6 Data Analysis and Results

6.1 Instrument Validation

We verified the validity and reliability of the survey instrument before we collected data. We measured composite reliability (CR), standardized path loading, average variance extracted (AVE), and Cronbach's α to test the convergent validity (Gefen, Straub, & Boudreau, 2000). With the help of confirmatory factor analysis (CFA), we found composite reliability (CR) to be more than 0.88. All the items of construct loadings exceeded 0.7 and were significant except for SOI-1 (0.676), SOI-2 (0.552), and SOP-1(0.579). The minimum Cronbach's α was 0.803 for the construct social participation (SOP). The average AVE for all the four constructs was more than 0.5. These results establish the measurement model's convergent validity. We used SmartPLS for our analyses since researchers often use the variance-based PLS-SEM approach to develop theories in exploratory research as in our case (Ringle, Wende, & Becker, 2015; Sarstedt, Ringle, Smith, Reams, & Hair, 2014).

We investigated the square root of AVE for each construct (the diagonal letters of Table 4) and observed that each was greater than the correlations between the constructs (i.e., the off-diagonal elements). These results establish the measurement model's discriminant validity (Kim & Kankanhalli, 2009).

Since we collected data following the survey methodology, it could suffer from common method bias, which we took various steps to address. First, we followed the procedures that Podsakoff et al. (2003) suggest when we designed the instrument and collected data. Second, we conducted Harman's (1960) single-factor test for common method variance and found no evidence that common method variance

affected our data. Third, we used the marker-variable technique (Lindell & Whitney, 2001) to find out the impact of CMV if any on our model. Using social norm as a marker variable, we found CMV had no critical impact (CMV = 0.17) on our model.

6.2   Results

Finally, we examined our hypotheses using SmartPLS. We assessed the structural model's coefficients and significance. We derived different fit indices according to Gefen et al.'s (2000) recommendations. Figure 2 presents the results.
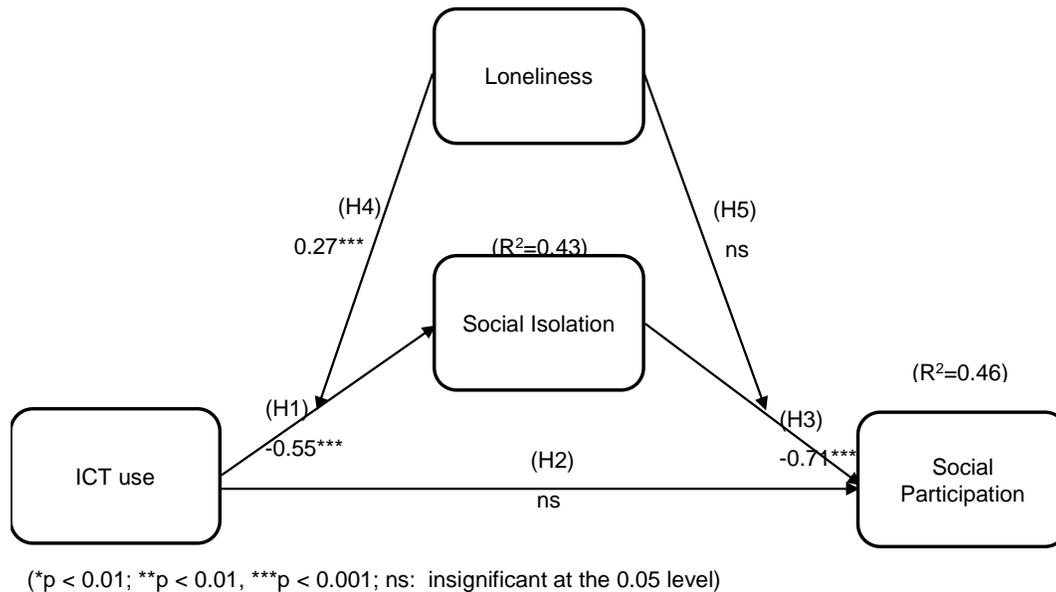

(*p < 0.01; **p < 0.01, ***p < 0.001; ns: insignificant at the 0.05 level)

Figure 2. Testing Results of the Structural Model

The results indicate that ICT use significantly affected social isolation and explained 43 percent of the variance. ICT use did not directly affect social participation (H2). Social isolation fully mediated the effect that ICT use had on social participation, and it and had a direct association with social participation (H3). We found that loneliness significantly moderated the relationship between ICT use and social isolation. However, we found that loneliness did not impact the relationship between social isolation and social participation (H5).

Table 4. Correlations between Latent Variables

	Mean	S.D.	ICT	LON	SOI	SOP
ICT	2.06	1.25	——			
LON	2.53	1.19	0.032	**0.884**		
SOI	2.98	1.48	-0.614	-0.251	**0.742**	
SOP	2.99	1.13	0.349	0.244	-0.702	**0.846**

Following Baron and Kenny (1986), we further examined the influence that social isolation had on the relationship between ICT and SOP. To do so, we conducted a Sobel (1982) test and found that SOI fully mediated the relationship between ICT and social participation.

Table 5. Sobel Test for Mediation

ICT-SOI coef.	SOI-SOP coef.	ICT-SOI stderr	ICT-SOI stderr	Sobel test value	Sobel test p value
-0.66	-0.93	0.204	0.125	2.967	0.001

Loneliness had a significant effect on the relationship between ICT and social isolation but a non-significant effect on the relationship between social isolation and social participation (Baron & Kenny, 1986). To further check the robustness of the moderated mediation effect, we followed Preacher, Rucker,

and Hayes' (2007) moderated mediation procedure (SPSS process number 58) to compute conditional indirect effects that ICT use had on social participation. We found the same result as in our SmartPLS estimation. Table 6 depicts the VIF table between two constructs. The low VIF values (i.e., below 5) indicate that the model had no multicollinearity.

Table 6. VIF Statistics of Various Constructs

	SOI	SOP
ICT	1.017	1.653
LON	1.086	1.098
SOI		1.994

7 Discussion and Implications

7.1 Discussion of Findings

In this paper, we offer a broadened view of social participation and develop an integrated framework that describes the new perspective on its mechanisms. Our framework holds important implications for research and practice in both the elderly and ICT areas.

We ground our model in actor-network theory (ANT) and activity theory (AT). Because actors (human and ICT both) in tandem facilitate communication, they connect to other actors and form a social network. As the human actor, the elderly have restricted communication power due to their inherent limitations, but ICT as a non-human actor helps them to bridge this gap, communicate, and take social action. By using ICT and leveraging ICT, the elderly can proactively participation in actions to remain socially active.

We conducted this research with motivation from the gerontology literature that suggests that the elderly are less eager to participate in social activities (Cumming et al., 1960; Diggs, 2008) and the ICT literature that suggests that people can use ICT as a medium to form social networks. With the help of IS theories, we identified how ICT can help the elderly engage with society and reverse their tendency to withdraw from it. Social isolation constitutes an important issue for the elderly. From our study, we found that ICT use minimizes their social isolation. Due to the increased level of communication that the elderly gain from using ICT, their cognitive functions increase, which results in increased activity. A high degree of communication has a positive correlation to network size. ICT use increases the elderly's activity level by increasing the size of their social network or reducing social isolation. The mediating role of social isolation concurs with social network analysis theory (Frith, 2014). Further, we found that a negative feeling (loneliness in our case) among the elderly positively moderated the relationship between ICT use and social isolation. This result extends previous findings that ICT use negatively impacts social isolation among the elderly (Cotton, Anderson, & McCullough, 2013). ICT acts as an important non-human actor that helps the elderly to communicate with others since it does not require physical movement. Social interactions through ICT triggers and advances a person's mental functions at a cognitive level, such as memorizing, filtering, evaluating alternatives, selecting the best alternative, etc. According to activity theory (AT), these mental functions eventually lead a person to conduct various activities.

AT originally comprised only three dimensions of activity (i.e., what, why, and how). With this research, we extend the how dimension to "how much". Additionally, we found that loneliness moderated the relationship between ICT use and social isolation. Prior research (Arampatzi, Burger, & Novik, 2016) has also found that loneliness moderated the relationship between ICT use and happiness. Although we do not consider happiness in our study, social isolation among the elderly represents a critical factor that influences the elderly's happiness, and loneliness moderates its relationship with ICT use.

However, we found two insignificant relationships in our model. First, ICT use had no direct impact on social participation. Rather, social isolation fully mediated the influence that ICT had on social participation. Our result indicates that social isolation decreases the elderly's social activity level, which emphasizes the importance of their social network for their wellbeing. Second, we found that loneliness did not impact the relationship between social isolation and social participation—an important contribution to ANT. The elderly require social networks to increase their activity level regardless of whether they feel lonely. In an experiment, Cacioppo et al. (2009) demonstrated that lonely elderly persons have less mental activity compared to elderly persons who do not feel lonely when they are exposed to a group of people. Our results reveal that elderly people with a similar social network will perform activities at a

similar level despite feeling lonely. As for why, we posit that loneliness might not influence the cognitive faculties in the brain that cover activity generation. However, one would need to conduct an authentic neuroscientific study to validate that claim.

7.2   Implications

This study significantly advances research on the interaction between the elderly and ICT and extends our knowledge about how the elderly form networks and participate in society in three ways First, we found that the technology divide plays a significant role in social isolation and that elderly people can adopt technology to lessen their social isolation. Second, in an IT-dominant society, the ability to access and disseminate information leads to living a meaningful life. ICT enables the elderly to maintain existing connections and to generate new connections. Further, ICT can help the elderly to participate in today's society. Third, for the elderly, social exclusion occurs in a sequence. A reduction in communication-related activities leads to a reduction in network size that, ultimately, creates loneliness. Hence, the elderly must take steps to increase their communication-related activities.

Our study has practical implication from a strategic perspective. The social exclusion that the elderly face represents more than just a social network problem; elderly people perceive any new technology quite differently from younger individuals and, thus, need to expend more effort and time to adopt it. As a result, organizations that deal with elderly people need to ensure they have sufficient effort and time to adopt ICT. Our findings provide value to any organization that deals with the elderly and ICT.

8   Discussion and Future Work

Social participation in a digital world increasingly depends on ICT. The rapid growth of global communications networks and the ease with which people can transfer information has caused increasingly more social participation to involve ICT. However, many extant studies on social participation and ICT have adopted a simplistic approach and failed to offer insights in light of emerging social complexities such as changing demography, declining health, and weakening social ties among generations.

In this paper, we offer a broader view of social participation (founded on actor-network theory and activity theory) that emphasizes the need to focus on networks that living and non-living actors form together, individuals' psychological condition, and ICT use. The tripartite framework presented here (i.e., ICT, social network, and social participation) further expands our view and brings forth the potential to draw rich and valuable insights on social participation that differ from the existing literature. Our validated framework also highlights the important role that ICT can play as an operand resource in enhancing opportunities for social participation.

In summary, our model conceptualizes the process of social participation using ICT in the Indian context. We examine how ICT-enabled socialization helps to alleviate the social exclusion that the elderly experience. For the elderly, social inclusion depends on their using socialization-specific ICT. ICT can help the elderly participate more in today's techno-society and help them regain control over their social relations. Based on our investigation, we advocate programs and policies that promote the use of socialization-specific ICT among elderly. ICT can increase their activity level, which can lead to increased social participation and reduced social isolation. We hope our efforts here motivate further research on the elderly's social participation in the digital world and the role of upcoming ICT in it.

8.1   Limitation and Future Research

As with any study, ours has several limitations. First, we used convenience sampling. We collected 75 percent of the data from one state in India (Madhya Pradesh) and the remaining 25 percent from other Indian states. As such, our results may not generalize to the entire Indian population. We conducted two tests to estimate the extent to which non-coverage bias affected our sample. We compared the proportion of the various age groups in our study with the 2011 Indian census and found that they did not significantly differ. Further, we compared the coefficients of Madhya Pradesh sample to the rest of sample and did not find any significant difference between them. However, to eliminate non-coverage bias, we recommend that researchers consider different respondents and settings. Second, we conducted a cross-sectional survey, and, hence, the study may include self-reported bias. Third, we cannot easily ascertain causal relation. Future research work could reinforce the causal associations among the elements in our model. For example, researchers could explore the connection between ICT use and individuals' activity level

through the opportunities ICT can provide to users. They could also use the network concept in which multiple opportunities for action arise from networks that individuals and technology form together (Majchrzak & Markus, 2013).

At a broad level, future studies should consider the dual roles that ICT has in social participation (i.e., as a source of communication and as a medium of communication). As we discuss in this paper, in the former role, ICT becomes an active agent in the communication ecosystem and can trigger or initiate social communication and, thus, impact other actors and their choices; as such, decisions about ICT use affect how much an individual communicates with others, which, in turn, expands or restricts the individual's social networking opportunities. In the latter role, ICT plays an enabling role and ensures that the collaborative communication process that underlies social participation is efficient and effective. These two roles may have varied academic and managerial implications. Potential implications of the first role may provide insights for technology design and development, marketing, platforms and standards, and so on. Future studies need to examine each area. Similarly, the second role focuses on concepts of social alliances and collaboration, social knowledge management, and so on. Studies that draw on these and other such areas could offer valuable insights into how ICT can enhance social participation.

Future research may also encompass specific ways that the elderly use ICT. One can see from our study that, if we understand why the elderly resist adopting a particular form of ICT, we can work towards addressing the issue. The elderly have sentimental attachments to their past. This behavior calls for new psychological studies that contemplate how elderly can orient themselves to the present day and the future (Emirbayer & Mische, 1998).

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