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Author Statement

Arif Perdana: Conceptualization, Methodology, Formal analysis, Investigation, Writing- Original draft preparation, Writing- Reviewing and Editing. Intan Azura Mokhtar: Writing- Reviewing and Editing.
Seniors’ Adoption of Digital Devices and Virtual Event Platforms in Singapore during Covid-19

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Singapore Institute of Technology

Abstract

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Keywords: Virtual Event Platform, Digital Devices, Covid-19, Seniors Go Digital, Seniors, Singapore
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From May 2011 to June 2020, Intan served as an elected Member of Parliament in the 12th and 13th Parliament of Singapore, in Ang Mo Kio Group Representation Constituency (GRC). From 2015 to 2020, Intan was the Deputy Chairperson for the Government Parliamentary Committee for Education and was a Member of the Government Parliamentary Committees for Manpower and for Transport. Intan has also served on the boards of several public education institutions and public service organisations in Singapore, such as the Institute of Technical Education (ITE), the Digital Readiness Council under the Ministry of Communication and Information, and the Health Promotion Board under the Ministry of Health.

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1. INTRODUCTION

Covid-19 has brought significant changes to the world. With multiple restrictions on the movements of people in many countries, the global economy has been severely affected as business operations are overwhelmed [1]. In addition, more people have become victims of social and psychological conditions such as depression, anxiety, loneliness, and other mental disorders [2]. These conditions may have resulted from restrictions in social gatherings and social distancing, which have prevented people from satisfying their needs for social interactions [3]. At the same time, socially supportive-coping strategies (e.g., maintaining human connections and a sense of community) are essential in managing anxiety that could emerge in difficult times [4].

Since the outbreak of the pandemic, Singapore has had restrictions on physical meetings, resulting in most events being moved to the virtual environment. Covid-19 has accelerated the adoption rate of digital technologies by several years, and many of these changes could remain as permanent, long-term measures that can provide tangible benefits [5]. Technologies have become so pervasive now, and have had significant impact on both the young and old. Unlike the younger generation, most seniors are digitally estranged [6]. To overcome this situation, particularly to facilitate seniors’ social wellbeing, the Singapore government has introduced supportive technologies and implemented support programmes to engage seniors and keep them connected with their family and friends during the Circuit Breaker\(^1\) period.

Singapore is experiencing increasing technological penetration. At the same time, it also faces a growing population of senior citizens [7]. Responding to this situation, under the Infocomm Media Development Authority (IMDA) (which is a statutory board under the Ministry of Communication and Information), the Singapore government launched the *Seniors Go Digital* programme in May 2020. The intent of this programme is to ensure that as Singapore accelerates digital adoption across all sectors, and progresses as a digitally connected nation, no one is left behind, particularly the older Singaporeans, or seniors. Through this programme, seniors can sign up for government-subsidised mobile data plans for their mobile phones or gadgets, and learn basic skills such as downloading phone apps, making video calls, and texting under close personal guidance of the

\(^1\) https://www.imda.gov.sg/news-and-events/Media-Room/Media-Releases/2020/Virtual-support-and-activities-to-help-more-Seniors-during-circuit-breaker
Digital Ambassadors, resourced and funded by the government\(^2\). While seniors are largely less familiar with digital technologies and the internet, an increasing trend in global internet usage by seniors have emerged, with one-third of seniors accessing the internet and seniors showing the highest increase in computer use [8,9]. In Singapore, this trend also been observed, where digital adoption among older Singaporeans is seen to be on the rise\(^3\), particularly among those aged 50 to 59 years old. With the nationwide implementation of Covid-19 restrictions on physical interactions and movements, as well as safe management measures (SMMs), seniors' regular routines in Singapore have been disrupted. They are now unable to carry out their daily social activities, such as meeting up with friends at the local coffeeshops or participating in morning exercise routines in the neighbourhood. The Seniors Go Digital programme could, however, facilitate seniors to readily access news and social activities via digital technologies for their own benefit, and to keep social isolation at bay. Digital technologies should enable seniors to engage in online gatherings, have access to government services and other online services, and continue to remain connected to family and friends, as well as to current social developments and activities [10–12].

Prior research on seniors' adoption of digital technologies has primarily focused on health-related purposes such as nutrition and exercise or managing old-age related diseases or ailments [13–17]. However, there is limited research done which have sought to understand how seniors use digital technologies for other purposes such as online public services, social networks, and leisure activities [11,12,18]. Digital technologies for seniors’ social and mental wellbeing should focus not only on healthcare or assistive technologies, but also on technologies that can help seniors socialise and reduce loneliness [12]. We argue that virtual event platforms can also help seniors find it easier to communicate and socialise with their peers, in addition to the use of social network sites.

Unfortunately, the literature on virtual event platforms is sparse. Although studies exist on virtual events in other disciplines such as hospitality, education, and management [19,20], apparently no research exists in examining the interaction between seniors and virtual event platforms. While research suggests that age, gender, and education are the most critical factors influencing the use

\(^2\) https://www.imda.gov.sg/en/seniorsgodigital
\(^3\) https://www.imda.gov.sg/news-and-events/Media-Room/archived/ida/Media-Releases/2015/tech-adoption-on-the-rise-among-singapore-residents
of online platforms for seniors [10,12], the antecedents of the adoption of virtual event platforms among the senior population remain unexplored. Unlike Niehaves & Plattfaut [21], which investigated the general internet usage among the elderly, our study focuses on the specific use of the internet to access virtual event platforms.

Thus, our study aims to explore the key factors that influence seniors' intention to use virtual event platforms, particularly among seniors aged 60 years old and above. Further, our study is contextualised within the Seniors Go Digital initiative. For our study, we collaborated with a government agency in Singapore to understand the attendant challenges and issues that emerged when seniors interact with digital technologies to access virtual event platforms. Virtual meetings are rapidly becoming commonplace, and hybrid meetings have been described as the mainstay of future meetings and events [20,22]; thus, research needs to keep pace with these developments. This study, therefore, seeks to answer the following research question: What are the most influential factors affecting seniors’ adoption of virtual event platforms?

To address the research question, we use social exchange theory [23–25]. We adopted risk and benefit constructs that precede the intention to use virtual event platforms. Risk includes the consideration of costs and fear of technological advancement [21,26,27]. At the same time, perceived benefit is associated with social influences and perceived ease of use. We collected sample data from 144 participants who are seniors (aged 60 years old and above) to empirically test our formulated hypotheses. Our study is relevant for understanding how digital technologies can support seniors’ social and mental wellbeing.

The contributions of this study are twofold. First, we provide insight into the antecedents of intentions to use virtual event platforms to anticipate seniors' intentions and better address their needs and expectations. Second, while information technology (IT) innovations are rapidly changing and creating multiple online features, relatively little attention has been paid to how seniors adopt and use virtual event platforms. Therefore, given the advances in technology and the wide range of benefits that can be sought, seniors need to stay informed about current technologies and features. By exploring the behavioural intentions behind seniors’ adoption and use of virtual event platforms, this study could provide insight into better managing the use and intents of digital technologies to create more meaningful social impact to improve seniors’ quality of life. Our
findings could provide pointers to enhance seniors' adoption of digital technologies and inform policy-making due to its alignment with current government initiatives.

The following sections discuss seniors' relationship with technology and social exchange theory, followed by a brief discussion of the research framework. To better understand the constructs, further preliminary work was done before the hypotheses were developed. Thereafter, the methodological framework is presented, along with the research instruments and measurements required for data collection. The research findings are discussed and further analysed with their theoretical contributions and implications for practice. Finally, we present the study’s limitations and other possible future research areas, followed by our conclusion for this study.

2. LITERATURE REVIEW, RESEARCH MODEL AND HYPOTHESES

2.1. Social Exchange Theory

Our study used social exchange as the underlying theory for seniors' adoption of virtual event platforms from both costs and benefits perspectives. Social exchange theory is frequently used to analyse human behaviours and relationships [28]. Researchers have used this theory extensively to understand interpersonal interactions and how individuals interact with organisations [29–31]. The theory also facilitates researchers to study the interaction between individuals and technology such as social media, online health, and virtual communities [32–34]. The theory emphasises that one typically expects reciprocal benefits such as trust, affection, social rewards, or other intangible considerations for actions. Human interactions with either other people or technology are typically the result of exchanges in which individuals expect more benefits than costs [29,30,35]. In this study, social exchange theory is used to better understand the concept of seniors' perspectives on adopting technology use, in particular, virtual event platforms, while considering the risks and benefits involved.

As digital technologies rapidly evolve and change the world at an astonishing pace, seniors may derive various benefits from technology usage [14,16]. Seniors are likely to be more receptive to technology if it offers them numerous benefits compared to the costs they have to incur [36]. Seniors tend to emphasise information exchange, interaction, and sharing, when adopting any form of technology that is perceived to be beneficial [16]. Aside from the benefits mentioned above,
technology can also pose risks to seniors. Seniors are likely to be reluctant to adopt technology, often due to fear of the technology involved, related anxiety, and unfamiliarity with digital devices [7,15].

2.2. Technology Adoption and Senior Generation

Previous research defines seniors as individuals who are over 65 years old [13,15]. However, Lin et al. [7] suggest that those less than 65 years old are considered younger seniors, while those over 65 years old are considered older seniors. In this study, we use the term "senior", which is also referred to as "elderly" or "retiree", to refer to someone who is at least 60 years old. As times change, seniors today are more tech-savvy than ever before. Inventors in digital and technology are also constantly looking for ways to connect their platforms and tools with seniors to create positive technology [37]. Research has shown that seniors' attitudes toward technology should encourage them to become more capable [16,38]. However, other studies found that frustrations with new technologies, concerns about privacy, health issues, and lack of support, make seniors doubt their ability to learn and adapt, which leaves them unmotivated to even try the technology [39,40].

Prior research related to technology adoption enablers and barriers addressed the issues and challenges on accelerating the adoption of digital technologies into seniors' daily lives [13,40]. The first stream of research suggests that seniors are less receptive to the use of technology. For example, Knowles & Hanson [41] found that older adults reject digital technologies, even when presented as trustworthy and accessible because they are afraid of making mistakes. Other studies found that outcomes revolve around seniors' barriers to technology use, such as self-efficacy, privacy, cost, and fear of dependency [39,40,42]. The second research stream suggests that seniors are more likely to adopt new technologies for a reason. Seniors are more likely not to adopt new technologies if they do not see a benefit in using them [10]. Many seniors tend to shy away from learning new technology because most feel that the technology is too challenging to learn and use. Some even believe that they are not able to conveniently handle digital technology, regardless of its perceived usefulness [43].
This current study examines seniors' intention to use of digital technologies and the internet to access virtual event platforms. Although online media has promoted the use of virtual event platforms and the technology has existed long before the Covid-19 pandemic, research remains limited in examining the intention to use this platform particularly among seniors. Virtual event platforms allow participants to interact virtually rather than face-to-face, from multiple locations (e.g., communication, conference, or trade forum). Moreover, participants can use multiple devices in the same meeting (i.e., some might use desktop computer and others may use smartphones or tablets) [20]. Other terms such as ‘online event platforms’ and ‘online event management platforms’ could also imply the same meaning or refer to the same type of virtual event platforms. However, the distinguishing feature lies in the additional functions of these platforms to promote, plan, and manage digital events. These features include an event-specific page, registration forms, the ability to organise or link video content. The platform can be through the use of social media or a website that has the above characteristics. Our study defines virtual event platforms as online software that hosts events with real-time content integrated with webcasting capabilities over the internet. We specifically studied the following virtual event platforms that seniors (aged 60 years old and above) mainly use in Singapore: ActiveSG and OnePA.

ActiveSG is a national movement in Singapore, to promote a healthy lifestyle through sports and sporting activities⁴. Through this nation-wide movement, public sporting facilities and programmes or courses are promoted to Singaporeans across all age groups, including seniors. While available as a website, ActiveSG also makes use of a mobile app to facilitate online booking of sporting facilities and healthy lifestyle programmes or courses, and ActiveSG users can be informed of activities they are interested to participate in.

OnePA provides a one-stop access to courses, community activities, facilities, interest groups, and membership information and deals under the People’s Association, which is a statutory board whose main objective is to promote social cohesion and racial harmony in multi-ethnic and multi-religious Singapore⁵. This is done through activities, courses and interest groups which are

⁴ https://www.myactivesg.com/About-ActiveSG
⁵ https://www.onepa.gov.sg/about-us
community-centric and heavily subsidised by the government, and which cut across racial or ethnic groups. OnePA is available as web-based platform.

3. RESEARCH MODEL AND HYPOTHESES DEVELOPMENT

We use social exchange theory to develop our research model. Aligning with this theory, we include risk and benefit considerations to investigate seniors’ interaction with virtual event platforms. In our model, we also include self-efficacy to confirm the relevance of this variable in the context of seniors’ intention to use virtual event platforms. Figure 1 presents our research model. Cost represents one of the concerns in technology adoption [27,44]. Venkatesh & Brown [27] suggested that cost can be a barrier to non-adoption of technology, especially adoption by households made up of seniors. Seniors often struggle and seem unwilling to purchase or use technology because they shy away from the costs [42,44]. Tsertsidis et al [42] also suggested that the fear of high costs may inhibit seniors' intention to use new technology. Therefore, this circumstance may also affect seniors' decision to acquire technological skills.

![Figure 1. Research Model](image_url)
A consolidation of 15 studies conducted by Kavandi and Jaana [44] found that cost have a negative impact on technology adoption by seniors. Claes et al.'s [45] study on the potential of low technology costs to improve seniors' perceptions of technology found that nearly 70 per cent of seniors considered cost as a deciding factor in technology adoption. Other studies have also described the same issue, citing cost as the most significant barrier to intention to use technology [46,47]. Intention to use arises from intrinsic motivation, which is affected by internal rewards that people believe they will receive [48]. If cost is a barrier, this could suggest that seniors have low motivation to adopt new technology, further affecting their intention to use technology. We, therefore, argue that cost can be seen as a factor that discourages seniors’ intention to use virtual event platforms. The cost of using virtual platforms may be related to registration, membership, access to the internet, and other subscription costs. Considering that cost was found to be an essential factor in technology adoption [27,44], we propose that cost may influence seniors' intention to use virtual event platforms. Accordingly, we formulated hypothesis 1:

**H1: Costs will have a negative relationship with Intention to Use.**

Fear of technological advances is another variable that may influence seniors' technology acceptance. Fear of technological advances is interpreted as "the extent to which rapidly changing technology is associated with fear of obsolescence or concern about internet use" [27 p. 82]. Unfamiliarity with new technological advances was one of the main concerns that hindered seniors' adoption of technology, as they often felt uncomfortable and awkward [49]. In another study by Raymundo & Santana [50], they described those seniors with little experience using technology are anxious as they often fear computer viruses, social networking, and damaging or destroying the technological device itself.

Fear of technological advances is one of the variables incorporated in the household technology adaptation model [26]. It refers to cognitive ability as one of the users' limitations [51]. Control beliefs have been found to impact ones’ behavioural intention [21]. Therefore, March [52] suggested that products should be engaging, promote a sense of discovery, and eliminate anxiety. Norman [53] reinforced this by emphasising that user experience depends on how the product is used, perceived, and learned. With the existing belief that new technologies lead to a diminished
user experience, we argue that seniors' fear of technological advances would inhibit their intention to use virtual event platforms. Accordingly, hypothesis 2 is posited.

**H2:** Fear of Technological Advances will have a negative relationship with Intention to Use.

Social Influences is defined as the extent to which a person considers their significant others affect their propensity to use technology [54]. For example, seniors were more likely to use technology where their children or grandchildren have used it [55]. Tseng *et al.* [56] found that peer opinion can contribute to social influence; if the social circle of seniors has a positive attitude toward technology, seniors will follow it and vice versa [57]. Therefore, we conclude that social influence can lead seniors to benefit from technology because their peers, families, and friends encourage them to connect with their affinity groups, further increasing their willingness to use technology. Accordingly, we formulate hypothesis 3:

**H3:** Social Influence will have a positive relationship with Benefits.

Perceived ease of use refers to the extent to which a person believes that using a particular technology is effortless [58]. Perceived ease of use significantly impacts seniors' attitudes toward technology [59]. Seniors' perceived ease of use could be influenced by observing younger people using technology [60]. For example, seniors might perceive a particular technological device as straightforward or easy to use when they see a younger person using it. However, it might prove more difficult than expected when seniors use it because they are less tech-savvy as the younger generation. In addition, the results of a focus group showed that seniors are hesitant to ask for help for fear of hindering others or not knowing where to turn [61]. As a result, seniors can become discouraged and often give up on learning, despite the potential benefits and opportunities that technology could provide.

While perceived ease of use is an important aspect influencing seniors' acceptance of technology, their usage patterns may vary. Long-term interaction with technology may cause seniors' perceptions to change over time. Perceived ease of use serves only as an anchor that determines the initial perception of ease of use of new technology or system encountered by the user [51]. Regardless, the actual objective usability may be adjusted and reflected depending on the
experiences and interactions during the final use of the technology [62]. Drawing on this argument, Hypothesis 4 is proposed:

**H4: Perceived ease of use will have a positive relationship with Perceived Benefits.**

Seniors have indicated that technology improves communication with their social circles and facilitates communication with people who are not nearby [63]. In addition, seniors expressed that technology increases their safety at home and makes them feel secure [63]. This sense of support makes it easier for seniors to get more information about their health and safety and improve their situation. A recent study also showed that seniors who use technology experience greater independence because they are not under the control of others, allowing them to feel more self-determined [64].

In addition, online use could also become a tool for seniors to manage and research health issues. This would be a way for seniors to increase their brain activity and manage their emotions. Dealing with their health issues alone can be emotionally daunting. Therefore, it is beneficial if seniors can benefit from other social circles. By hearing from others who have gone through the same situation, seniors feel empathically relieved and less helpless. This is consistent with social exchange theory, which states that empathy altruism occurs when the benefits to the recipient outweigh the costs [29,30].

Overall, seniors must have good reasons to adopt technology, and if they do not, we argue that the outcomes may be less favourable. Regardless, in today's society, technology offers limitless opportunities and a large number of positive benefits. The feeling of being connected to family and friends, the satisfaction, the benefits, and the positive learning experiences that can be obtained are compelling for seniors [65]. With these optimistic outlooks of practical benefits, seniors would be more inclined to adopt technologies that add significant value to their lives, which in turn, increases their overall intention to use technology. Accordingly, we formulate Hypothesis 5:

**H5: Perceived Benefits will have a positive relationship with Intention to Use.**

Self-efficacy refers to a person's belief in the ability of using a technology [27,66,67]. Perceptions of self-efficacy influence the decision of what behaviour an individual would engage in [68,69].
While self-efficacy is formed by one's appraisal of his or her ability to perform certain activities, it also refers to the psychological processes that can create or reinforce expectations of personal efficacy [68]. This, in turn, would determine the following actions they would take, the effort they would invest, and the duration they would persevere in using the technology [70].

Seniors are more likely to feel discouraged to learn technology if society perceives them as frail when they rely on technological support [42]. This perception can make them feel devalued and unmotivated. For example, there may be seniors who have the skills to adopt technology, but their peers are looked down upon by others, usually younger than them. Therefore, these seniors who are able, may feel inadequate or are unwilling to adopt technology and question their ability to learn. Nicholls [71] explains this phenomenon as affecting the individual's ego, contributing to a decline in self-efficacy [71]. However, this problem can be remedied if they are able to perceive themselves as being competent. With an increased perception of one's competence, intrinsic motivation would also increase [72]. Thus, we assume that the stronger the perceived sense of self-efficacy, the higher the intention to use virtual event platforms.

Venkatesh et al. [51] suggested a relationship between intrinsic motivation and self-efficacy, where both play a crucial role in determining a person's behavioural intention or actual behaviour. It was also found that higher intrinsic motivation leads to higher satisfaction [73]. Therefore, this means that the additional trait of intrinsic motivation would help seniors feel satisfied when learning technology. One could develop self-efficacy to achieve his or her goal despite the lack of intrinsic motivation since self-efficacy is considered stronger to support for intention to use a tool. This can be explained by the fact that self-efficacy influences the degree of the perceived difficulty of the endeavour [74]. Seniors who previously perceived it is challenging to learn technology may not perceive it that way once they gain self-efficacy. Considering that technology enables seniors to meet various personal needs, it is expected that self-efficacy will critically impact an individual's decision to use technology. Therefore, hypothesis 6 is as follows:

**H6: Self-Efficacy will have a positive relationship with Intention to Use.**
4. RESEARCH METHOD AND DATA

4.1. Measurement Items

We constructed a questionnaire comprising seven constructs. A total of seven constructs were identified from an extensive review of previously published work [21,54,75–77]. Each question was adopted and adapted from existing research sources for this study, as shown in Table 1.

**Table 1. Measurement Items**

| Constructs                          | Measurement Items                                                                 | Sources   |
|-------------------------------------|------------------------------------------------------------------------------------|-----------|
| Perceived Ease of Use (PEOU)        | PEOU1: I find virtual event platforms easy to use.                                | [21,76]   |
|                                     | PEOU2: Using the virtual event platform require less mental effort.                |           |
|                                     | PEOU3: I think I can use the virtual event platforms without any significant help and guidance. |           |
|                                     | PEOU4: My interactions with virtual event platforms are clear and understandable. |           |
|                                     | PEOU5: I find I am ready to operate and navigate the virtual event platforms.      |           |
| Social Influence (SI)               | SI1: In general, my peers have supported the use of virtual event platforms.      | [21,75,77]|
|                                     | SI2: People whose opinions that I value prefer that I use virtual event platforms. |           |
|                                     | SI3: My family members think I should interact with virtual event platforms.       |           |
|                                     | SI4: Those in my social circle think I should engage with virtual event platforms. |           |
| Perceived Benefits (PB)             | PB1: I could communicate faster if I used virtual event platforms.                | [75]      |
|                                     | PB1: I would be more efficient in my time if I used virtual event platforms.      |           |
|                                     | PB1: Using virtual event platforms would improve the quality of the event experience. |           |
|                                     | PB1: I could register faster if I used virtual event platforms.                   |           |
| Costs                               | RC1: It is not cheap to use the virtual event platform.                            | [21]      |
|                                     | RC2: Using virtual event platform require us to spend extra costs.                 |           |
|                                     | RC3: The costs of using virtual event platforms will contribute significantly to my monthly expenditure. |           |
| Constructs | Measurement Items                                                                 | Sources |
|------------|-----------------------------------------------------------------------------------|---------|
| Risk: Fear of Technological Advances (FOTA) | FOTA1: The trend in technological advancement makes me worried. | [21] |
|            | FOTA2: I fear that the virtual event platforms will disappear soon.               |         |
|            | FOTA3: I am worried about the rapid advances in virtual event platforms.          |         |
| Self-Efficacy (SE) | SE1: I feel comfortable using virtual event platforms on my own. | [21] |
|            | SE2: If I wanted to, I could easily operate virtual event platforms on my own.    |         |
|            | SE3: I can use virtual event platforms if no one is around to help me.           |         |
| Intention to Use (IU) | IU1: If available, I intend to use virtual event platforms for activities of daily living in my home. | [54] |
|            | IU2: If available, I intend to recommend to others for activities of daily living in their homes. |         |
|            | IU3: In the future, I predict that I would use virtual event platforms.          |         |

### 4.2. Sample Data

Our project has been reviewed and approved by the IRB (IRB Expedited Review: 2021089). We obtained the data from a Community Club in Singapore. The management of the Community Club allowed our research assistants to set up a dedicated booth where the researchers could target seniors (aged 60 years old and above) for survey recruitment and maximise contact opportunities with our potential respondents. The research assistants conducted the survey on days when the Community Club held their respective events (e.g., hand sanitiser distribution, mask distribution, immunisation program, etc.) that our target sample - seniors - might be involved in.

During the data collection phase, our research assistants helped the seniors to complete the questionnaire (see Appendix for the questionnaire fulfilment). Participants were given the Participant Information Sheet (PIS) which explained the study in detail. The research assistants read the PIS aloud in English or Mandarin if the participants preferred not to read these on their own. Participants had to give verbal consent before proceeding with the interview. The 7-point Likert scale was drawn on an A4 paper to help respondents navigate their answers and to speed up
the interview process. Research assistants supported the entire survey process, where questions were read verbally to participants (text-to-speech), while responses were recorded accordingly via mobile phones on Qualtrics. We adopted this approach because it is still challenging for many seniors in Singapore to communicate effectively in English. This is because local seniors mostly speak Mandarin or local dialects, and not English. Therefore, we decided to address the communication difficulties by carefully guiding and supporting the seniors to better engage with us. Thus, we read the questionnaires aloud and explained the questionnaire in Mandarin or local dialects when necessary. All participant responses will be kept confidential and retained for the period of time allowed by the University's IRB Research Data Management Policy. No personal or identifiable information about participants was collected. Since all reports were in summary form only, it is not possible to identify individuals.

The respondents selected for this study were to be 60 years old and above. A total of 144 surveys were conducted. As shown in Table 2, most respondents were between 60 and 74 years old (88%), while the remaining respondents were older than 74 years old. The oldest respondent was 89 years old. Most of the respondents completed primary school (51%) and secondary school (31%) education and earned no income at all (69%). Almost equal proportions of the respondents had either relatively low incomes of up to $10,000 per year (14%) or earned more than $10,000 annually (16%). In terms of digital device use, smartphones were found to be the most commonly used (48 per cent), followed by computers and desktops (15 per cent), then tablets and laptops (13 and 14 per cent, respectively).

Table 2. Sample Characteristics

| Dimension          | Category                  | Percentage |
|--------------------|---------------------------|------------|
| Gender             | Male                      | 49         |
|                    | Female                    | 51         |
| Age (years old)    | 60 to 64                  | 30         |
|                    | 65 to 69                  | 40         |
|                    | 70 to 74                  | 18         |
|                    | 75 to 79                  | 5          |
|                    | 80 to 84                  | 3          |
|                    | 85 to 89                  | 3          |
| Education          | Primary School (PSLE)     | 51         |
| Dimension                          | Category                                      | Percentage |
|-----------------------------------|-----------------------------------------------|------------|
| Secondary School (GCE “O” / “N”  Level) | 31                                            |            |
| Diploma / Junior College / ITE    | 6                                             |            |
| Bachelor’s Degree                 | 1                                             |            |
| Postgraduate Degree (Masters / PhD) | 2                                             |            |
| Income                            | No Income                                      | 69         |
|                                   | $1-$10,000                                     | 14         |
|                                   | $10,001-$20,000                                | 8          |
|                                   | $20,001-$30,000                                | 4          |
|                                   | $30,001-$40,000                                | 3          |
|                                   | $40,001 and above                              | 1          |

| Types of Digital Devices Used (Participants can select more than 1) | Computer/Desktop | 15 |
|---------------------------------------------------------------------|-------------------|----|
|                                                                     | Smartphone        | 43 |
|                                                                     | Tablet (e.g., iPad) | 13 |
|                                                                     | Laptop            | 14 |
|                                                                     | None of the above  | 15 |

5. RESULTS

We use the Partial Least Squares Path Modelling (PLS-PM) technique to analyse our data. PLS-PM is a commonly used tool that generalises and combines the features of principal component analysis and multiple regression [78]. As the study is primarily exploratory, PLS-PM structural equation modelling develops our hypotheses by explaining the variance in variables to better predict and analyse a set of dependent variables from independent variables [79].

Prior studies recommend that the minimum requirements for determining the sample size for PLS-PM be at least ten times the largest number of formative indicators or pathways of the inner model that are directed toward a construct in the inner model [79]. Thus, our collected sample data exceeded the minimum requirement of 80 samples. We will first present our measurement model evaluation in the following subsections to ensure its reliability and validity. We will then evaluate the structural model to better examine the hypothesised relationships between variables.
5.1. Measurement Model

The measurement model proposes factors that influence seniors' adoption of virtual event platforms, following our PLS-PM that frames latent variables in a diagrammatic design. This model aims to test the reflective measurement scale, as the latent variables represent behavioural concepts that explore the motivations and intentions to use virtual event platforms by our respondents. Therefore, the first part of this analysis will examine whether the measurement items are highly correlated and interchangeable. The reliability of the constructs, the average variance extracted (AVE), the Harman test for individual factors, and the external loadings and weights will examine the reliability and validity of the latent variables of the study. Table 3 shows the descriptive statistics of the variables examined in this path model. With seven constructs, our sample size of 144 provides a higher level of precision in the PLS-PM estimates [80], far exceeding the minimum sample size required. No distributional assumptions are required because PLS-PM is a nonparametric method [79].

Survey participants rated their level of agreement with a series of statements that examined their motivations for using online event platforms. Twenty-five measures were rated on a 7-point Likert scale - "strongly disagree" (1), "strongly disagree" (2), "strongly disagree" (3), "neither agree nor disagree" (4), "strongly agree" (5), "agree" (6), "strongly agree" (7).

Table 3. Sample Characteristics

| Variables                          | Mean   | Standard Deviation |
|-----------------------------------|--------|-------------------|
| Costs                             | 3.97*  | 1.51              |
| Fear Of Technological Advances    | 5.27*  | 1.13              |
| Perceived Ease of Use             | 3.98   | 1.48              |
| Social Influences                 | 4.24   | 1.42              |
| Perceived Benefits                | 4.35   | 1.40              |
| Self-Efficacy                     | 3.74   | 1.36              |
| Intention to Use                  | 4.84   | 1.62              |

*Reverse scoring
Note: All measures are from 1 to 7

We assessed the composite reliability (CR) to ensure the construct reliability and validity of the measures. Our analyses revealed that CR was above 0.7 for most measures, indicating that
measurement reliability was satisfactory. Subsequently, AVE and Heterotrait-Monotrait Ratio (HTMT) were used to assess the construct validity of the measurement items [81]. AVE reflects the average commonality for each construct in a reflective model [79], while HTMT assesses discriminant validity in partial least squares structural equation modelling. All AVE values for each measure were above 0.50, indicating that the variables generally showed valid convergence. Table 4 shows the summary statistics of CR, AVE, and HTMT. All HTMT ratios for each variable were less than 0.9, indicating that each variable was sufficiently distinct when an event was recorded.

### Table 4. Measurement Items’ Reliability and Validity

| Variable                        | CR   | AVE  | Heterotrait-Monotrait Ratio (HTMT) |
|--------------------------------|------|------|------------------------------------|
|                                |      |      | Costs                              |
| Costs                          | 0.957| 0.882|                                    |
| Fear of Technological Advances  | 0.943| 0.847|                                    |
| Perceived Ease of Use          | 0.939| 0.759|                                    |
| Social Influence               | 0.943| 0.806|                                    |
| Perceived Benefits             | 0.934| 0.781|                                    |
| Self-Efficacy                  | 0.778| 0.574|                                    |
| Intention to Use               | 0.992| 0.977|                                    |

This study collected data on seven endogenous latent variables from the same respondents using the same survey instrument. The variance in the common method could be due to a lack of internal consistency, resulting in biased data. For our exploratory research, Harman's one-factor test was used to assess the presence of common method variance. The data set was analysed using SPSS Statistics and yielded 25 distinct factors. Harman's single factor test shows that a single factor explains 45.38% of the variance. This shows that the risk of bias from a common method is unlikely because the Harman test was below the 50% threshold [82,83].
5.2. Structural Model

Following the assessment of construct reliability and validity, the structural model was assessed using PLS-PM. The PLS-PM bootstrapping and algorithm techniques were used to generate the results of the structural model. The results in Figure 2 show that both social influence and perceived ease of use can explain about 64% of the change in perceived benefits, and 30% of the change in intention to use be explained by the variables of cost, fear of technological advances, perceived benefits, and self-efficacy.

The path coefficients and structural model for the study are shown in Figure 2. As shown in Table 6, H3, H4, H5 and H6 were supported, while H1 and H2 were not. The signs of all path coefficients were positive, except for H1 and H2. The effect sizes of our hypotheses range from small to large (0 to 0.447). The most significant effect size is shown by H3, the relationship between social influences and perceived benefits (0.447). This is followed by H4, the relationship between perceived ease of perceived benefits (0.327), and self-efficacy and intention to use (0.027). The summary of the results of the hypotheses is presented in Table 6.
Table 5. Summary of Hypotheses Tests

| Hypotheses                              | p Values | Effect Size ($f^2$) | Support for Hypotheses |
|-----------------------------------------|----------|---------------------|------------------------|
| H1: Costs → Intention to Use            | 0.117 n.s| 0.018               | Not Support            |
| H2: Fear of Technological Advances → Intention to Use | 0.529 n.s| 0.004               | Not Support            |
| H3: Social Influences → Perceived Benefits | 0.000*  | 0.447               | Support                |
| H4: Perceived Ease of Use → Perceived Benefits | 0.000*  | 0.327               | Support                |
| H5: Perceived Benefits → Intention to Use | 0.000*  | 0.142               | Support                |
| H6: Self-Efficacy → Intention to Use    | 0.023*   | 0.027               | Support                |

*p < 0.05, n.s. = not supported

6. DISCUSSION AND STUDY CONTRIBUTIONS

This study aims to understand the factors that drive seniors' intention to use virtual event platforms. With the ongoing Covid-19 pandemic, digital transformation will continue to be a large part of our lives. It has been shown that seniors are the most disadvantaged group and are referred to as digital outcasts [84]. Therefore, researchers believe that it is crucial to understand the motivational factors of seniors and find the most effective approach to address them.

The challenges of technology adoption for seniors have been widely recognised and studied on various virtual platforms [12,60,85,86]. These platforms include web-based services, gaming programmes, virtual reality platforms, mobile applications, and social networks, which are primarily explored in the information systems, healthcare, financial, and social domains. Numerous solutions based on information and communication technology (ICT) have been developed to address seniors' physiological, psychological, and social needs [87]. However, seniors need for social interaction has shifted significantly to a digital lifestyle due to the pandemic Covid-19 [88]. Organisations have also shifted to virtual meetings and event platforms to maintain
social and business interactions. It is important to note that learning new technologies is becoming more complex for seniors as technology evolves. This has led to the term "digital divide," which only widens the technological gap between seniors (the “digital immigrants”) and the younger generation (the “digital natives”), as well as the rest of society [89]. Therefore, there is an urgent need to study variables that can improve the digital inclusion of our seniors [21].

Concern for the wellbeing of the senior population has become more critical in recent years. It has also become one of the most vital factors in Singapore, which is currently experiencing an increasingly ageing population. In 2020, seniors aged 65 years and older accounted for more than 15 per cent of the local population⁶. It is therefore essential to investigate how seniors and technology can be effectively integrated. This study identifies significant variables that may influence seniors' use of virtual event platforms. Studies have shown that technology use is associated with better mental and physical health and chronic fevers [7,13,16,57]. Therefore, our study focuses on bringing clarity to this issue by understanding the variables that can either promote or hinder seniors' intention to use virtual event platforms.

6.1. Theoretical Contributions

Our theoretical contribution aims to quantitatively add to the literature on seniors' intention to use technology with new insights into the antecedents for seniors' intention to use technology, particularly virtual event platforms. Our findings suggest that social influences and perceived ease of use function as catalysts for seniors’ intention to use virtual event platforms. Our results, however, show that seniors are not afraid of technological advances and costs, suggesting that they are not impressed by technological advances. Instead, our analysis showed that seniors pay more attention to the benefits that technology would bring. Should the virtual event platforms' providers wish to attract seniors' attention, they might focus more on the benefits and perceived ease of using the technology for a virtual connection or interaction.

In addition, social influences have been shown to affect the participation rate of seniors in events, as the opinions of these social influences have been deemed necessary. Therefore, it would be important for the providers to also address the social influence circles of seniors directly, when

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⁶ https://www.statista.com/statistics/1112943/singapore-elderly-share-of-resident-population/
advertising an event for seniors to attend. Our path model diagram combines variables from other studies of IS/IT behaviour [12,21,54,76,77] and explores new relationships such as cost and fear of technological advances as risk variables. Further, the results also suggest that the negative relationship between cost and fear of technological advances is not statistically significant.

6.2. Implications for Practice and Society

The use of technology may be widespread today, but some people like seniors, continue to struggle with the technology or stay away from it altogether due to uncertainty and lack of confidence [8]. Although the Singapore government has taken initiatives to encourage the use of technology, some seniors are still reluctant to use it [84]. The Singapore government could consider allocating more financial, time, and human resources to address these issues. To elaborate, the Seniors Go Digital programme have been rolled out since June 2020, and more than 1,000 Digital Ambassadors (DAs) have been deployed to reach out to and engage more than 36,000 seniors. However, this is only a small proportion of the approximately 900,000 seniors aged 60 years old and above in Singapore [90]. There is more that can be done to ensure that our seniors are able to digitally transform their daily lives and activities, and not just adopt technology [84], and these certainly require even more financial, time and human resources to be invested.

In addition, there is a need to have more regular dialogues and collaboration between policymakers and social service agencies, to better understand seniors’ motivation to learn and solicit direct feedback and inputs from the grassroots to address this issue. While feedback platforms, such as the government’s feedback unit (reaching everyone for active citizenry@ home/REACH)\(^7\), have been useful in providing the much-needed inputs to the government and policymakers when designing national policies and initiatives, the government and government agencies would need to move beyond just receiving feedback or inputs when designing national policies or initiatives. A more collaborative approach of co-creating national policies and initiatives related to seniors and the ageing population is needed. The government and government agencies would need to work with social service agencies, academics and practitioners in the ageing and gerontology

\(^7\) https://www.reach.gov.sg/
sectors to explore the attendant issues and challenges, co-create solutions, and design national policies and initiatives, much like what has been done for the financial sector [91]

Our study was a community-based research project investigating the senior generation's acceptance of online learning platforms. The significance of this study is in line with the government's initiatives to encourage more seniors to use digital media under the Seniors Go Digital programme launched by IMDA. This study will benefit industries such as hospitality, meetings, incentives, conferencing, exhibitions (MICE), the social services sector, and community development sector through community clubs across Singapore, where IMDA implements the Senior Go Digital programme.

Our research findings have provided an insight of how seniors interact with technology. Stakeholders involved could explore the social influences of seniors. They can promote the use of technology among seniors, as social influences strongly support seniors' willingness to learn. For example, the government could introduce an intergenerational approach to encourage seniors to learn technology. The younger generation, such as their more tech-savvy grandchildren, could assist seniors who need help in exchange for academic credit. The government could also introduce peer teaching among seniors, as this has been identified as one of the most critical influencers of technology adoption among seniors [60]. In peer teaching, a senior could share his or her technological knowledge with peers to encourage technology use. In return, these experienced seniors receive incentives as a form of motivation. Furthermore, these social influences could help facilitate the use of technology as perceived ease of use is another factor that encourages seniors to use technology.

Community clubs could offer classes for seniors and their key social caregivers to bring their companions and feel more comfortable and confident participating in the classes. Community Clubs could also host training for the social caregivers of seniors who are unable or hesitant to attend these classes. The courses would empower them to help seniors adopt the technology. Extensive guidance from the people around them would further motivate the seniors to embrace technology as the cost and fear of technological advancements are insignificant to their intention to use technology. Consequently, more promotional activities can be organised to promote seniors' self-efficacy in using technology in their daily lives. For example, placing more advertisements in
media that seniors frequently come across or have contact with would support the change in perspective towards technology.

This study provides genuine insight into seniors' behaviours, needs, attitudes, opinions, and motivations regarding virtual events. This study explains the significant concerns and main reasons that discourage seniors from participating in online events. Considering that in Singapore, the government is involved in the acceleration of technology use among seniors, this study is relevant as it would go a long way in allocating national resources. For instance, this study has found that a substantial proportion of seniors use mobile technologies, in particular mobile phones (48%) and tablets (13%). Hence, push technology such as healthcare or Covid-19 vaccination information, or information on social services and assistance, by government agencies, in the form of broadcast messages on chat platforms (e.g., WhatsApp or Telegram), could be one way to reach out to and engage seniors in Singapore. The community clubs can attract more visitors and promote their other activities to more residents. The government would also benefit from more seniors enrolling in relevant courses related to technological usage. Thereafter, it would focus on improving current practices to attract more seniors and initiate more promotional activities to convey the benefits of using technology. This would eventually generate interest and enable more seniors to adopt technology and become familiar with its use. While the findings could help the Singapore Government to gain insights and improve the quality of training programmes by tailoring it to meet the needs of citizens, governments from other countries may also gain insight from our study. We also contribute to the literature on seniors and technology that is currently clustered in medical, assistive, and healthcare technologies [13,16,17].

7. LIMITATIONS AND CONCLUSION

The results of our study should be interpreted in light of two limitations. First, all data were collected exclusively from seniors who actively participated in a community club in Singapore. Therefore, the results are not representative of the entire population. This sample selection may not have been particularly representative, as the study was obviously based on a random sample, which is particularly prone to selection bias. Furthermore, because the researchers limited themselves to this relatively small community, future studies could compare seniors from different backgrounds in other countries. This comparison should provide a more comprehensive
understanding of the potential factors that influence seniors' intentions to use virtual event platforms.

Second, our findings were limited to certain variables to make our research model parsimonious. Future research may also investigate other relevant antecedents of seniors’ intention to use technologies. Future research may also conduct an in-depth interview study to understand more the unique cases that may inform policymaking on facilitating and accelerating technology adoption for seniors' social wellbeing.

In conclusion, the main objective of this study is to investigate the motivational factors that encourage seniors to use online event platforms. This study examines cost related to technology use or adoption, fear of technological advances, social influences, perceived ease of use, self-efficacy as the antecedents of seniors' intention to use virtual event platforms. Our findings highlight that social influences and perceived ease of use contribute to perceived benefits. These variables play an essential role in supporting seniors' intentions to use virtual event platforms. The constructs in this study may provide insights to inform practice, and society at large on how to better accelerate the use of technology for seniors.
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Appendix

Questionnaire Fulfilment
Highlights

• Our study focuses on the specific use of the internet to access virtual event platforms.

• Our study aims to explore the key factors that influence seniors' intention to use virtual event platforms, particularly among seniors aged 60 years old and above.

• This study provides insight into better managing the use and intents of digital technologies to create more meaningful social impact to improve seniors' quality of life.

• This study helps inform policy-making due to its contextualisation with current government initiatives in Singapore.

• We contribute to the literature on seniors and technology that is currently clustered in medical, assistive, and healthcare technologies.