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by

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Abstract

In today's world, where digital transformation offers numerous benefits, its uneven distribution—often driven by socioeconomic and demographic factors—can exacerbate social inequalities. This study explores the digital divide among vulnerable elderly populations in Thailand, drawing on survey data collected in Lampang province, a region with one of the highest proportions of older persons relative to its population. Focusing on their digital skills and access to government welfare services, we assess digital competence across five key domains: information literacy, communication, online safety, problem-solving, and confidence in engaging with online activities. The findings reveal significant gaps in digital literacy, with limited device ownership and internet access identified as critical barriers. Logistic regression analysis indicates that education, income, and personal access to technology are significant predictors of digital competence. While the results are region-specific, they provide important insights into the challenges faced by older populations in similar socioeconomic contexts. The study underscores the urgent need for targeted interventions, such as digital skills training and increased access to affordable technology, to promote inclusion and enhance the quality of life for older adults. These efforts are crucial for reducing disparities and ensuring equitable participation in Thailand's increasingly digital society. Therefore, implementing policies and interventions that effectively address this divide is essential to fostering greater social and digital inclusion.

Keywords: Digital disparity, Logistic regression, Older adults, Aging society, Thailand

JEL Codes: J18, O31, O33

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1 Introduction

The past couple of years have witnessed a substantial surge in digital adoption, driven by emerging technologies, across various sectors, including public, private, and societal organizations at large. The COVID-19 crisis, in a remarkably brief span, has instigated profound shifts in the way society generates, disseminates, and integrates knowledge, all while embracing cutting-edge technologies. This transformative impact of emerging technologies in a post-COVID-19 world has intensified the significance of knowledge development, especially digital skills, and exchange among individuals in different social settings. Moreover, the digital and technological transformation has also impacted the proliferation of online activities such as digital healthcare and social welfare services all over the world. Despite the widespread attention garnered by COVID-19 and the associated emerging technologies, some groups of populations still have been left behind (Alam and Imran, 2015; Garcia et al., 2021; Heponiemi et al., 2023).

The digital skills distribution among populations varies significantly across regions. Nonetheless, this disparity tends to particularly exacerbate with increasing age (Garcia et al., 2021). Hence, the propensity of the most vulnerable group of citizens regarding digital skills and relevant knowledge is the elderly population, among others. As per data from 2015, a substantial proportion, around two-thirds, of individuals aged 55 and above in 17 European countries demonstrated a lack of computer skills (Midão et al., 2020). Despite the exponential growth in internet usage, there are a large number of aging populations who remain disconnected from the digital realm (Xie et al., 2021). Additionally, in developing countries, the proficiency of digital skills for the elderly depends on individual resources and social classifications (Lopez-Sintas et al., 2020). Therefore, these circumstances, the unequal access to and use of the internet and digital equipment, can be called the "digital divide".

In response to the digital divide, various initiatives aimed at enhancing the digital skills of older adults have been launched, seeking to diminish age related disparities in the utilization of information and communication technology (ICT) tools (Hargittai et al., 2019). Given the intrinsic integration of technology into modern society, it is imperative to provide older adults with enhanced opportunities to acquire the skills necessary for navigating these new digital tools effectively. Notably, older adults constitute a vulnerable group influenced by multiple factors that have the potential to exacerbate their predicament during their daily lives (LYONS et al., 2019; Xie et al., 2021). The elderly face challenges in accessing online services, such as e-health, online shopping, food delivery, public resources and assistance, and others. Moreover,

the accessibility to information remains limited, and they often grapple with feelings of loneliness and social and physical isolation, which were prevalent issues even before the pandemic emerged, and even worse after the incident.

Teaching individuals, with limited or no digital skills, how to use computers and smartphones, by leveraging these very technologies as teaching tools, presents a formidable challenge (Garcia et al., 2021). Consequently, the implementation of digital learning tools for older adults confronts significant barriers, primarily arising from the digital proficiency gap within this demographic (Hargittai et al., 2019; Midão et al., 2020). The use of digital tools holds the key to expanding the horizons of older adults, facilitating their engagement with modern society and innovative technologies, improving their intergenerational connections, and streamlining their daily activities. Moreover, social networking platforms, video chat, and online stores offer valuable avenues for maintaining connectivity and activity (Hargittai et al., 2019; Blazic and Blazic, 2018).

Thailand is becoming an aging society with over 12 million senior citizens (aged 65 and over). Rodrigues and Rueanthip (2019) revealed that approximately one-third of the elderly population resides in conditions characterized by hardship or economic circumstances falling below the threshold of extreme poverty (defined as an income of approximately 60 baht per day, equivalent to \$1.90 per day). Although the Thai government has implemented several initiatives, including the Thailand Digital Economy and Society Development Plan, the 2018 Net Pracharat policy, and the Digital Economy Promotion Agency's Digital Workforce Development Plan, senior citizens remain one of the most vulnerable groups, especially in terms of digital disparity, which can hinder their access to government welfare services. Therefore, integrating older adults into the digital sphere is no longer merely an opportunity to keep up with technological advancements but has become an imperative subject necessitating interdisciplinary discussions among scholars, policymakers, healthcare professionals, governments, and society. This is a critical investment in promoting equality and social inclusion for the older adult population. However, a pressing issue remains: how to equip individuals in this demographic, who have not yet acquired sufficient digital skills, to adapt to the digital environment. Additionally, it is essential to assess the level of their digital skills to enable access to various online activities.

This study, therefore, aims to address this gap by examining the digital skill levels that contribute to the digital divide among vulnerable older adults in Thailand, exploring how digital exclusion and digital poverty hinder access to welfare services, and identifying strategies to reduce digital disparity through education and training. This study employs a survey-based methodology focusing on vulnerable older adults in Lampang province, Thailand, utilizing structured questionnaires to assess levels of digital skills, access to digital tools, and associated barriers. The findings reveal significant digital skill gaps among elderly participants, with socioeconomic factors such as income, education, employment status, and living arrangements influencing digital inclusion. By identifying key determinants of digital inequality, the study contributes to the broader under- standing of how digital skills can support poverty reduction and social inclusion among aging populations in Thailand.

2 Literature Review

The term 'digital divide' primarily denotes the inequality that arises from disparities in access to computers and the Internet, while in some contexts, cell phones, especially smartphones, and other digital hardware and software, may also be considered (Van Dijk, 2006). These are creating a distinction between those with ample access to information and those with limited access. This divide emerges when a segment of the population lacks access to information and communication technology (ICT) resources, which subsequently hinders their participation in a range of socio-economic opportunities, including education, income, and employment (Acharya, 2017). This disparity in digital skills among the economically disadvantaged especially in developing nations, which referred to as a component of the first digital divide. Most digital technologies are primarily designed for affluent Western nations, aligning with their socio-economic conditions, including skill sets, income levels, infrastructure, and cultural attitudes (James, 2021). While innovation in developed countries tends to align with available digital skills, disparities persist among specific demo- graphic groups, such as individuals in poverty, the older persons, and minority populations, who often lack the digital skills needed for effective internet use (Van Dijk, 2006).

2.1 Digital Divide and the Older Adults

The rapid advancement of the internet and digital technologies is transforming lives, making digital skills essential for all, especially older generations. These skills encompass the ability to use hardware (e.g., computers, smartphones, tablets) and software (e.g., programs, applications) to harness the benefits of technological evolution effectively. Furthermore, the extended notion of digital skills has constituted the possibility of social inequality in access and use of digital devices (Kim and Shim, 2020) and the increasing of digital technologies advancement has exacerbated the digital divide among individuals.

Regarding the digital divide, this concept is stratified into three distinct aspects. The first pertains to unequal access to information and communication technology, the second encompasses skill proficiency, and the third revolves around the conceptualization of opportunities (Jang and Je, 2022). The digital divide represents the disparity between individuals who have access to emerging information technology and those who do not (Blažič and Blažič, 2020). This divide encompasses the technological aspect, involving internet access and the availability of digital equipment (James, 2021). In well-developed countries with established digital infrastructure, the digital divide primarily revolves around inequalities in skills, particularly regarding access to knowledge and proficiency in utilizing the internet and digital devices.

Generally, the normal level of digital skills to receive digital dividends is common among the young generation, men, and highly educated populations, however, older adults, women, migrants, the unemployed, and the low- or none- educated ones are vulnerable and face a negative effect from the digital evolution, employment opportunities, income, promotion, societal participation, and living standard (Carpenter and Buday, 2007; Jang and Je, 2022). The studies of James (2021) and Fung et al. (2023) highlight that the unequal distribution of skills among older individuals presents particular challenges, especially considering the increased demand for government services in many aspects as people age. Older citizens, on the whole, tend to be less engaged and interested in digital technologies.

Moreover, low digital skills among the older persons limit opportunities for online communication and social interaction, contributing to increased rates of psychological issues, loneliness, depression, and suicide. A 2020 survey revealed that while 35% of individuals over 70 could perform basic tasks like mobile internet use, only 6% were proficient in advanced applications such as email or internet banking, compared to an average of 96.4% among those under 70 (Jang and Je, 2022). According to Friemel (2016), despite internet diffusion reaching 80–90% in Western societies, the 'grey divide' remains evident among seniors aged 65 and above. A representative survey conducted in Switzerland (N = 1105) using logistic regression analysis revealed significant exclusion of those aged 70 and older, with factors such as education, income, technical interest, and social support—especially encouragement from family and friends—playing a key role in narrowing the divide, often through private learning settings. Similarly, Mubarak and Suomi (2022) reviewed research from a 5-year period to examine the digital divide among the older adults globally and suggested implications for addressing the grey digital divide. Their findings indicate a significant increase in the severity of the digital divide for older adults, particularly in developed countries.

Because of the relative rapid technological advancement, the digital divide constitutes a crucial impediment for this specific aging group to participate and benefit from the digital transformation. The older adults thus experience numerous problems in terms of their daily basic tasks, ordering foods and commodities, or booking or renewing tickets as such, because most of the services are already digitalised. Moreover, the older adults also face another challenge regarding their limited digital skills which is social exclusion. Some of the aging population cannot connect with their families and friends through digital platforms because of their digital skill level. Although this aspect is also found in developing countries, the consequence is less severe because, in their circumstances, the older adults can get immediate help from family members and friends due to their joint living style.

Although internet and computer use can enhance the lives of all, including the older adults, their usage rate among this group remains relatively low compared to other social groups (Carpenter and Buday, 2007). A study of 324 older adults in a suburban naturally occurring retirement community (NORC) in St. Louis found that only about 30% actively used computers, with frequent users being younger, more educated, healthier, and richer in social resources. Corresponding to the later study, Cresci et al. (2010) shows that while older adults' interest in technology is blossoming, not everyone jumps on board. This study reveals distinct profiles of tech-savvy 'Pro-Nets' and internet-wary 'No-Nets'. No-Nets tend to be older, less educated, and face health and activity limitations compared to Pro-Nets. Despite the older adults in No-Nets being more likely to benefit most from online health resources, they remain hesitant.

2.2 Determinants of Digital Disparity among Elderly Individuals

There are also collections of research that have been tried to find a reason behind this disparity. According to research from the US, for instance, Smith (2014) shows that older adults who are not yet their retirement age, who received higher income, also more highly educated are more likely to be able to use the internet. Nevertheless, the number of internet users among older adults, 75 and above, drops significantly. Correspondingly, the data on the internet adoption level of the aging population in The UK illustrates a similar pattern in the variation of their age, income, education, and other relevant socioeconomic factors (ONS, 2016). Moreover, there are also studies mention that not only do those factors have impacts on the fluctuation of the digital ability for being online, but factors such as disabilities and health issues are also crucially affecting the internet adoption rates of the older population (Choi and DiNitto, 2013; Dobransky and Hargittai, 2016).

A continuous line of research on technology and older adults focuses on identifying the factors contributing to the age-related digital divide and the barriers that hinder technology adoption among older individuals (Charness and Boot, 2009; Niehaves and Plattfaut, 2014). Older persons frequently encounter barriers when attempting to acquire and use digital devices like computers, tablets, and smartphones. Factors such as limited financial resources, lack of awareness, and technology-related apprehension can impede device ownership within this demographic (Fung et al., 2023). Although some older persons may have access to the internet at home, there still are those who choose not to use it for personal reasons. This disengagement can result from either involuntary exclusion or a matter of personal choices and attitudes (Blažič and Blažič, 2020). Existing research primarily focuses on defining the nature of the digital divide, its prevalence across various countries, and its underlying causes. Some research delves into social disparities in different socioeconomic, for example, the education and e-service activities, and the adoption of specific technologies like tablets and smartphones (Hargittai et al., 2019; Bla^{*}zi^{*}c and Bla^{*}zi^{*}c, 2020; Garcia et al., 2021). While many studies examine the digital skills of older adults in various contexts, research focusing specifically on Thailand is limited. This study seeks to address this gap by exploring the digital skills that contribute to the digital divide among vulnerable older adults in Thailand, examining how digital exclusion and digital poverty hinder access to welfare services, and identifying ways to reduce digital disparities through education and training.

3 Method and data

3.1 Data

This study utilizes primary data collection and the analysis of survey data to generate empirical evidence. The data used to explore digital skills among elders was obtained from a self-assessment survey conducted in Thailand. The survey primarily focused on vulnerable older adults in Lampang province in northern Thailand, which has one of the highest proportions of older persons relative to its population. It collected information on demographics, detailed assessments of digital skills and device competence, factors influencing learning and digital skills development, and the ability to access government welfare. However, given that the survey was conducted solely in Lampang province, the results should be interpreted with caution when extending them to the national level. Although Lampang province shares several demographic and socioeconomic traits with other provinces experiencing rapid population aging, regional differences may limit the full generalizability of the results. The next subsection will provide more details about the field survey.

3.2 Field Survey

A survey instrument was devised to evaluate the proficiency in digital skills among older adults, with the overarching goal of gaining insights into their utilization of digital technology within both personal and professional domains. The survey encompassed five principal sections, namely demographic information, assessment of digital skills, current utilization of digital technology, learning experiences with digital technology, and performance evaluation of accessibility in digital public services. The digital skills measurement construct comprised five validated areas of digital competence, rooted in DigComp 2.2¹. The survey was made available in the Thai language through both online and paper-based modalities.

In order to achieve a confidence interval of 95 percent, a target of surveying a minimum of 400 older adults was established, as determined by sample size calculations². The eligibility criteria for participation in the survey stipulated that participants were required to be aged 60 years or older, reside in Lampang province, and possess a state welfare card. The possession of a state welfare card, which is issued to low-income individuals by the Thai government, was used to identify economically vulnerable older adults, aligning with the study's focus on digital exclusion among disadvantaged populations. However, this eligibility criterion may introduce selection bias by excluding older adults who, despite not holding welfare cards, may still face significant socioeconomic or digital disadvantages. Survey participants were selected through a snowball sampling approach, and the allocation of respondents for each specific location was determined via non-probability sampling. A training session for enumerators was conducted to offer technical guidance and advice on the preparation and execution of the field surveys. Prior to conducting the survey, enumerators were instructed to clarify the research objectives and inform respondents of the researchers' contact details, allowing them the opportunity to amend or withdraw any provided data or information. Additionally, enumerators obtained the respondent's consent before each survey was administered³.

¹ The European Digital Competence Framework for Citizens (Vuorikari and Holmes, 2022)

² In determining the sample size for the field survey, we applied the sample calculation formula proposed by (Yamane, 1973)

³ To comply with international standards in protecting those involved in research, this study has passed the Chulalongkorn University Research Ethics Review System for Research Involving Human Participants.

3.3 Logistic Regression

To identify key determinants of digital skills among the elderly, we first computed a dichotomous variable indicating whether the older adult possesses digital skills or not. That is,

$$DS = \begin{cases} 1, \text{ if older adult has digital skills} \\ 0, \text{ otherwise} \end{cases}$$
(1)

where *DS* denotes digital skills. It should be noted that DS in this study, representing exceptional digital skills, is derived from the digital skills assessment conducted in Section 2 of the survey⁴. Respondents were asked to self-evaluate their digital competence based on the five components of DigComp 2.2. The maximum possible score for this assessment is 112. However, the majority of respondents scored 0, with only a small fraction achieving more than 10 marks. Consequently, a threshold of 10 marks was established to distinguish individuals with exceptional digital competence. Observations with a DS value of 1 correspond to respondents who scored 10 or more, signifying outstanding digital skills relative to others.

On the basis of Pearson's Chi-square statistic, we determine whether the predictors gender of the elderly individual, age of individual, marital status of the individual, educational level of the individual, type of occupation, monthly income (in THB), electronic device obtainment, and access to internet were associated with the digital skills. We then employed a Logistic regression model which assumes a linear relationship between the independent variables and the log-odds of the dependent variable, expressed as:

$$logit(p) = \left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + \epsilon$$
(2)

where p denotes the probability that the elderly possesses digital skills, $X_1, X_2, ..., X_n$ are the predictor variables (i.e., gender of the elderly individual, age of individual, marital status of the individual, educational level of the individual, type of occupation, monthly income, and access to digital devices and internet), $\beta_0 0$ is the intercept, $\beta_1, \beta_2, ..., \beta_n$ represent the coefficients for the predictor variables, ϵ is the error term.

⁴ Appendix A presents a comparison between the digital competency evaluation derived from the questions in Section 2 and respondents' actual skills as assessed by the questions in Section 3.

4 **Results**

4.1 **Descriptive Statistics**

The descriptive statistics presented in the table 1 and 2 offer insights into the demographic, socio-economic, and technological characteristics of the surveyed elderly population. The sample consists of 370 observations⁵, with 62.7 percent being female. Marital status data reveal that 63.2 percent are married, while 30 percent are widowed. Educational attainment is predominantly low, with 58.7 percent having only a primary-level education and 38.9 percent reporting no formal education. The household structure shows that 33.2 percent of older adults live in two-person households, while 59.7 percent co-reside with a spouse and 56.8 percent live with children. It is important to note that respondents could indicate both living with a spouse and children, so these categories are not mutually exclusive. These patterns highlight the traditional family support systems among older adults, with many living in multigenerational households.

Economic and technological indicators further illustrate the participants' circumstances. Occupation data indicate that 63 percent engage in general labor, while 30 percent are retired or unemployed. Most respondents (61%) report low incomes, earning less than 3,000 THB per month, and relying heavily on government support, particularly the elderly allowance (99.7%) and welfare cards (100%). Electronic device ownership is relatively low, with 44.6 percent personally owning a device, primarily smartphones (43.8%). These findings highlight economic vulnerability and limited access to technology, underscoring the need for targeted interventions to enhance digital inclusion and welfare accessibility among the elderly.

Tables 3 and 4 present descriptive statistics evaluating digital competence across five main areas: Information and Data Literacy, Communication and Collaboration, Online Safety, Digital Problem Solving, and Trust in Online Activities. Each area is further divided into specific competencies, with results expressed as percentages, means, and standard deviations. Most participants demonstrated low self-assessed competence, with percentages often exceeding 76%, indicating limited familiarity with digital tools and practices. However, the relatively low standard deviations (mostly around 0.22–0.50) suggest minimal variability in responses, reflecting consistency in perceived digital skills across the sample.

⁵ This study collected survey data from 400 respondents; however, after removing incomplete responses, 370 respondents were included in the analysis

Variable	Mean	S.D.
Female	0.6270	0.4842
Marital status		
Single	0.0486	0.2154
Married	0.6324	0.4828
Divorced	0.0189	0.1364
Widowed	0.3000	0.4589
Educational level		
Uneducated	0.3892	0.4882
Primary Level	0.5865	0.4931
Under-secondary Level	0.0135	0.1156
Upper-secondary Level	0.0027	0.0520
Bachelor's Degree	0.0027	0.0520
Family member residing with		
Living Alone	0.0027	0.0520
Spouse	0.5973	0.4911
Children	0.5676	0.4961
Grandchild	0.3946	0.4894
Parents	0.0162	0.1265
Sibling	0.0486	0.2154
Others	0.0486	0.2154
Ownership of Personal Electronic Devices		
Non	0.5622	0.4968
Smartphone	0.4378	0.4968
Tablet	0.0027	0.0520
Occupation		
Retired/Unemployed	0.3000	0.4589
Merchant/Dealer	0.0405	0.1975
Agriculture and Fishery	0.0216	0.1456
Craftsman	0.0054	0.0734
General Hire	0.6297	0.4835
Others	0.0027	0.0520
Monthly Income		
Less than 1,000 THB	0.1486	0.3562
1,001 to 3,000 THB	0.4622	0.4992
3,001 to 5,000 THB	0.2405	0.4280
5,001 to 7,000 THB	0.0865	0.2815
7,001 to 9,000 THB	0.0405	0.1975
More than 9,000 THB	0.0216	0.1456

Table 1: Descriptive Statistics

Table 2: Descriptive Statistics (cont.)

Variable	Mean	S.D.
Sources of Income		
Occupation	0.6811	0.4667
Thai Government's Elderly Allowance	0.9973	0.0520
Thai Government's Disability Allowance	0.0514	0.2210
Thai Government's Welfare Card	1.0000	0.0000
Spouse	0.1595	0.3666
Children	0.1541	0.3615
Relatives	0.0081	0.0898
Observations	370	

Note: All of the variables are binary variable which have a unit in percentage. THB denotes the Thai baht. Source: Authors' calculations from a survey for measuring the digital skills of the elderly to access the welfare/public assistance from the government.

In the Information and Data Literacy area, respondents reported limited proficiency in browsing, filtering, and managing data, with scores ranging from 76.22% to 80.00%. They exhibited a lack of awareness regarding the evaluation of data reliability (79.46%) and expressed low confidence in managing digital files, such as downloading, saving, and organizing digital content (80.00%). Similarly, in the Communication and Collaboration domain, older adults reported low competence in engaging with others through digital technologies. Approximately 80 percent indicated difficulties in sharing files, participating in online communities, and practicing netiquette, suggesting challenges in effectively in interacting in virtual spaces. Furthermore, 80% stated they were not able to create and manage online accounts, including changing passwords and protecting personal data. These findings imply that participants not only lacked an understanding of basic digital communication tools but also exhibited limited social and collaborative capabilities.

Regarding Online Safety and Digital Problem Solving, which emphasize participants' focus on security and troubleshooting, the data reveals a relatively low level of awareness about online threats and personal data protection. Approximately 80% of respondents failed to recognize the importance of antivirus software, the risks of online threats, and the need to safeguard personal data. Additionally, they did not demonstrate competence in addressing technical issues, identifying technological needs, and conducting online transactions. Trust and confidence in accessing online activities, particularly financial and government services, were also notably low, with more than 80% expressing limited confidence in managing financial transactions and preventing data breaches. Despite this challenging outlook, the findings

highlight the critical need for ongoing training programs to address evolving cybersecurity threats and equip older adults with the necessary skills to sustain and enhance their digital competence over time.

4.2 Logistic Regression Analysis

The logistic regression analysis presented in Table 5 examines the marginal effects of various sociodemographic and contextual factors on the likelihood of possessing digital skills among vulnerable elderly individuals (see Table 4). The results highlight that income and personal technology access are among the most influential predictors. Elderly individuals with higher monthly incomes are significantly more likely to have digital skills compared to those earning 1,000 THB or less. For example, those earning between 3,001-5,000 THB, 5,001-7,000 THB, and 7,001–9,000 THB experience increases in the likelihood of possessing digital skills by 21.14%, 21.53%, and 29.19%, respectively, with all effects being statistically significant. These findings underscore the critical role of financial resources in enabling access to digital tools and learning opportunities. Furthermore, the ownership of digital infrastructure is strongly associated with digital literacy. Possessing a personal electronic device increases the probability of having digital skills by 22.42 percentage points, while having personal internet or Wi-Fi access boosts it by 9.64 percentage points, both statistically significant at the 1% level. These results suggest that ensuring elderly individuals have personal and consistent access to digital technology may be one of the most effective strategies for promoting digital inclusion.

In addition to financial and technological factors, educational attainment also plays a positive, albeit statistically weaker, role. Elderly individuals who completed primary school or secondary education and above are more likely to have digital skills than those with no formal education. In particular, those with secondary education or higher have a 16.87 percentage point higher likelihood of possessing digital skills. While this effect is not statistically significant, it is substantively meaningful and suggests that past educational experiences contribute to digital competence later in life. On the other hand, demographic and social variables such as gender, age, marital status, employment type, and living arrangements appear to have limited influence on digital skill acquisition. For example, being aged 80 or older is associated with an 8.79 percentage point decrease in the likelihood of having digital skills, and being married reduces it by 10.13 percentage points, but neither effect reaches statistical significance. Similarly, residing with children or grandchildren shows negligible impacts. These findings imply that while age-related and familial factors may influence digital

Table 3: Digital Skills Assessment

Digital Competence Area	Not true	Mean	S.D.
1. Information and data literacy			
-I know how to use search engines using keywords to find uncomplicated information online.	76.76%	0.32	0.68
-I know how to access the data and digital content.	76.76%	0.34	0.74
-I can type the related words to finds my desired information.	76.22%	0.32	0.68
-I know not all information online and content I see is reliable.	79.46%	0.25	0.56
-I know how to download/save files or content I found online and retrieve them once saved.	80.00%	0.23	0.50
2. Communication and collaboration			
-I know how to share files and content with others digitally using email or other simple tools.	79.46%	0.25	0.55
-I know how to digitally share files and content with others.	80.27%	0.22	0.49
-I know how to explain the basic usage of digital technology systems to share information and data, including digital content, with others.	79.46%	0.23	0.49
-I know how to digitally access any social communities, using appropriate apps or websites.	80.27%	0.21	0.45
-I have a good understanding in digital technology etiquette and practices in online.	79.73%	0.22	0.48
-I know how to communicate with others using email, mobile phone, or other messaging Apps.	79.46%	0.23	0.49
-I know how to create an online account, change the passwords, and protecting personal information in online.	80.00%	0.22	0.46
3. Online safety			
-I am aware that viruses can damage my device and anti-viruses' software should be used to prevent this.	79.73%	0.22	0.48
-I can distinguish risks and threats from the online and can also explain them to others.	80.00%	0.22	0.48
-I have appropriate digital tools for preventing my digital devices.	80.27%	0.22	0.49
-I have knowledge and understanding of protecting personal information and privacy in online, and can also explain it to others.	80.00%	0.22	0.48
-I can share personal information, but at the same time, I am also concerned about online safety, and can also explain it to others.	79.73%	0.22	0.48
-I understand the importance of personal information online and always be careful about sharing it.	79.73%	0.23	0.49

 Table 4: Digital Skills Assessment (cont.)

Digital Competence Area	Not true	Mean	S.D.
4. Digital problem solving			
-I can recognize when my digital device works abnormally.	78.92%	0.24	0.51
-I know how to solve some technical problems (e.g., update/re-install/close program, re-start computer, re- connect WIFI network, check internet connection).	79.19%	0.23	0.48
-I can use digital technology to fulfil certain needs, such as buying and selling things online or conducting financial transactions.	80.27%	0.22	0.47
-I can recognize that I need an improvement in digital competence and skills based on my personal experience.	80.00%	0.22	0.47
-I know to access the resources for developing my online skills on my own, and can also guide others in developing their digital skills.	79.73%	0.22	0.47
5 Trust and confidence in accessing online activities and s	services among	g elderlies	
-I know how to create an account to purchase goods and services electronically with confidence and trust in the relevant systems, especially in terms of financial transactions, and I can do everything myself.	80.00%	0.22	0.47
-I know how to create an account to make financial transactions, whether checking balances, transferring money, paying money, or even using a bank application to scan money to buy goods or services, and I can do everything.	80.27%	0.22	0.47
-I know how to create an account to use government services and receive benefits with confidence and trust in the relevant system.	80.27%	0.22	0.47
-I know how to establish secure codes to pay for goods and services online.	80.27%	0.22	0.47
-I am aware of online deception by scammers, such as sending suspicious links, and posing as government agencies to solicit digital benefits without needing to receive advice from other people.	80.27%	0.22	0.47

Note: Mean scores are based on a 5-point Likert scale (1 = not at all true of me; 5 = very true of me). Not true (%) indicates the proportion of participants who selected 1.

Source: Authors' calculations based on a survey designed to measure the digital skills of the Elderly in accessing welfare and public assistance from the government.

engagement in subtle ways, they are outweighed by more tangible resources such as education, income, and device ownership. Meanwhile, regarding digital registration for Thai government welfare programs, respondents primarily reported receiving assistance from their children or grandchildren (see Appendix B). Policymakers aiming to bridge the digital divide among the

elderly should therefore prioritize targeted interventions that enhance affordability, infrastructure access, and lifelong learning opportunities.

Variable	dy/dx	S.D.
Gender (ref: male)		
Female	0.0095	(0.0388)
<i>Age</i> (ref: 60-69 years)		
70 to 79 years	-0.0080	(0.0432)
80 years or older	-0.0879	(0.1350)
Marital Status (ref: single)		
Married	-0.1013	(0.0693)
Divorced	-0.0341	(0.1194)
Widowed	-0.0106	(0.0779)
Education (ref: uneducated)		
Primary school	0.0546	(0.0510)
Secondary school or higher	0.1687	(0.1059)
Employment (ref: unemployed)		
Merchant or Dealer	0.0339	(0.0843)
Craftsman	0.0496	(0.1270)
General Hire	0.0262	(0.0588)
Monthly Salary (ref: 1,000 THB or lower)		
1,001 to 3,000 THB	0.1266	(0.0836)
3,001 to 5,000 THB	0.2114**	(0.0897)
5,001 to 7,000 THB	0.2153**	(0.0908)
7,001 to 9,000 THB	0.2919***	(0.0967)
More than 9,000 THB	0.2371^{*}	(0.1224)
Residing with Children	0.0355	(0.0412)
Residing with Grandchild	0.0123	(0.0375)
Personally Owned Electronic Device	0.2242***	(0.0539)
Family-Owned Electronic Device	0.0560	(0.0788)
Personally Owned Internet or Wi-Fi	0.0964***	(0.0323)
N	370	

Table 5: Marginal effect from logistic regression of digital skills among vulnerable elderly individuals

Note: The reference category is having digital skills, so coefficients represent the effect that a given trait has on the likelihood that an individual would have digital skills versus not having digital skills. Delta method standard errors are given in parentheses.***p < 0.01, **p < 0.05, *p < 0.1.

Source: Authors' calculations (see Appendix C for logistic regression estimates)

5 Discussion

This study provides a thorough exploration of older adults' use of digital technology and examines the digital divide related to digital device use and overall digital competence. Overall, the findings from the descriptive statistics demonstrate low digital competence across all areas. Our results indicate that limited access to digital devices and the internet significantly impacts older adults' skills. This is further supported by the data on smartphone usage frequency in Figure 1, which reveals notable patterns in user behavior. A vast majority of the respondents (70.81%) report never using smartphones, indicating limited adoption or access within this group. In contrast, 12.97% use smartphones once a week, and 12.16% report daily usage, highlighting a smaller but consistent group of regular users. Occasional usage is less common, with 2.70% using smartphones once a month and only 1.35% reporting usage one or two times in total. These findings suggest that while a small proportion of individuals incorporate smartphones into their routines, the majority do not use them at all, possibly due to barriers such as affordability, lack of necessity, or limited digital literacy.



Figure 1: Frequency of Smartphone Use

While the digital divide among the older adults is typically linked to access to digital resources, economic factors such as income level also play a key role. This aligns with our results in Figure 2, which highlight several key reasons why individuals may not adopt a particular digital device or its associated services. A majority of the elderly respondents (63%) perceive it as unnecessary, suggesting that they do not see its relevance or value in their daily



Figure 2: Reason for not owning a smartphone

lives or work. Financial constraints also play a significant role, with 41% reporting that they cannot afford it. Additionally, 26% of respondents admit to lacking the knowledge or skills required to use smartphones or services effectively. Lastly, only 1% of older adults cite a lack of internet access at their workplace or accommodation as a barrier, indicating that connectivity issues are less of a concern compared to other factors.

Also, this study builds upon earlier assumptions that attitudes and capabilities are key factors influencing technology adoption among older adults (Charness and Boot, 2009). Our results in Figure 3 highlight several obstacles faced by older individuals in learning digital competence and using electronic devices. The most significant barrier is a lack of skills or knowledge, reported by 56% of respondents, indicating a widespread need for foundational digital education. Financial constraints also pose a major challenge, with 43% citing a lack of budget as a limiting factor. Additionally, 41% mention a lack of interest or motivation, suggesting that promoting the relevance and benefits of digital skills could help boost engagement. Lack of time is another notable obstacle, affecting 17% of respondents, while 8% point to insufficient training opportunities as a hindrance. Furthermore, 9% highlight a lack of facilities or supporting resources, and only 1% identify a shortage of learning materials as a barrier. Overall, our findings emphasize the need for affordable, accessible, and engaging training programs that address both knowledge gaps and motivational challenges to improve digital competence and enhance older adults' lives in a digitally inclusive society.



Figure 3: Factors Affecting Elders' Learning in Digital Technologies

This study makes a valuable contribution to the literature on digital skills gap, with a particular focus on vulnerable older adults. Our results indicate that access to digital resources, such as owning personal electronic devices and having internet connectivity, plays a pivotal role in enabling older adults to develop digital skills. Moreover, income significantly influences digital competence among older adults, highlighting the importance of economic resources in promoting digital literacy. This effect is likely mediated through improved access to technology and enhanced training opportunities. Training modules incorporated into curricula should be tailored to meet the specific needs of older adults, as highlighted by the study findings in Figure 4.



Figure 4: Digital Skills Training Programs of Interest to the Elderly

The data shows the respondents' interest in digital skills training programs which highlights varying levels of demand across different areas. Online communication emerges as the most popular area, with 69% expressing interest, indicating a strong desire to improve skills related to virtual interactions. Information searching also ranks high, attracting 59% of respondents who wish to enhance their ability to locate and evaluate online information effectively. Interest in the operation of electronic devices is notable at 36%, reflecting a need for technical proficiency in handling digital tools. Additionally, 26% are interested in online safety, emphasizing concerns about cybersecurity and protecting personal information. Financial activities, such as online banking and transactions, appeal to 25% of respondents, while 18% prioritize digital problem-solving skills. Content creation, however, garners the least interest at only 2%, suggesting that fewer respondents view it as a critical skill. These insights can inform the design of training programs that focus on the most essential areas, while also supporting the development of a broader range of skills.

5.1 Limitations and Future Research

This research has several limitations that open opportunities for future investigation. We focused on older adults' digital skills and the key determinants of digital skills among the vulnerable elders particularly within the context of Thailand, where the data might be influenced by a particular culture. As a result, generalizing the findings of this study to older adults' digital skills in other countries - particularly those non-vulnerable ones - should be approached with caution. Future studies could consider a comparative approach across different countries or different socioeconomic groups, providing a detailed overview of digital skills competency in each society to better interpret the findings.

Aging is a multifaceted process, and this study only begins to explore the role of digital technology in the lives of older adults by considering chronological age as one aspect of aging. However, chronological age alone may not fully encompass the biological, functional, psychological, and social aspects of aging that affect individuals in varying ways (Chen and Chan (2011)). Some of these age-related factors include declines in visual and auditory perception, mobility issues, cognitive decline, social isolation, and fears related to illness and death. Future research should expand the concept of aging to deepen our understanding of how aging and digital technology use are interrelated.

5.2 Conclusion Remarks

With the rapid emergence of aging societies and the integration of digital technology into daily life, this study sheds light on the digital competencies of vulnerable older adults in Thailand and the key determinants of technology use. Access to digital resources plays a vital role in promoting digital skills among older adults. Specifically, our findings indicate that a lack of skills or knowledge, along with financial constraints, represents the most significant barriers hindering technology adoption among older adults. Targeted interventions, such as digital skills training and affordable technology, are crucial for inclusion. To better support older adults, digital skills training programs and platforms should take their preferences into account and provide customizable interfaces and interactive features to address their unique needs. Policymakers must enhance digital accessibility to ensure equitable participation in Thailand's digital society, bridging the digital divide and fostering greater inclusion for aging populations.

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Appendix A: Comparison of Digital Competency Evaluations: Academic vs. Practical



Appendix B: How Recipients Register for Thai Government Welfare Using Electronic Devices

The chart illustrates the sources of assistance respondents relied on during the registration process for welfare programs in Thailand. The majority of respondents, accounting for 68%, reported receiving help from their children or grandchildren, highlighting the pivotal role of younger family members in supporting older or less digitally literate individuals. Additionally, 14% of respondents indicated assistance from government officers, reflecting the presence of formal institutional support, though to a lesser extent than family assistance. A smaller proportion, 4%, relied on neighbors or relatives, suggesting that some individuals turned to their broader social networks for help. Notably, only 1% of respondents completed the registration process independently, emphasizing the limited digital skills or confidence in self-registration among this population. This data underscores the reliance on intergenerational support and informal networks for navigating digital technologies, particularly in welfare-related contexts. It also points to potential gaps in digital literacy and the accessibility of formal support systems, suggesting a need for targeted policies and interventions to promote independent digital engagement and reduce digital inequalities.



Variable	β	SE	Z	р	$Exp(\beta)$
Gender (ref: male)					
Female	0.1073	0.4388	0.24	0.807	1.113
Age (ref: 60-69 years)					
70 to 79 years	-0.0905	0.4865	-0.19	0.852	0.913
80 years or older	-0.9923	1.5583	-0.64	0.524	0.371
Marital Status (ref: single)					
Married	-1.1436	0.8025	-1.43	0.154	0.319
Divorced	-0.3853	1.3491	-0.29	0.775	0.680
Widowed	-0.1192	0.8803	-0.14	0.892	0.888
Education (ref: uneducated)					
Primary school	0.6161	0.5711	1.08	0.281	1.852
Secondary school or higher	1.9044	1.2054	1.58	0.114	6.715
Employment (ref: unemployed)					
Merchant or Dealer	0.3823	0.9441	0.40	0.686	1.466
Craftsman	0.5593	1.4294	0.39	0.696	1.749
General Hire	0.2962	0.6579	0.45	0.653	1.345
Monthly Salary (ref: 1,000 THB or lower)					
1,001 to 3,000 THB	1.4293	0.940	1.52	0.129	4.176
3,001 to 5,000 THB	2.3863	1.0286	2.32	0.020	10.873
5,001 to 7,000 THB	2.4295	1.0474	2.32	0.020	11.353
7,001 to 9,000 THB	3.2943	1.1523	2.86	0.004	26.959
More than 9,000 THB	2.6760	1.4216	1.88	0.060	14.527
Residing with Children	0.4002	0.4678	0.86	0.392	1.4921
Residing with Grandchild	0.1393	0.4231	0.33	0.742	1.149
Personally Owned Electronic Device	2.5300	0.6694	3.78	< 0.001	12.553
Family-Owned Electronic Device	0.6326	0.9002	0.70	0.482	1.882
Personally Owned Internet or Wi-Fi	1.0882	0.3799	2.86	0.004	2.969
Constant	-6.3216	1.5682	-4.03	< 0.001	0.002
Pseudo R-squared	0.4412				
N	370				

Appendix C: Estimates of logistic regression of digital skills among vulnerable elderly individuals

Note: The reference category is having digital skills, so coefficients represent the effect that a given trait has on the likelihood that an individual would have digital skills versus not having digital skills. *p*-value <0.05 is statistically significant; SE is robust standard errors; and $Exp(\beta) = \text{odds ratio}$.

Source: Authors' calculations