



Understanding Elderly Women's Needs for Building an AI-Powered Matchmaking Platform in Finland and Indonesia

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Leading Business Transformation (LEBUM)
Experience Economy and Designing Services
Master's Thesis
2023

Abstract

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Degree Master of Business Administration, Leading Business Transformation
Report/Thesis Title Understanding elderly women's needs for building an AI-powered matchmaking platform in Finland and Indonesia
Number of pages and appendices 108 + 6
<p>Currently, the life expectancy of women is higher than the life expectancy of men in every country in the world. Consequently, there will be more elderly women than elderly men in the future's aging population. While increased longevity is a blessing for elderly women, it also brings challenges such as loneliness due to the loss of spouses and close friends.</p> <p>The aim of this thesis is to explore the needs of elderly women aged 60 to 80 in the Helsinki metropolitan area in Finland and the Jakarta metropolitan area in Indonesia when using AI-powered matchmaking platform to find friends and activities to enhance their well-being, promote active aging, foster social inclusion, and combat loneliness.</p> <p>The literature review of this thesis covers aging among elderly women in Finland and Indonesia, matchmaking platforms, AI and Human-Centered AI, and technology usage among the elderly. The empirical part of this thesis applies an iterative service design approach, using the Double Diamond service design model. This thesis uses multi-method qualitative study. Semi-structured online interviews and thematic analysis were used to collect and analyze data in the first research. In the second research, the thinking aloud method and template analysis were used to collect and analyze data from a prototype testing.</p> <p>The findings in the first research revealed that elderly female participants in both Finland and Indonesia shared common interests such as cooking and reading. They used mobile phones and WhatsApp in communication, with different attitudes towards security and data privacy. While Finnish participants concentrated on individual contentment and health, Indonesian participants emphasized family and financial support for others.</p> <p>In the second research where the elderly participants tested a prototype, elderly women in both Finland and Indonesia shared a common preference to maintain and nurture relationships. Trust was a key factor for online interaction among elderly Finnish women, while elderly Indonesian women showed greater caution in interacting with strangers online. Overcoming the fear of technology and the problem of limited vision were challenges for both elderly women in Finland and Indonesia. The participants in both countries expressed a desire for a user-friendly platform that could facilitate meaningful social interactions and events.</p> <p>At the end of this thesis, the prototype is updated in the form of recommendations, with validation and input from three AI experts in Finland and Indonesia.</p> <p>This study was conducted between January 2023 and September 2023.</p>
Keywords Elderly women, Finland and Indonesia, Well-being, Social inclusion, Matchmaking platform, Human-Centered AI

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Abbreviations

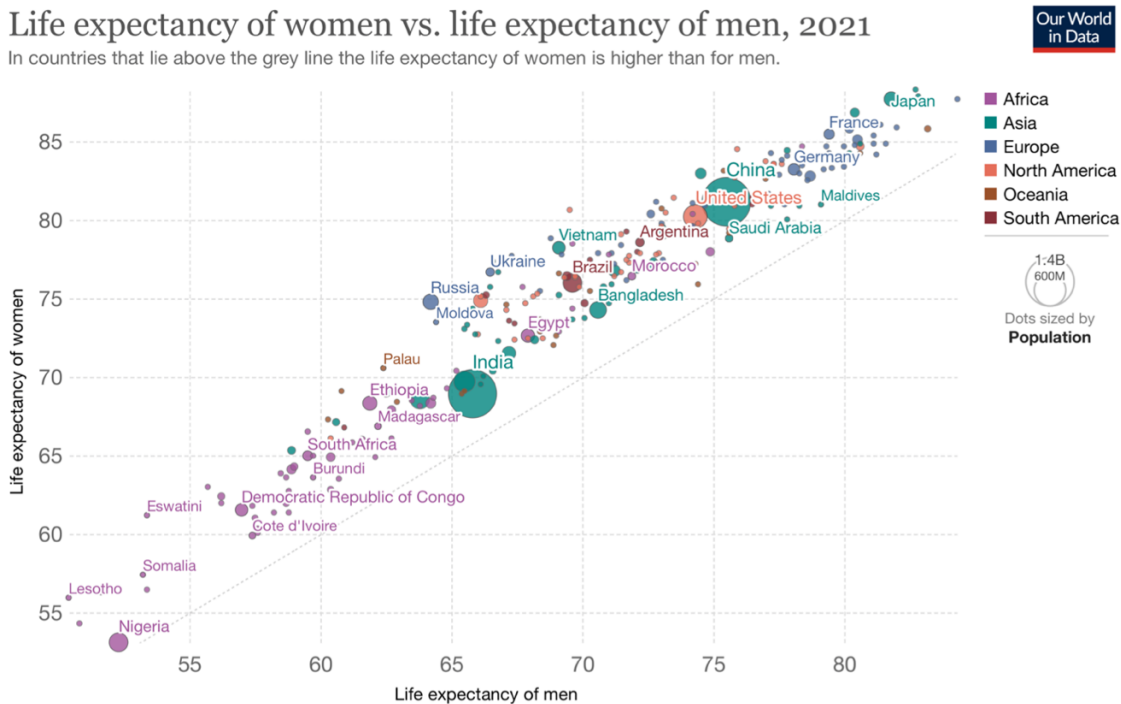
AI	Artificial Intelligence
BFF	Best Friend Forever
CCM	Constant Contact Media
Covid-19	Coronavirus disease 2019
ESR	Exclusion from Social Relationship
EU	European Union
GDP	Gross Domestic Product
GDPR	General Data Protection Regulation
GPT	Generative Pretrained Transformer
HCAI	Human-Centered Artificial Intelligence
IBM	International Business Machines
ICT	Information and Communication Technology
IF	Interviewee Finland
II	Interviewee Indonesia
IoT	Internet of Things
IT	Information Technology
ML	Machine Learning
RS	Recommendation System
RQ	Research Question
SDG	Sustainable Development Goal
UAS	University of Applied Sciences
UN	United Nations

USA	United States of America
VF	Validator Finland
VI	Validator Indonesia
3D	Three Dimension

1 Introduction

The world's human life expectancy at birth has increased significantly, from 46.5 years in 1950 to 71.0 years in 2021 (United Nations, 2022). Better lifestyle and habits, enormous progress in medicine (Boudoulas & al., 2017) and advancements of technology that support the progress in medicine and healthcare (Pomeroy, 2019) are the elements contributing to the increase in life expectancy.

The population of people who are 60 years old or older will increase from 1 billion elderly people in 2020 to 1.4 billion elderly people by 2030 and is projected to reach 2.1 billion elderly people by 2050, covering 22 % of the world's human population, a significant increase from 12 % of the elderly population in 2015 (WHO, 2022).



Source: United Nations, World Population Prospects (2022)
Note: Shown is the period life expectancy at birth measured in years.

OurWorldInData.org/life-expectancy • CC BY

Exhibit from Max Roser, Esteban Ortiz-Ospina and Hannah Ritchie (2019) - "Life Expectancy". Published online at OurWorldInData.org. Retrieved from: <https://ourworldindata.org/life-expectancy> [Online Resource]

Figure 1. Life expectancy of women and men in 2021 (Roser, Ortiz-Ospina & Ritchie, 2019)

There are more women than men in the elderly population. Even though women are more affected by depression than men (WHO, 2021), have higher level of anxiety disorders (Somers & al., 2006), and face more social inequality compared to men (UN Women, 2021), women tend to outlive men in all countries around the world (UN, 2022), as shown in Figure 1.

While increased longevity is a blessing for elderly women, it also brings challenges such as loneliness due to the loss of spouses and close friends. Elderly women who experience the loss of their spouses are likely to display increased level of depressive symptoms that can reach a severe level (Sikorski & al., 2014). Friendship and close personal relationships support the elderly women during major life changes, help cope with isolation and loneliness and make it possible for the elderly women to age with better physical and mental health. Friendship also leads to increased function of immunological system and increased life expectancy. (Sugar & al. 2014, 175-184.) Friendship which supports active aging is therefore important for elderly women.

In this thesis, the focus is on how the elderly women in both Finland and Indonesia can find good friends by utilizing AI-powered matchmaking platform or Artificial Intelligence- powered matchmaking platform (Paspelava, 2019) to enhance their well-being, promote active aging, foster social inclusion, and combat loneliness. Even though AI and ML (Machine Learning) technology such as RS (Recommendation System) are included inside the literature review of this thesis, this thesis does not emphasize AI algorithms or business profitability. This thesis instead emphasizes on customer experience and service design (Lawrence, 2019), and develops a concept for an online friend-making and activity-finding experience for elderly women who live in Helsinki metropolitan area in Finland and Jakarta metropolitan area in Indonesia, that can support their daily life, taking their families, friends, and the society into accounts. Ethical considerations in AI will play an important role in the AI-powered online matchmaking platform, to create a Human-Centered AI (HCAI) experience which is safe, fair, and secure for the vulnerable elderly women. Striking a balance between the positive and negative aspects of AI usage is important, so that rather than complicating the experience, the AI is expected to enhance friend-making and activity-finding experience online.

1.1 Objective and research questions

The objective of this thesis is to find out the needs of elderly women in both Finland and Indonesia when using AI-powered matchmaking platform to find friends and activities, to enhance their well-being, promote active aging, foster social inclusion, and combat loneliness. A concept of AI-powered matchmaking platform which answers to the needs will then be created.

The Research Question (RQ), and Sub-Questions RQ1, RQ2, RQ3 and RQ4 of this thesis are:

RQ: How might we help elderly women to apply active aging, to be socially inclusive and less lonely by using AI-powered matchmaking platform?

RQ1: What kind of activities and services are available for elderly women in Finland and Indonesia now to promote active aging and make them less lonely?

RQ2: In what ways do the service needs of elderly women differ between Finland and Indonesia?

RQ3: What kind of improvements can be made to the current situation?

RQ4: How can AI and AI ethics be mixed well to maximize friend-making and activity-finding experience for elderly women?

1.2 Scope, limitations and advantages

The scope of this study is limited to elderly women from the baby boom generation, aged 60 to 80 (Iberdrola, 2023) in Helsinki and Jakarta. The research focuses on elderly women who have not resided in elderly homes and can manage their daily activities with little assistance. The purpose is to help the elderly women to enhance their quality of life. The study is conducted with strong consideration of cultural and geographical distinctions between Finland and Indonesia. Instead of comparing different measures of parameters, developing a concept which is good for each country is the focus, to create an AI-powered matchmaking platform that caters to the need of elderly women in both areas.

Abundance of recent sources in AI and AI ethics in Finland and Indonesia that are used for this thesis is one of the advantages of this thesis. The UN (United Nations) decade of healthy aging 2021-2030 is also an important time frame, when the UN facilitates global collaboration to improve the lives of elderly people, their families, and the communities where they live (WHO, 2023), which means there are various materials which can be used to support this thesis writing. The writer of this thesis currently lives in Finland and is originally from Indonesia. The unique backgrounds provide valuable insights into the cultures, access into research materials from both countries, and the ability to conduct interviews and other research methods for this thesis.

While the interviews and data collection from research participants in Indonesia were conducted in Indonesian language (Bahasa), the official language of Indonesia, the interviews and data collection in Finland were conducted in English, which is not the official language in Finland. All the interviews in the first research were conducted online. Therefore, the limitations of this thesis are that the participants in Finland did not include those who can only speak Finnish, and the participants in the first research did not include those who lacked access to the internet and online platforms.

In this thesis, the terms 'the writer of the thesis', 'the interviewer', and 'the researcher' all refer to the same individual. The terms 'interviewee' and 'participant' all refer to the participants of the semi-structured interviews and prototype testing. No external commissioners were involved in the executions of this thesis and any companies or organizations mentioned in this work have no affiliations with the writer of the thesis. All sources are cited following Haaga-Helia University of Applied

Sciences (UAS) referencing policy. ChatGPT (Generative Pretrained Transformer) was used during the thesis editing process to identify grammatical errors and increase readability, following Haaga-Helia UAS' guidelines on AI usage. ChatGPT was used without changing the original meaning of the content. Additionally, the quotes from interviews and prototype testing in the data analysis and findings in this thesis were not processed within ChatGPT.

1.3 Structure of the thesis

The first chapter of this thesis introduces the topic and discusses its purpose, scope, limitation, and advantages. It also outlines the structure of the thesis.

Chapter 2 and Chapter 3 of this thesis cover literature review, key concepts, and theoretical framework. Chapter 2 explores aging among elderly women in Finland and Indonesia, while Chapter 3 is about online matchmaking platforms, AI, AI ethics, and technology usage among elderly women. The theoretical framework is presented at the end of Chapter 3.

The methodology of this thesis is covered in Chapter 4. This study uses multi-qualitative research with service design method flow. The main data collection methods are semi-structured online interview and prototype testing by using thinking aloud method. The main analysis methods of the data obtained are thematic analysis and template analysis.

Chapter 5 covers data analysis in more detail and presents the findings from each analysis. The data analysis and findings are important parts of the Double Diamond service design model which is used in this thesis. The service design phases also include brainwriting and prototype creation.

Chapter 6 is the final chapter where recommendations and validation are offered in the last stage of the Double Diamond service design model of this thesis. Research ethics, reliability and validity of the thesis, limitation, recommendation for further research, and reflection are written in the latter part of the chapter.

2 Aging for elderly women in Finland and Indonesia

This chapter starts with defining the concept of aging and its various aspects from studies around the world. The aspects include elderly well-being, loneliness, depression, friendship and relationship, social inclusion, and active aging. It would then continue to go specifically into elderly women in both Finland and Indonesia, examining each country in terms of their policies related to the well-being of the elderly population, the studies about elderly people and elderly women, and popular activities among elderly women in each country.

2.1 Aging

Aging is the stage in one's life when there is a gradual decrease in physical and mental capacity due to the impact of the accumulation of a wide variety of molecular and cellular damage over time (WHO, 2022). Arking (2006) defined aging as "the time-independent series of the cumulative, progressive, intrinsic, and deleterious functional and structural changes that usually begin to manifest themselves at reproductive maturity and eventually culminate in death."

Gray hair, wrinkling skin, being more prone to negative effects of cold temperature, heat stress, problems with vision, impaired hearing, reduced sensitivity in taste, bone thinning, lower sleep quality, and menopause in women are natural physical changes that can occur in people when they are aging (Sugar & al. 2014, 37-48).

2.1.1 Psychological well-being, loneliness, and depression

Stone & al. (2010) conducted research on people from several age groups in the USA (United States of America) about various aspects of psychological well-being. The research shows that the U-curve graph with the wellbeing rate reaches the lowest level in individuals who are in their early 50s, and the well-being rate has gradually increased in the elderly people starting from their late 50s. This suggests that elderly people tend to become happier as they age. However, Hudomiet & al. (2021) challenge the research by examining the age profile of life satisfaction and propose that higher life-satisfaction in the elderly people is because the less-satisfied elderly people might have already died, or it is a greater likelihood of dying among people with less satisfaction.

Loneliness is subjective, and it is a negative feeling which results from lack of social relationships (Peplau & Perlman, 1981). Depression is the mood symptoms of loss of pleasure and low mood for most of the day for at least two weeks (WHO, 2021). There is a close relation between loneliness and depression, and in elderly women, the depressive symptoms predict more experiences of loneliness (Tiikkainen & Heikkinen, 2005). Elderly people who committed suicide had the combina-

tion of loneliness and depressive symptoms, with elderly suicide attempters were most likely widowed women with social isolation, loneliness, and depression (Lebret et al., 2006). Loneliness and depression have a complex mutual relationship, where loneliness is contributing and a consequence to depression, making loneliness a significant challenge in old age (Jylhä & Saarenheimo 2013, 317-328).

Holmen and Furukawa (2002) show a decrease of loneliness as people get older, due to meaningful contacts with friends, despite having fewer good friends to talk to. However, Jylhä (2004) reports that loneliness increases as people get older, which is caused by the negative changes in their old age, such as death of spouse and decrease of capability to be independent.

Another survey for 45-year-old adults and older shows the connections between loneliness, social connections, life experiences, health, and technology. It reveals that the size of social network and being physically isolated are the predictors of loneliness. Factors such as age, depression, urbanicity, anxiety and overall health also contribute to loneliness. From the survey, 33 % of the adults who have ever spoken to their neighbors experience loneliness, while 60 % of the adults who have never spoken to the neighbors are lonely. The individuals who volunteer, participate in clubs, or attend religious services are less likely to be lonely than those who do not. The individuals who live in rural areas are less lonely than those who live in the cities. This survey also shows that individuals in their 60s are less lonely than those in their 40s and 50s. (Anderson & Thayer, 2018.) This aligns with the findings by Stone & al. (2010) which were mentioned earlier in this sub-chapter.

In relation to depression, elderly individuals can get depressed due to significant losses, such as the death of their partner or friends, the loss of their children, job loss or reduced income, loss of home, and the feeling of being disregarded in their later years after enjoying respect in their younger years (Sugar & al. 2014, 65-79).

The study of loneliness in Europe shows varying results across countries. Loneliness is more likely to happen in individuals in collectivistic countries compared to individualistic ones. Friends have greater impact in reducing loneliness for individuals in individualistic countries compared to collectivistic ones, while family has greater impact in reducing loneliness for individuals in collectivistic countries. (Lykes & Kemmelmeier 2013, 468-490.) The study by de Jong Gierveld and van Tilburg (1999) reports that elderly people in Italy are lonelier than those in the Netherlands. Even though poor health contributes to the loneliness in both countries, in the Netherlands loneliness is characterized with a partner's absence and small social network, while socioeconomic dependence and living alone are the elements of loneliness in Italy.

2.1.2 Friendship, relationship, social inclusion and active aging

While family is the main support of most elderly people, friendship has significant roles in the elderly people's well-being during their old age (Sugar & al. 2014, 175-184). Kalmjin's study in the Netherland (2003, 247) reports that individuals tend to have fewer friends and fewer friendship contacts as they age. However, in a study involving 42 elderly women, Adams (1987) mentions that the few friends are only in very late life, and before those new friendships replaced the previous inactive friendships.

Older men are likely to be married compared to older women. Older men are also more inclined to remarry than older women. While men often struggle when living alone, women tend to thrive in such situations. Women are capable of travelling, volunteering, pursuing their hobbies and engaging in activities independently. However, women may face challenges related to financial burden and social isolation. Women maintain close and confiding relationships which are good for health, and they tend to have stronger bonds with their adult children. (Span, 2016.) Another study reports that elderly women tend to have bridging potential in their networks, which expands as they grow older. These networks often include individuals who are not connected to their spouses or partners. Additionally, elderly women tend to have larger social networks outside their households. (Cornwell, 2011.)

In perceived sense of significance in the world, women gain social significance to the extent of interpersonal attachments, such as parenthood, family relationships and friendships, while men's sense of significance is influenced by broader social factors such as social media use or ability to contribute financially to the community (Bonhag & Froese, 2022). On friendship norms among older adults, women tend to have greater sense of intimacy, and have higher expectations of friends compared to men. Women also tend to disapprove more than men when friendship rules are violated. (Felmlee & Muraco, 2009.)

"Social Inclusion is the process of improving the terms on which individuals and groups take part in society – improving the ability, opportunity, and dignity of those disadvantaged on the basis of their identity" (World Bank, s.a.).

According to a study which was conducted to clarify the barriers to social participation in lonely older adults, the significant barriers which prevent elderly adults from social participation are illness and disability, loss of contact with friends and relatives, lack of a supportive community and limited access to social opportunities. Instead of seeking new accessible social opportunities, the elderly adults try to minimize the challenge of loneliness on their own and avoid social engagements. It is

also revealed that the fear of social rejection or exploitation, and the concern of losing preferred identities play a role in their avoidance of social interaction. (Goll & al., 2018.)

A study on ESR (Exclusion from Social Relationship) among elderly people in 14 European countries shows that the lowest ESR rates are in the Northwest of Europe. The highest ESR rates, signifying the least socially inclusive area are in the Southeast of Europe and are predominantly among elderly women. Higher age and a lack of personal resources, including socioeconomic factors and health, increase the risk of ESR for both men and women. Compared to men, women are more susceptible to social exclusion and loneliness. Despite being more socially active and integrated when they are younger, women's high social standards and expectations might make them more vulnerable in facing loneliness and losses as they age. (Hansen & al., 2021.)

“Active aging is the process of optimizing opportunities for health, participation and security in order to enhance quality of life as people age” (WHO, 2014). The cross-cutting determinants to active aging are culture and gender. Different cultures might have different views towards elderly people and the aging process. For example, in some cultures, elderly people live with their adult children, while in others, they live independently in their own home, without their adult children. Gender determinants might view women as having lower social status than men, which can lead to poverty and unhealthy conditions in old age. Several other determinants connect to these cross-cutting determinants of active aging. Those determinants are health promotion and disease prevention, long-term care, mental health services, tobacco use, physical activities, healthy eating, oral health, biology and genetics, psychological factors, safe housing, social support, education and literacy, and income. Inevitably, the aging population faces challenges, such as the double burden of disease, an increased risk of disability, providing care for the aging population, the feminization of aging, the ethics of aging, the economics of aging, and the development of a new paradigm in policies and programs. (WHO, 2014.)

Age, gender, and the amount of time spent outside the home show significant correlation with self-assessed health. The study reveals that the middle-aged group engages in fewer physical activities than the younger-aged group and experiences a greater number of chronic conditions than their younger counterparts. The middle-aged group may be at risk of health problems that could threaten their successful aging in the future. Physical activities tend to be less common in elderly women than in elderly men, possibly due to elderly women having lower body weight and strength than elderly men. The amount of time spent outside the home and the satisfaction with social support are significantly associated with self-rated health. Social engagement emerges as an important factor of physical health into very late adulthood. (Cherry & al., 2016.)

2.1.3 Elderly people and scams

Elderly people are vulnerable and often become prime targets for frauds, scams, and other consumer scams (Sugar & al. 2014, 259-272.)

Most older consumers who filed fraud reports avoided losing any money. Older adults experienced higher median individual dollar losses than younger customers. Older people are more likely than younger customers to report tech support scams, lottery scams, or family impersonator scams. Older people reported the highest losses in fraud cases that started with a phone call. (FTC, 2021.)

2.2 Elderly people-friendly community

Creating an elderly people-friendly community is the goal in an aging population. An elderly people-friendly community is a community which is free from physical and social barriers, and is supported by systems which promote health and maintain physical and mental capacity and enable people to do the things they value. This community helps elderly people meet their basic needs, learn, grow, and make decisions, build, and maintain relationships, and contribute. (WHO, 2018.)

An elderly-friendly city is community-wide rather than individually based for the well-being of elderly people. While elderly-friendly cities could be measured by physical and social indicators, this thesis focuses more on the social indicators. For the accessible social environment, the core indicators are positive social attitude towards elderly people, engagement in volunteer activities, paid employment, engagement in socio-cultural activity, participation in local decision making, availability of information, availability of social and health services, economic security, and quality of life. The supplementary indicators for elderly-friendly cities are accessibility of priority vehicle parking, accessibility of housing, participation in leisure-time physical activity in a group, engagement in life-long learning, internet access, public safety, and emergency preparedness. (WHO, 2015.)

2.2.1 Elderly women in Finland

The Republic of Finland declared its independence in 1917. Finland is in Northern Europe, located between Sweden and Russia, with land area of 303,815 square kilometers, and has a cold temperate climate. The population is 5,601,547 people, and it is the 116th most populous country in the world. The population aged 65 and older covered 22.26 % of the total population (male 543,331/ female 697,045). The population growth rate is 0.24 %, and the urban population covers 85.8 % of total population. The sex ratio for those aged 65 and older is 0.63 male/ female. GDP (Gross Domestic Product) per capita is USD 48,400. Unemployment rate 7.53 %, and population before poverty rate 12.2 %. (CIA, 2023a.) The current retirement age in Finland is 64 to 68 years old (ETK, s.a. b).

The percentage of population aged 60 years old and older has been increasing in Finland, as seen in Figure 2. In 2050, the median of the population of the elderly people who are older than 60 years old in Finland is predicted to reach almost 35 %, an increasing number from below 30 % in 2023 (Figure 2).

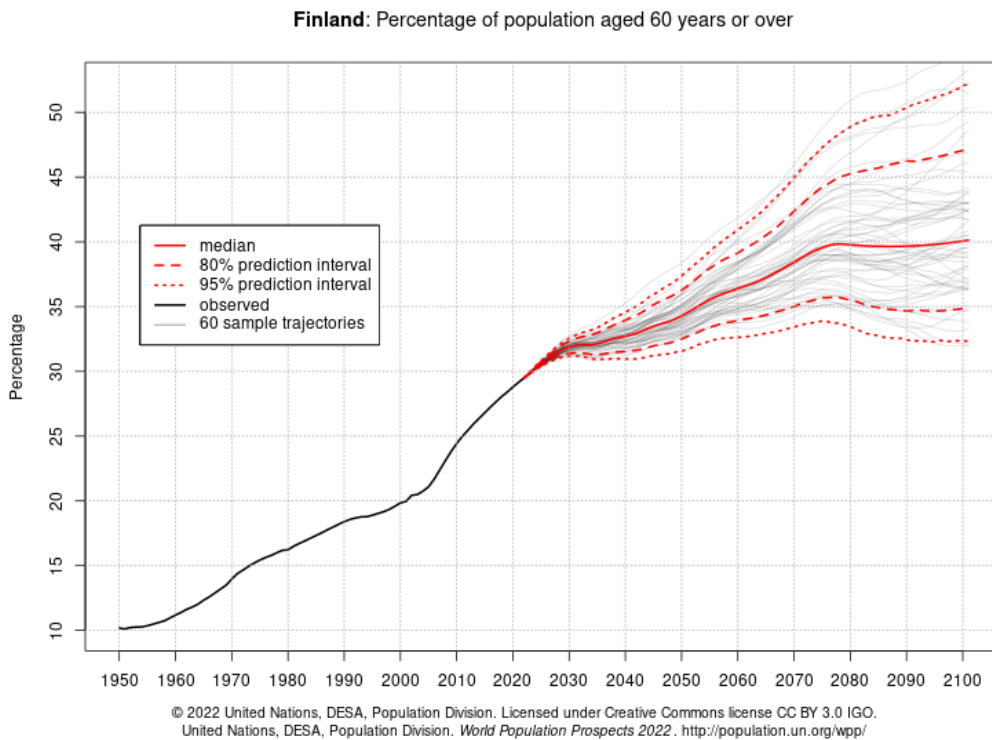
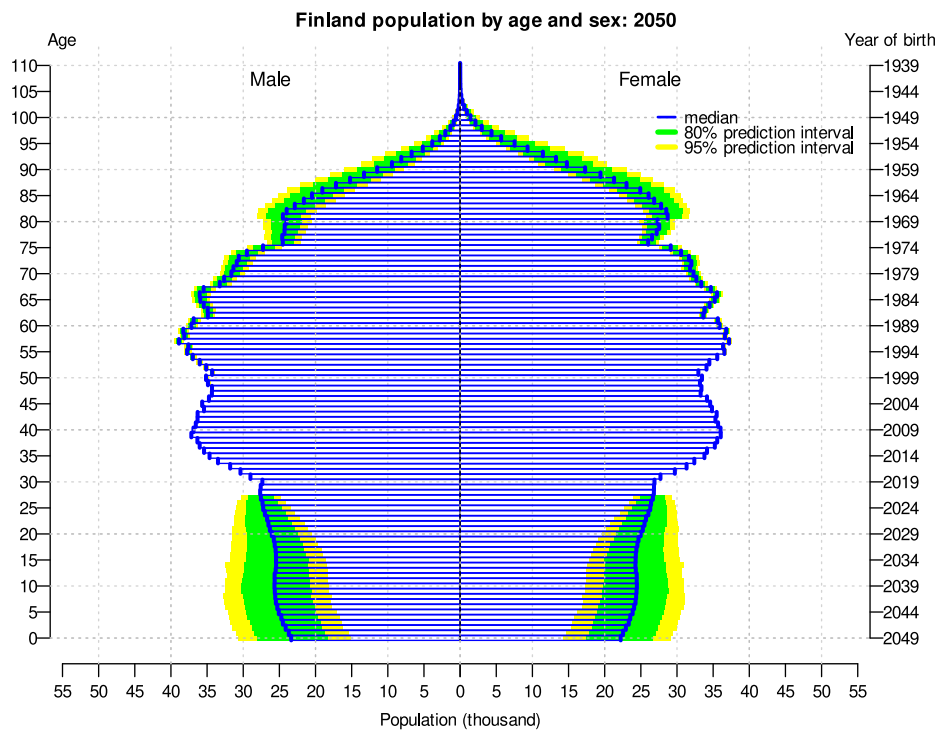


Figure 2. Percentage of population of 60 years old and older 1950-2100 in Finland (United Nations, 2022a)

Figure 3 shows the predicted population pyramid of Finland in 2050. Here it shows that on the old age coverage (the upper part of the pyramid), the right side, which represents females, is thicker than the left side of the pyramid which represents males. This means that it is predicted that in 2050, there would be more elderly women than elderly men in Finland. While providing good service equally to men and women is important, providing elderly women-oriented service now and in the future is becoming more necessary than before. Finland ranks second in the Global Gender Gap Report, an index to measure gender equality (WEF, 2021). Finland ranks first among 163 countries in Sustainable Development Report which measures the progress towards achieving 17 SDGs (Sustainable Development Goals). In the report, Finland achieved the SDGs of no poverty and quality education. There are challenges or significant challenges for zero hunger, good health and well-being, gender equality, and clean water and sanitation, but Finland is still on track or maintains the SDG achievements for those SDGs. (Sachs & al., 2022.)



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Figure 3. Prediction of population in Finland by age and gender in 2050 (United Nations, 2022b)

To support the well-being, health, functional capacity and independent living, to improve the opportunities to participate in the decision that influence the living conditions, to improve access to social and health care services for elderly people in Finland, the Act on Supporting the Functional Capacity of the Older Population and on Social and Health Care Services for Older Persons was enacted (Finlex, 2012; THL, s.a.) Guarantee pension is provided to elderly people, to ensure elderly people living in Finland receive at least the minimum amount of pension. Approximately 7 % of all pensioners get a guaranteed pension. (ETK, s.a. a.) The Ministry of Social Affairs and Health published a quality recommendation together with Finnish local and regional authorities. This recommendation is aimed to guarantee a good quality of life and effective service for elderly people in Finland. (STM, 2020.) The laws that cover social welfare, primary healthcare, special medical care and informal care support entitle people to services according to the needs, and not on the basis of the age (STM, s.a.).

A study about the connection between social participation, social networks and perceived social support reported that for both men and women, social participation reduces the risk for mortality, and social network showed a negative correlation with the risk of mortality. Perceived social support showed no correlation with mortality. (Nyqvist & al., 2014.)

In a study about differences of income poverty between men and women in Finland and Sweden, elderly men in Finland and Sweden had lower poverty rate than elderly women, even after controlling age, civil status, health, education, and country. Poverty prevalence tend to increase with age and is negatively associated with education and health. Elements such as women's weaker position in the labor market, domestic responsibilities, career breaks and part-time work make women more exposed to lower incomes than men, and lower pension after retirement. (Nygård & al., 2017.)

A study investigating the correlations of active aging in Finland, Spain and Poland found differences in active aging based on country, age, education, and occupation. Younger age, higher education, and occupation, being married or in cohabitation were associated with higher active aging than the opposites. While men were associated with higher active aging in Spain, gender was not associated with active aging in Finland and Portugal. (Perales & al., 2014.)

A study conducted in two Finnish cities suggests that encouraging elderly people with physical limitations to go for walks can have a positive impact. Knowledge of attractive environmental features and walk-friendly environmental design motivate elderly people to go outside to walk to remain physically active. (Portegijs & al., 2017.)

Urbanization and aging population in Finland lead to younger people moving to the cities, leaving the elderly people in rural areas. This affected the activities of the population in the rural area in Finland, where elderly people inevitably take the roles as actors and players of the life in the rural area. In one case in eastern Finland, retired people often function as volunteers, using their previous knowledge and skills for the rural development projects, or participating in common activities of 'talkoot' of their village. Talkoot is the way of socializing for the community, to work together with a goal-oriented action. Another type of voluntary work is taking strong responsibility for a certain neighbor's well-being, creating a community which supports and develops goodwill towards each other. (Tedre & Pehkonen, 2014.)

In a study predicting factors for paid and voluntary work in Finland among elderly people in their 60s, it is revealed that education level, sufficient income, good health, and stay at home mom or dad are the predictive factors for the people who engaged in voluntary activities in Northern Savo area at the time of the report. College and university education, sufficient income and well-being are more predictive for paid work compared to voluntary work. (Akintayo & al., 2016.)

Singing is one of the good hobbies for elderly people in Finland. In research involving elderly choral singers in Jyväskylä, Finland, it was reported that there are significant correlations between choral singing and psychological domain, social relationship, and environment. However, choral

singing is not correlated with physical domain. The elderly choral singers had fewer depressive symptoms, high level of quality of life, and high level of health satisfaction. Singing in a choir might develop social relationships, create social support, and opportunity for social expression and relaxation. (Johnson & al., 2013.)

Despite the popularity and health benefits of outdoor physical activities such as walking for the elderly, many elderly people face barriers to conduct outdoor physical activities in their daily life. As the results, five barrier profiles were reported. They are minor barriers, weather-related barrier, health and weather barriers, health, weather and insecurity-related barriers, and health and mobility barriers. For the elderly who had mobility barrier and insecurity about the outside environment, the number of outdoor physical activity barriers was the highest. However, the risk of lack of physical activities would be the highest among people who were not aware of the barriers in the environment because of severe mobility problems. (Eronen & al., 2014.)

In the study about the relationship between leisure activity and self-rated health among elderly people, studying and self-development are the most popular forms of leisure activities which are associated with self-rated good health among elderly men, while for elderly women going to art exhibition, theaters, movies, and concert are the most popular leisure activities which are associated with self-rated good health. Additionally, participation in voluntary work is mildly associated with self-rated good health for elderly men, and studying and self-development are mildly associated with self-rated good health for elderly women. Further, for elderly women, voluntary work and religious events are associated negatively with self-rated good health. (Nummela & al., 2008.)

Nordic walking is one of the popular activities in elderly women in Finland, and is more effective in improving physical endurance and health benefit than fitness training in gym. (Yle, 2014.) Nordic walking increases calories burning, from the regular walking of 18 % to 67 %. Nordic walking also reduces fat mass, depression, anxiety, chronic pain, increases good cholesterol, muscle strength, walking distance, and quality of life (Harvard Health Publishing, 2022.)

Other popular activities that promote active aging in elderly women in Finland include swimming, skis, bicycling. Local authorities provide facilities and discounts that can support elderly people in using public transport, swimming pools, gyms with easier access, as well as in visiting theaters, concerts, museums, and libraries. Elderly people in Finland are encouraged to actively involved in volunteering, where they can meet other elderly people and contribute to the society. Self-service co-housing program encourages elderly people to be independent and at the same time share space with others by taking turns cleaning common space and cooking. The co-housing provides shared facilities so that the elderly people can have workshops, can play games together, can do gardening on the roof, can sing, and enjoy saunas. (Weaver, 2016.)

2.2.2 Elderly women in Indonesia

The Republic of Indonesia declared its independence in 1945. Indonesia is a large archipelagic state in Southeast Asia, with land area of 1,811,569 square kilometers, and a tropical climate. The population is 277,329,163 people, and it is the 4th most populous country in the world. Population with age of 65-year-old and older covered 7.82 % of the total population (male 9,099,773/ female 11,781,271). The population growth rate is 0.79 %, and the urban population covered 58.6 % of total population. The sex ratio for 65-year-old and older is 0.66 male/ female. GDP per capita is USD 11,900. Unemployment rate 4.41 %, and population before poverty rate 9.4 %. (CIA, 2023b). The current retirement age in Indonesia is 58 years old (Timorria, 2022).

By 2050, the median of the population of the elderly people who are older than 60 years old in Indonesia is predicted to reach over 20 %, an increasing number from a bit more than 10 % in 2023 (Figure 4).

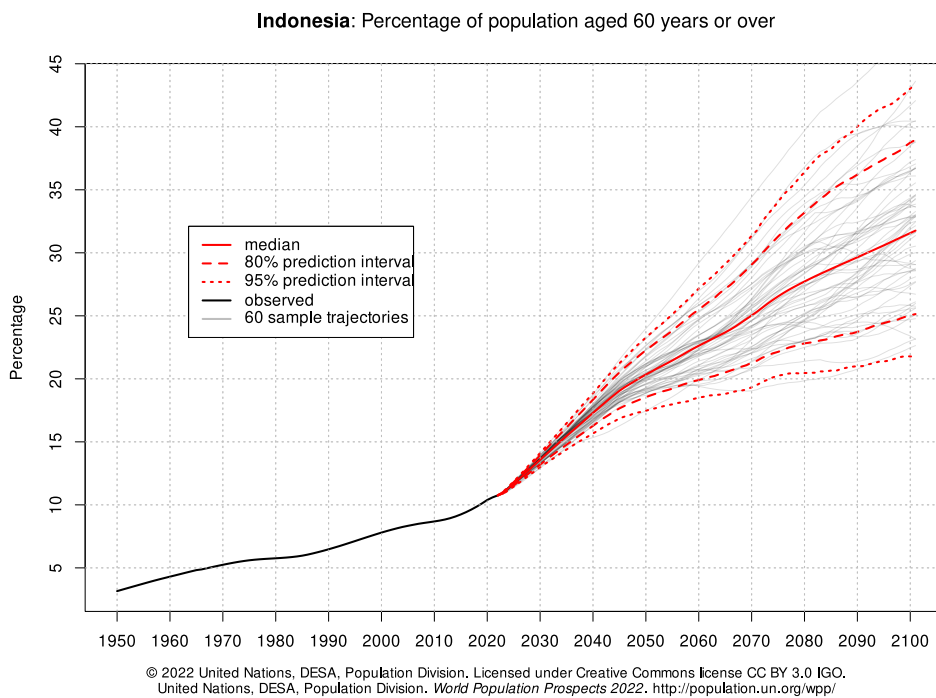


Figure 4. Percentage of population 60 years old and older 1950-2100 in Indonesia (United Nations, 2022c)

Figure 5 shows the predicted population pyramid of Indonesia in 2050, with the right part, which represents females, being thicker than the left part, which represents males. This means that it is predicted that there would be more elderly women than elderly men in Indonesia in 2050. While

providing good service equally to men and women is important, providing elderly women oriented service now and in the future is becoming more necessary than before.

Indonesia ranks the 101st in Global Gender Gap Report, an index to measure gender equality (WEF, 2021). Indonesia ranks the 82nd among 163 countries in Sustainable Development Report which measures the progress towards achieving the 17 SDGs. In the report, Indonesia has not yet achieved any goals of the SDGs. Indonesia still has major challenges in no hunger and good health and well-being. It also still has significant challenges in no poverty, gender equality and clean water and sanitation. It still has challenges in quality education. However, in the areas of quality education and clean water and sanitation, Indonesia is on track or maintains SDG achievements. For the rest of the mentioned SDGs, Indonesia is moderately improving. (Sachs & al., 2022.)



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Figure 5. Prediction of population in Indonesia by age and gender in 2050 (United Nations, 2022d)

The welfare of elderly people in Indonesia was enforced by law number 13 of the year 1998 (JDIH, 2017). The bill on the elderly welfare has been drafted by the Indonesian House of Representative

with the aim of strengthening the integration of social rehabilitation of the elderly people in Indonesia (Antara, 2020). Before the 1st of July 2015, only military personnel and civil servants were entitled to receive monthly pension after retirement in Indonesia. Starting from the 1st of July 2015, employees of the private sectors are covered by social insurance and are entitled to monthly pension after retirement. (OECD, 2019.)

A low level of education and high level of elderly poverty make the elderly people in Indonesia vulnerable and in need of social assistance to fulfil their basic needs. The government of Indonesia has created various social assistance programs for the elderly, which have not been sufficient. The programs target the bottom economic group, however not all elderly people from this group receive social assistance. The top 20 % group who are supposed to be able to access the contributory social protection program (not the social assistance) were still lacking the access. The middle class who are not the priority for social assistance also have limited access to the contributory social protection program. (TNP2K & SMERU, 2020.)

Active aging pillars that apply to Indonesia are health, participation, and security. Under the health pillar, regardless of there are and there will be more women in the aging population than men, elderly women do not have a better health status in later life. Higher life expectancy at birth is associated with a higher level of physical independence. Elderly people who are in good health would be less likely to need help to do basic daily activities. Regarding the participation pillar it is shown that elderly people in Indonesia participate in their community, and this still needs to be improved. There are more home-centered leisure activities than outdoor activities such as physical exercise, recreation, and fishing. Elderly women spend more time watching television programs than elderly men, a habit that is correlated with memory ability for elderly people. For the security pillar, elderly women are more financially dependent on their spouses and their adult children than elderly men, and this makes elderly women more vulnerable in their old age than elderly men. (Arifin & al., 2012.)

Women who live in major cities in Indonesia have higher chronic prevalence than women who lived in smaller cities. Among the chronic conditions, hypertension was the most prevalent, followed by degenerative joint disease and lifestyle related chronic disease such as heart disease and diabetes. Women who live in major cities have a greater probability of having high blood pressure, being overweight, and being smokers, which indicate an increased burden of chronic diseases overtime. Unhealthy eating habits and a lack of open spaces and poor transportation in the major cities contributed to an increased possibility of developing obesity, leading to an increased risk of chronic conditions. (Christiani, 2015.)

Women tend to be more negative than men towards retirements, and this can affect the elderly women to greater risk of loneliness and depression. Retirement happens in the aging process, where elderly women could experience a loss of physiological, psychological, and social involvement. A study showed that the retired elderly women can increase their self-esteem by life-review therapy. Following the increase in self-esteem, the elderly women had their psychological well-being improved. (Karmiyati & al., 2020.)

A study about co-residency decisions of elderly Indonesians mentioned that elderly parents in the cities tend to co-reside with their adult children more often than the elderly parents in the rural areas. Elderly single women are less likely to co-reside with their adult children compared to elderly single men. Elderly couples are less likely to co-reside with their adult children compared to the single elderly because of a lower need in companionship. Elderly parents with higher income are also less likely to co-reside with their adult children. Co-residency with adult children will bring benefits in companionship, financial support, and domestic care for the elderly parents. (Cameron, 2000.)

In the study in two districts in Indonesia, the level of depression among the elderly people is positively correlated with the perception of the elderly people's use of leisure time. The elderly people understand that their tendency for depression could be reduced by having good active leisure, and that negative feelings could be avoided by having positive thoughts. Elderly people with low spiritual level have a high level of perception of leisure and are dependent on leisure to improve their quality of life. Elderly people with high spiritual level engage themselves with religious activities to provide themselves with a peaceful life. (Nurhidayah, 2019.)

Indonesian adults have a better literacy rate, higher education level than before, and the highest rate in accessing technology. However, they also have negative lifestyle habits such as smoking and lack of physical activities. They have an unbalanced intake of nutrients, cardiovascular and diabetes as health problems. Since population aging is inevitable, more efforts should be made to support adults who will become old in the future to practice active aging and to stay healthy. (Basrowi & al., 2021.) According to research conducted in Yogyakarta's urban and rural areas, Indonesian elderly who live in rural areas were more likely to be malnourished and cognitively impaired than those in urban areas. They have reduced functional capacity and are more dependent on help. (Arjuna & al., 2017.)

In the study about social participation in Indonesia, the group of elderly people who were very active were dominated by men, while elderly women dominated the least active group. This might be due to Indonesian culture that men are freer to participate in various social activities outside home, and men are physically stronger than women. The group of elderly people who are active in social

participation also scored the highest in average life satisfaction, and the group of the elderly people who are the least active scored the lowest in average life satisfaction. (Kusmaedi & al., 2017.)

Arisan is a popular social gathering activity where each time each member contributes some amount of money to be given to one specific member by lottery. It takes turns for the specific member who can receive the gathered money (Indra, 2022).

According to the webpage of the Ministry of Social Affairs of the Republic of Indonesia (Kemensos, 2020), all activities which are done according to the elderly people's capabilities and can keep their life balanced such as sports, gardening, art and culture, entrepreneurial work, social, volunteering, and religious activities, cognitive-enhanced activities, gardening, and daily chores at home can function as hobbies for the elderly people. Indonesian climate which is warm throughout the year and its fertile soil make it a good place for gardening, where elderly people can grow plants or flowers, even in the urban areas where land is more limited than in the countryside (Tempo, 2018). With the richness in cultural diversity, elderly women in Indonesia like cooking various kinds of food and desserts according to the local areas they are originally from (Schonhardt, 2017), or doing textile crafting such as batik and weaving various local textile crafts (Finney, 2016), or having the option of dancing various traditional dances (Putri, 2017).

In Indonesia everyone should have a religion. The recognized religions in Indonesia are Islam, Protestant, Catholic, Hindu, Buddhism and Kong Fu Tzu (Indonesia, 2020). The government encourages the people to respect and tolerate others with different religions, according to the first precept of Pancasila (Sampoerna, 2022). Elderly women often gather with other elderly women with the same religion to hold prayer gathering, or to do religious trips together. Choir groups in churches for Christians and regular community prayer gatherings for Muslims are, for example, popular activities among elderly women in Indonesia.

3 Matchmaking platforms, AI, technology usage and theoretical framework

The first part of this chapter concentrates on websites that function as matchmaking platforms that can be utilized as benchmarks to build an AI-powered matchmaking platform centered around elderly women. Helping the elderly women to find new friends is the primary goal, and then enlarge it to build the community for the elderly women is the longer-term goal.

The latter part of this chapter addresses AI technology, its ethics, and the theoretical framework of this thesis. The elderly women-centered matchmaking platform will be AI-powered. Therefore, gaining a deeper understanding about AI technology, its strength, its weakness, and maximize it to create an elderly women-centered matchmaking platform is the purpose of this part. HCAI would be the proposed AI for the elderly women-centered online platform.

3.1 Matchmaking platforms and AI

3.1.1 Matchmaking platforms

Matchmaking is “the activity of arranging marriages and romantic relationships between people” (Cambridge Dictionary, 2023). These days the term matchmaking has expanded beyond its traditional scope of marriages and romantic relationships. It now encompasses various other purposes such as businesses seeking the best partners through events (Brella, 2023), companies searching for the right employees to fill specific positions and individuals looking for jobs (Glassdoor, 2023), and customers seeking specific products that meet their needs (Amazon, 2023). The matchmaking has also extended to the online space, offering more choices compared to the previous traditional offline matchmaking. While in the past, individuals typically assumed roles of matchmakers, contemporary matchmaking no longer solely relies on individuals. Companies have entered the scene as matchmakers, leveraging the latest technological advancement in platforms and tools (Bumble, 2023a).

Bumble BFF (Best Friend Forever)

Bumble is an online dating application aiming to create safe environment for women, where women have higher privilege than men to initiate contact and decide the course of the relationship. As a part of Bumble, Bumble BFF is the online platform targeting the users who look for BFF or Best Friend Forever, for the purpose of meaningful friendship, and not for romantic relationships. The users would need to fill in some information about themselves, including the possible activities they intend to do, go through checking the possible BFFs online, communicate with them online, before continuing the friendship offline in the real world, meeting, and then do activities together. (Bumble, 2023b.)

As per 20 February 2023, Bumble.com is ranked the 16th among the category ‘dating and relationship’ for ‘community and society’ in United States (Similarweb, 2023a). According to Similarweb (2023a), Bumble had 18.7 million visitors in January 2023. The highest percentage of Bumble’s users were in United States (23.39 %), and then followed by Germany (8.14 %) and Brazil (5.06 %). Even though Bumble is a pro-women platform, there are more male visitors (58.61 %) than female visitors (41.39 %) in January 2023, as shown in Figure 6. The largest age group of the visitors are visitors from 25 to 34 years old, covering 33.7 % of the total visitors as shown in Figure 7.

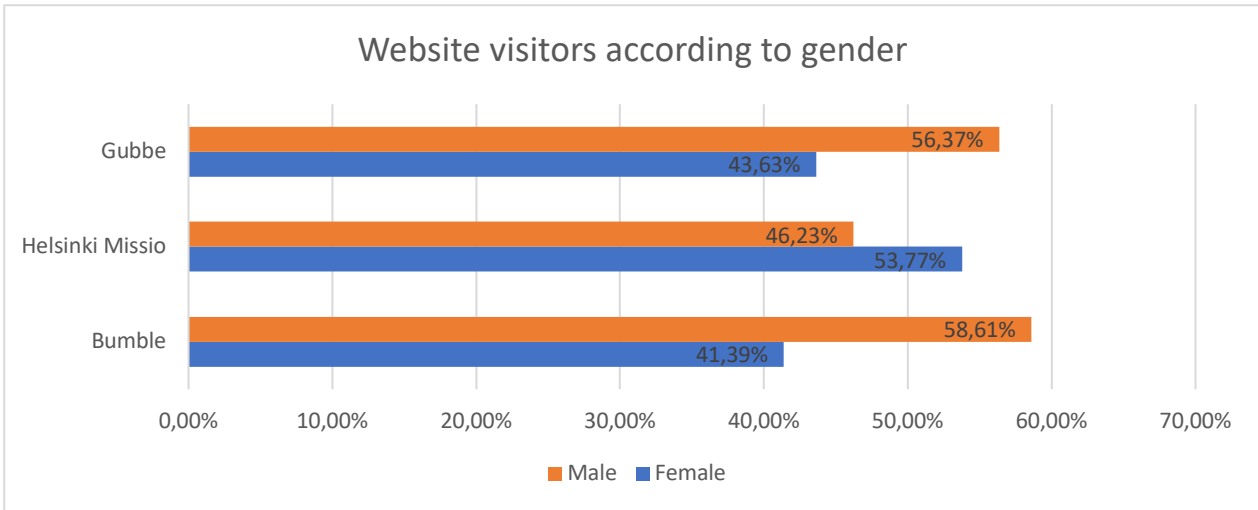


Figure 6. Online visitors in January 2023 according to gender, website: Bumble, Helsinki Missio, Gubbe (Adapted from Similarweb, 2023a; Similarweb, 2023b, Similarweb, 2023c)

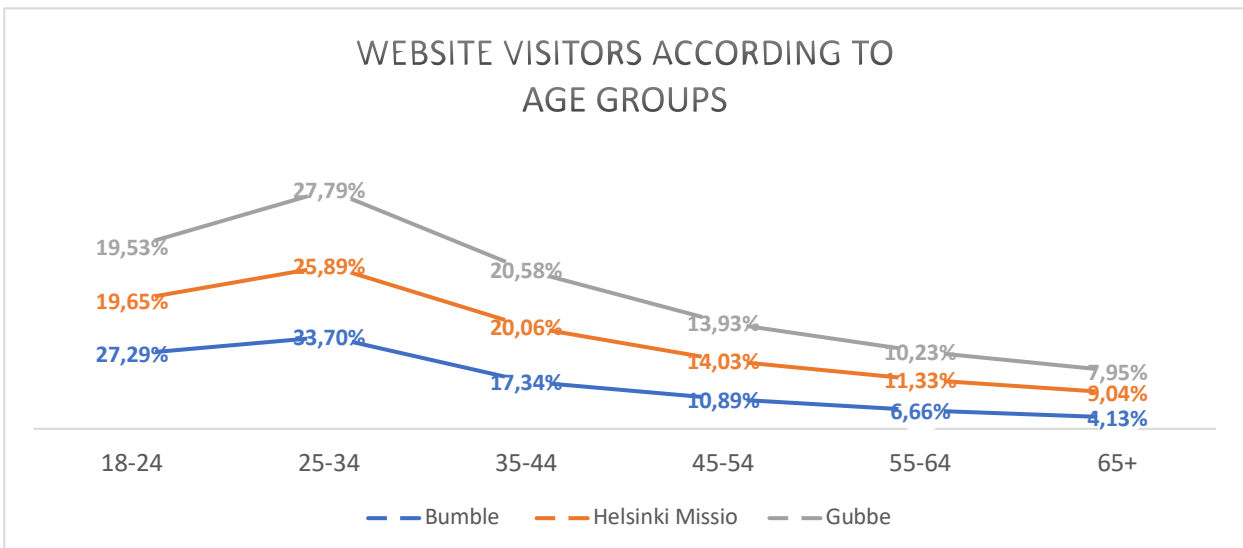


Figure 7. Online visitors in January 2023 according to age group, website: Buble, Helsinki Missio, Gubbe (Adapted from Similarweb, 2023a; Similarweb, 2023b; Similarweb, 2023c)

There are several reviews online from people who have used Bumble BFF. The Bumble BFF friend-searching experience can differ from one's expectations. After getting connected with other Bumble BFF users and communicating online with them, a user met with those other Bumble BFF users. However, they turned out to be different than what the first user expected. The user mentioned that the whole app experience was fun, but one should not expect to meet a best friend after only a single meeting. (Binge Staff, 2020.) Another Bumble BFF user mentioned that the app itself was really a great idea. However, even after people said that they should meet, they never met. While people genuinely wanted to connect, people did not follow through and it's not easy to hold them accountable since it was only an app. (Lizzie in Lace, 2021.)

Helsinki Missio

Helsinki Missio is a non-profit organization, with a mission to reduce loneliness and promote well-being among the elderly people, children, families, and individuals in Helsinki and around. For the elderly, Helsinki Missio's activities include therapeutic discussions, helping the elderly people with every day's challenge, offering phone calls companionship when the elderly need someone to talk to, providing digital help for technology, organizing group activities, and hosting elderly-oriented events. Helsinki Missio receives donations from institutions and private donors, and most of the work is carried out by volunteers. (Helsinki Missio, 2023.)

As per 21 February 2023, the website helsinkimissio.fi is ranked the 27th among the category 'dating and relationship' for 'community and society' in Finland according to Similarweb website. Helsinki Missio had 37,300 visitors in January 2023. Most of the website visitors, 95.01 % of them were in Finland. (Similarweb, 2023b.) As shown in Figure 6, there were 53.77 % of female visitors and 46.23 % of male visitors. The largest age group of the visitors were visitors from 25 to 34 years old, covering 25.89 % of the total visitors, as shown in Figure 7.

Gubbe

Gubbe aims to help elderly people to live longer, happier and have an active life. Gubbe helps elderly people by visiting them during the agreed time, accompanying, and helping them in doing outdoor activities and guided exercise, shopping trips, transport assistance, showering, toilet and hygiene, food preparation, home and yard chores, and technology guidance. This is a paid service, and the work is carried out by paid staffs, not volunteers. (Gubbe, 2023.)

As per 21 February 2023, [Gubbe.com](https://gubbe.com) had 25,300 visitors in January 2023 (Similarweb, 2023c). According to Similarweb (2023c), most of the website visitors were in Finland (77.85 %), followed by Poland (12.72 %) and then Sweden (9.43 %). There are 43.63 % of female visitors and 56.37 %

of male visitors in January 2023 as shown in Figure 6. The largest age group of the users are users from 25 to 34 years old, covering 27.79 % of the total users, as shown in Figure 7.

Senior Club Indonesia

Senior Club Indonesia is not exactly an online matchmaking platform. It is an offline club for individuals aged 60 and older, mostly middle- and upper-class individuals, where they can meet face-to-face and engage in various activities. Here elderly people can participate in programs such as light morning sport, tai-chi, morning walk, gardening, reading at the library, watching TV and video together, and talk together. Additionally, there are activities such as music, cooking, crafts, drawing, and language learning. The club also serves as a venue to celebrate birthdays, wedding anniversaries, or watch musical and artistic performances. The club provides pick-up service, transporting the elderly members to the club and back. (Senior Club Indonesia, s.a..)

While data regarding audience demographic, country targeting, traffic and engagement can be obtained from previous matchmaking platforms such as Bumble BFF, Helsinki Missio and Gubbe, the same parameters of data could not be obtained for the website of this club.

Kanopi Insan Sejahtera

Kanopi Insan Sejahtera is a professional home caregiver service provider which service mostly covers caretaking of elderly people at home. (Kanopi Insan Sejahtera, s.a.) Professional home caregiver service provider companies which especially take care of elderly people such as Kanopi Insan Sejahtera are few in Indonesia. In Indonesia it is more common for middle and upper-class families to employ live-in domestic helpers, whose job may also cover taking care of elderly family members (Expat, 2021).

Kanopi Insan Sejahtera provides daily or monthly home care service. The home care service is a paid service. Kanopi Insan Sejahtera trains caregivers to be able to take care of elderly or sick individuals. (Kanopi Insan Sejahtera, s.a..) Kanopi Insan Sejahtera expanded its elderly care business into Kanopi Nursing Home in 2018. Kanopi Nursing Home specializes in the service for elderly people who have a certain illness condition and need a 24-hour professional nursing care assistance. (Kanopi Nursing Home, 2022.)

While data regarding audience demographic, country targeting, traffic and engagement can be obtained from previous matchmaking platforms such as Bumble BFF, Helsinki Missio and Gubbe, the same parameters of data could not be obtained for the website of this service company.

3.1.2 AI technology and AI ethics in matchmaking platforms

AI and ML are being adopted more extensively in both business and our daily lives than ever before. According to a McKinsey survey, while 20 % of businesses adopted AI in at least one business area in 2017, there were 50 % of businesses adopting AI in 2022. Recommendation Systems (RS) which is a part of ML, is often used in matchmaking platforms, and is embedded in 25 % of the business process. (McKinsey & Company, 2022.)

At the end of 2022, Open AI unleashed ChatGPT and it has disrupted the education system and took the attention of millions of users from various backgrounds. In March 2023, an upgraded and more powerful GPT-4 was released. (Millson, 2023.) This upgraded GPT excels in advanced reasoning, in understanding complex situations, and is more creative (Rogers, 2023), resulting in divided opinions in society (Chace, 2023).

Over the next 5 years, ML is expected to become more advanced, reaching into industries such as healthcare, telecommunications, financial transactions and advising, media and content creation, network communications, transportation, national security, biotechnology, energy management, education, computer security, image recognition and supply chain management, and government and legislation (Forbes, 2023).

In matchmaking platforms, RS is used in helping users to find compatible matches by analyzing tremendous amount of data to make personalized recommendations. There are different kinds of RS. Content-based method is the RS that can be used when we know something about the content, collaborative-filtering method is the method that is used when we do not know any metadata about the items, and the knowledge-based method is the method which is used when either content-based or collaborative-filtering method cannot be implemented. (Vidyarthi & al., 2023.)

To meet the increased demand of the big data recommendations, multiple AI techniques have been introduced and applied to RS. Those AI techniques are transferring learning, active learning, reinforcement learning, fuzzy techniques, evolutionary algorithms, Natural Language Processing, Computer Vision, and deep neural networks. (Zhang & al., 2021.)

While the matchmaking platform where an individual seller looks for various kinds of items and the matchmaking platform where an individual looks for a compatible romantic match both use RS, the RS which is used in each of them is not the same. Human dating recommendation is different from product recommendation. For human-to-human matchmaking, like in dating app, or in the elderly women-centered matchmaking platform in this thesis, a two-sided matching market is necessary to create better matchmaking experience for the human users of the matchmaking platform. The two-

sided matching market approach by Tu & al. (2014) showed that by using the two-sided market formulation and user preferences learning, the rate of successful matches increases by 48 %, and this is based solely only the recommendation of suitor preference.

More dating platforms, human-to-human matchmaking platforms have come up and recommended suitable candidates to users. However, the recommendation algorithms did not meet accuracy, coverage, and other requirements. Using many recommendation algorithms at the same time might increase the difficulties and causes losses in the recommendation process. Fang & al. (2019) proposes a strategy to switch recommendation algorithms in different situations with a certain rule according to the advantages of those various recommendation algorithms, minimize the effects caused by mixed recommendation results in one recommendation, and support the diversity of the algorithm. It compares the RS under several switching strategies, analyzes the advantages and disadvantages, and decides on switching algorithms with a higher level of accuracy and coverage.

Another paper about RS in matchmaking platform proposes RRS (Reciprocal Recommendation System), where users are recommended to each other. The preferences of each user should be fulfilled to achieve a successful recommendation. This paper proposes a reciprocal recommendation algorithm that considers multiple aspects of each user, such as user's preferences, popularity awareness, availability, and demographic information. Evaluation of the reciprocal recommendation algorithm showed the effectiveness of the algorithm. (Kumari & al., 2021.)

In RS, fair matchmaking with privacy is sometimes desired. Examples of this include high-level executive recruitment, corporate mergers, negotiations for voting in high-level governmental institutions and peace treaties. For the development of privacy-enhanced technology like those cases, Horne & Nair (2020) explain the process of privacy engineering, that rather than viewing the regulations for security and privacy as burdens, they can be seen as a potential differentiator, to distinguish and position the provided RS from the others.

While AI can improve efficiency in business, bring down costs, accelerate research and development positively on one side, there is a questionable part covered in the ethics of AI on another side of the coin. AI presents three main ethical areas of concern for society, which are privacy and surveillance, bias and discrimination, and the role of human judgement. (Pazzanese, 2020.) A huge increase in dataset size, computing power and improvement in algorithm and human talents have led to ML rapid advancement. The advancement brought consequences on the ethical side of AI. Green (2020) mentions about 16 issues in AI ethics, which are technical safety, transparency and privacy, beneficial use and capacity for good, malicious use and capacity for evil, biases in data and training sets, lack in purpose and meaning, growing socio-economic inequality, environmental

effect, automating ethics, moral deskilling and debility, AI consciousness and personhood, superintelligence AI, AI dependency, AI-powered addiction, isolation and loneliness, and effects on the human spirit.

For the ethical challenges in the RS used in matchmaking platform, Milano & al. (2020) reported 6 areas of ethical concerns, which are inappropriate content, privacy, autonomy and personal identity, opacity, fairness, and social effects. For inappropriate content, the problems could be solved by using specified, demographic, or geographical filters. The possible architectural solutions for the problems of privacy concern where there is unauthorized data collection and storage, data leaks and unauthorized inferences will be data storage in separate databases. The possible algorithmic solution for privacy concerns will be anonymization and encryption, and the possible solution on the policy side is by legislation. On autonomy and personal identity, there are issues of behavioral traps and sense of personal identity which might be solved by increasing the transparency of user categorization. Factual explanations could solve the issues of black-box algorithms, uninformative explanations, and feedback effects from opacity concern. The problems of observation bias and population imbalance in the fairness concern could be solved by using multi-sided recommendation framework. Recommending coincidental personas could be the solution for the problems in lack of exposure to contrasting point of view. (Milano & al., 2020.)

The aforementioned 'lack of exposure to contrasting point of view' is the result of the RS, which was initially designed to enhance user experience by recommending and personalizing the products, services, and opinions that the user would like and enjoy. Exposure to only the recommendations of products and services which one likes within a long period of time decreases diversity and brings the consequence of a narrow range of content. This phenomenon is called echo-chamber. It is difficult for an individual to break out from echo-chambers once the echo-chambers situation is established. (Noordeh & al., 2020.)

In relation to social media and media, echo-chamber is when we are overexposed to news that we like or agree with, and the news distorts our perception of reality because we only see what we like and agree. A filter-bubble situation is when the news that we do not like being filtered out so that we are not exposed to that news. While echo-chambers are the results of filtering or other processes, filter bubbles are the result of algorithmic filtering. (Fletcher, 2020.)

Confirmation bias is when people tend to believe and share the information that confirms their existing belief. Confirmation bias is often found in the echo-chamber community, which is polarized and lacks diversity, where people have similar beliefs and strengthen each other, making their belief even stronger. Echo-chambers may have a link to the spread of viral misinformation (Törnberg, 2018). There are ideas to provide proof of identity and age for the users to avoid polarization, so

that they will feel less anonymous and will be less likely to be in polarizing activities. Another idea is to use algorithms which do not choose content which can cause emotional responses. Influencers with a high number of followers should be advised to be less engaged in over polarizing behavior. (Daskalopoulos & al., 2021.)

Governments, companies, and institutions have recognized the importance of ethical considerations of AI, and created guidelines of AI ethics for societies, their companies, or members. IBM (International Business Machines) has 5 pillars of explainability, fairness, robustness, transparency, and privacy for its AI ethics (IBM, s.a. a). Microsoft has its responsible AI principles in fairness, reliability and safety, privacy and security, inclusiveness, transparency, and accountability (Microsoft, 2023). The IEEE (Institute of Electrical and Electronics Engineer) provides certification program to assess AI ethics to protect, differentiate, and grow product adoption (IEEE, 2022). Partnership on AI is also an example of an institution which works for the development, recommendations, and best practice of AI (Partnership on AI, 2023). Examples of government policies on AI would be written in the sub-sub chapters of AI technology in Finland and AI technology in Indonesia.

3.1.3 Human-centered AI

Human-centered AI (HCAI) is implemented to increase human self-efficacy, creativity, responsibility, and social connections, while reducing the effect of malicious actors, biased data, and flawed software, in the purpose to achieve the UN's 17 SDGs. To adjust the AI to HCAI, proper HCAI framework is needed. The framework is a two-dimensional framework as shown in Figure 8, with the goal of reliable, safe, and trustworthy design, and is achieved through high level of human control and high level of computer automation. (Shneiderman 2022, 7-68.)

In HCAI, to bridge the gap between the ethical principles and the practical steps, proper governance structure is needed. To achieve the desired goals of reliable, safe, and trustworthy AI, there should be reliable systems based on sound software engineering practices, safety culture through business management strategies, trustworthy certification by independent oversight, and government interventions and regulations. (Shneiderman 2022, 151-225.)

To assess HCAI trustworthiness, Shneiderman (2022, 245-257) proposes HCAI trustworthiness scale which includes 12 factors, as shown in Table 1. The proposed scoring method would result in a maximum of 24 points, since 1 point would be given when the factor is available through report, and another 1 point would be given to the same factor when the result in the report is positive. The HCAI trustworthiness scale still needs further improvement. (Shneiderman 2022, 256-257.)

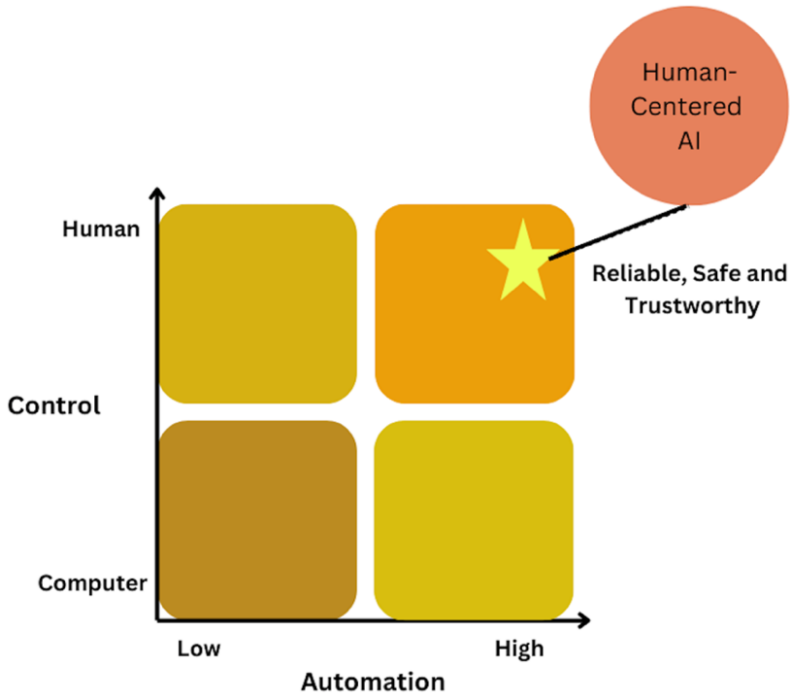


Figure 8. Shneiderman's two-dimensional framework HCAI (Adapted from Shneiderman 2022, 60)

Table 1. Shneiderman's HCAI Trustworthy Scale (Adapted from Shneiderman 2022, 256-257)

Up to 1 point for openly available thorough report Up to 1 point if report has positive result
1) Internal independent review prior to implementation
2) Audit trail has been implemented
3) Training data was collected and assessed
4) Software was verified and validated
5) Fairness was tested
6) Explainability was implemented and tested
7) Performance in first two months of usage
8) Performance in first six months of usage
9) Stakeholders make suggestions, raise questions, and report on incidents, near misses and Failures
10) Internal review process for incidents with redress for failures
11) Continuous reviews to support refinements
12) External review by an independent oversight body

3.1.4 AI technology in Finland

Finland ranked 4th among 181 countries, after USA, Singapore, and UK on the Government AI Readiness Index 2022 by Oxford Insight, based on government pillar, technology sector pillar, and data and infrastructure pillar (Rogerson & al., 2022). Data, which is the crucial element in AI, is protected through the Data Protection Act, which specifies and supplements the GDPR (General Data Protection Regulation) of EU (European Union) and the implementation in Finland (Tietosuoja, s.a). In June 2023, The European Parliament and the Council of EU reached an agreement on the European Data Act, a key measure to make data available to use and in line with EU rules and values (European Commission, 2023), which would affect the direction of AI progress in Finland.

The highest use for AI technologies purposes in Finland was as a part of product/ service, which covered 74.42 % of the total amount, followed by a part of production at 28.57 %. The most used AI technologies in Finland were Machine Learning (72.09 %), Deep learning (55.81 %), and Explainable AI (46.51 %). AI brought value in improved product and service quality (71.43 %), customer attraction and retention (57.14 %), and improved features and usability for product/ service (57.14 %). A total of 69.47 % of the companies were investing in experimenting with AI, 48.84 % of them were investing in recruiting more AI talent, and 46.51 % for each AI infrastructure and AI use cases. Among the Nordics, Finland was listed as the most attractive AI talent destination. The biggest challenges in scaling the use of AI in companies in Finland was lack of talent (46.51 %), lack of shared practices related to data (37.21 %), and lack of data (30.23 %). (Silo AI, 2022.)

The latest Finland's National AI strategy is AI 4.0 program, which is meant to speed up digitalization of businesses after Covid-19 or Coronavirus disease pandemic. The program combines AI technologies with other digital technologies such as IoT (Internet of Things), 3D (Three Dimension) printing, robotics, quantum computing, and virtual reality/ augmented reality. (Ministry of Economic Affairs and Employment, 2020.) Finland supports AI ethical foundation that is based on fundamental human rights. The ethical principles are based on transparency, reliability, and accountancy, where ownership and responsibilities were defined clearly. (European Commission, 2021.)

AuroraAI network was an AI network in Finland which was established to interconnect services automatically. AuroraAI network would facilitate the integration of society's services and shape infrastructure which lets services to use the network. Government, municipalities, companies, and institutions can share their services in the AuroraAI network. AuroraAI network functions based on openness, interoperability, and technology neutrality. (Ministry of Finance Finland, s.a..)

3.1.5 AI technology in Indonesia

Indonesia ranked 43rd among 181 countries on the Government AI Readiness Index 2022 by Oxford Insight, based on government pillar, technology sector pillar, and data and infrastructure pillar (Rogerson & al., 2022). As of 2021, Indonesia had the most unicorn companies in Southeast Asia, the startup companies with each valued over USD 1 billion (Yanwardhana, 2021). In those unicorn companies, such as Tokopedia, AI has been used as chatbot and product recommendation (Tokopedia, 2023). Indonesian law for personal data protection was approved by the House of Representative in 2022, which means Indonesia started to protect the personal data of its people (Widianto, 2022).

The Indonesian government introduced national AI strategy to develop AI between 2020 and 2045. Indonesia would focus on education and research, health services, bureaucratic reform, food security, and mobility and smart cities AI projects. AI development is one of the 5 sectors in technology development, besides IoT, advanced robotics, augmented reality and 3D printing. Indonesia also needs to focus on infrastructure and data, research and industrial innovation, ethics and policies, and talent development. Forming a data ethics board, create regulations and set national standards for AI innovation are also crucial for AI development in Indonesia. Several state projects implementing AI have been conducted such as tackling forest fire, technology projects in schools and teaching. (Iswara, 2020.)

AI is expected to accelerate Indonesian economy, with expected addition of USD 366 billion to Indonesia's GDP by 2030. To solve the problems of Jakarta, the capital city, in traffic jams, flooding, and waste management, AI has been tried for the implementation. The Jakarta municipality launched Jakarta Smart City with its 6 AI pillars in governance, people, living, mobility, economy, and environmental issues. (Kaur, 2020.)

3.2 Technology usage for the elderly and theoretical framework

3.2.1 Technology usage for the elderly

By using ICT (Information and Communication Technology) to connect to the outside world, elderly people can reduce social isolation, gain social support, engage in the activities that they like, and boost their self-confidence. ICT helps the elderly to stay connected with family members, friends, and acquaintances, which leads to social connection and social support. Proper training of ICT will benefit the elderly people and make them able to use ICT products better. However, ICT might not apply to every elderly person because in some cases ICT influences different kinds of loneliness. (Chen & Schulz, 2016.)

Elderly people tend to be risk-averse toward digital technology usage. They are afraid to make mistakes, to damage the technology tools, and are afraid to embarrass themselves. As non-digital natives, elderly people tend to stop using technology tools when they experience problems with the tools. When elderly people face problems with technology tools, they tend to blame themselves, the apps, or the apps designers. They also tend to avoid technology tools which are designed for the elderly because they do not want to be considered old. (Johnson & Finn 2017, 145-157.)

Young elderly between the age 60 and 75 years old can improve their quality of life by adopting and using ICT technology. However, young elderly people have spent most of their life in different environments than now, before the disruption of mobile technology. Therefore, it is important to measure their perception towards ICT. Measuring the impact of technology-anxiety and other sociological, psychological, and aging factors on them will lead to a pleasant ICT using experience (Nikou, 2015.)

3.2.2 Elderly women and technology usage in Finland

According to a study about internet usage in elderly population in their 60s and 70s in Finland, most of the elderly people in their 60s and elderly people with higher education level are frequent internet users. Frequent users are people who use the internet daily or at least weekly. Among the elderly in their 70s and the elderly with low education level, there are more non-frequent users than frequent users. There is no gender difference in frequent internet users among elderly people. There are more frequent internet users than non-frequent users among non-single elderly people. There are mostly frequent internet users among elderly people who previously worked in the leading position, or higher-level white collar, or lower-level white collar. There are more frequent internet users than non-frequent users among elderly people regardless of their satisfaction of social relations, and regardless of their having children and grandchildren. (Arief & al., 2018.)

In another study about social media usage trend in Finland within the time span of 8 years, the probability of using social media increased among men and women, with women having higher probability than men at the end of the research compared to the first time when the research took place. There are increases in the probability of using social media among each age of research group. However, at the end of research time, the youngest age range (16-24 years old) has the highest probability of social media usage, while the highest age group (65-74 years old) has the lowest probability of social media usage. Respondents with master's degree or respondents who reside in the metropolitan area have the highest probability of social media usage. (Koironen & al., 2020.)

According to a study about time spent alone in Finland, men and women spent more time being alone than before. The increase of time spent alone on weekdays was higher in men than women. The elderly people group of over 65 years old has the highest rate of spending time spent alone. Time spent alone for leisure purposes increased, especially during passive leisure activities such as watching television and interaction with computers. There is a connection between time spent alone, technology usage and decrease of face-to-face interaction. (Anttila & al., 2020.)

3.2.3 Elderly women and technology usage in Indonesia

Majority of elderly people in Indonesia did not finish elementary education (67.51 %) and they are most likely in the lowest 40 % economic group. The Indonesian elderly's access to ICT and mobile phones is 46.68 %, access to internet is 11.44 %, and access to computer is 1.47 % from the total elderly population, which means that there is still low level of digital literacy. (Cicuh, 2021.) The number of Indonesian elderly people with internet access increased into 14.1 % in 2021 (Pahlevi, 2022). The number of elderly people in rural areas who have access to the internet is lower than in the urban areas. Some of the Indonesian elderly were targets and victims of frauds, scams, and irresponsible fake news (Antara, 2021).

In a study among elderly people in Yogyakarta, Indonesia, 30 % of elderly Indonesians are mobile phone users, 41 % of them know how to use mobile phones but they do not use mobile phones, and 29 % do not know how to use mobile phones. The elderly people's professions do not affect their adoption of technology and communication tools. However, their economic status affects technology adoption. This means that price is one of the main factors which affects technology product adoption in elderly people. The reasons why Indonesian elderly people adopt and use mobile phones and other technology tools are because the tools help the elderly people in their daily life, the technology is useful for them, they need the technology for work, their family advise them to use the technology, they are financially able to buy the technology, and they want to learn about new technology. The elderly people decide not to adopt new technology because they cannot afford the technology financially, they think they are not capable of learning new technology, they are used to do things in traditional ways, and they have not needed the new technology yet. (Restyandito & Kurniawan, 2017.)

According to Statistics Indonesia (2023a, 2023b), the proportion of individuals aged 65 and older who use mobile phones in Indonesia increased from 21.70 % in 2017, to become 27.46 % in 2022. As comparison to these numbers, the proportion of individuals in age group 15- 24 years old who used mobile phone is 91.82 % of the same age group in Indonesia in 2022 (Statistics Indonesia,

2023a). The rate of mobile phone adoption among elderly people in Indonesia has increased significantly in the last 5 years, even though the proportion of mobile phone adoption among the elderly generation in Indonesia is much lower compared to the younger generation.

3.2.4 Designing technology for elderly women

Digital inclusion for elderly people requires them to live and work with digital tools. They need to be ensured to overcome the key barriers of access, installation, knowledge, design, and trust. High-speed, low-cost internet and devices, installation and support, digital literacy programs and updated information on relevant technology are essential elements for elderly people while creating digitally inclusive technology. (Akinola, 2021.)

There are 5 types of elderly people according to their attitudes towards technology. The first type is the old traditionalists, which group covers 20 % of the elderly people aged 60 to 74 years old, or the young elderly. They do not have children, do not see relatives often, have fewer devices and fewer online and offline activities compared to the average elderly people. The second type is the striving pensioners, which covers 26 % of the elderly, live alone, have financial restrictions and more health problems than the average elderly person. They have fewer devices than the average elderly person, but they watch television more often than the others. The third group is the sociable grandparents which group covers 25 % of the elderly. They are often married and socialized more with friends compared to other elderly people. They are on the average level of using devices. The fourth group is the group of mature life connoisseurs and covers 13 % of the elderly. They are well educated, have a higher income than the average. They use various kinds of devices and are aware of what is going on in society. The last group is the aging techies and covers 16 % of the young elderly. They use devices not only to use them, but also because they like technology. The aging techies are well-educated and often make money from hobbies. 47 % of the aging techies are interested in AI. (Rinderud, 2021.)

CCM (Constant Contact Media) is the frequent message exchange and the stimulating new social interaction through devices that people started to use in the beginning of the 21st century. In the study about CCM in elderly people to see how they managed the transition into the new technology era, there are 3 groups of elderly people. The first group is the group that, due to retirements and other reasons, can become isolated. They can maintain their independence and stay sociable through CCM. The second group is the elderly people who became active and use CCM in their later life. The third group consists of elderly people who have been active, independent and technology users. All groups use CCM to guard themselves from social exclusion and isolation. (Singh, 2015.)

In designing user interfaces for an aging population, it is important to understand the differences and changes of vision, cognition, knowledge, and search between elderly people and most other users. Elderly people's characteristics of vision are reduced visual activity, farsightedness, narrowing or peripheral vision, loss of central vision, diminished light perception, diminished ability to discriminate colors, increased glare sensitivity, slower adaptation to changes in brightness, increased susceptibility to eyestrain, slower visual processing and increased sensitivity to visual distractions, slower visual search. Elderly people, however, have faster speed in reading compared to younger adults. (Johnson & Finn 2017, 27-53.) In cognition changes, elderly people tend to have reduced working memory capacity, less effective long-term memory storage and retrieval, less generalization between situations, declining spatial memory and control, cognitive blindness, and slower responses (Johnson & Finn 2017, 85-118). The digital knowledge gap in elderly people is not understanding the terms, icons, control gestures in digital technology, and outdated understanding about the current new trends. The elderly people, however, have more domain knowledge which is called crystallized intelligence. (Johnson & Finn 2017, 119-136.) Elderly people are slower than younger people to enter search queries. They experience less successful searches, but they can compensate those with their crystallized intelligence (Johnson & Finn 2017, 137-143).

Including elderly people inside the design process is an important part in designing technology for social connection with elderly people. Focus groups and workshops are effective in the process of including elderly people in co-designing. However, they risk challenges such as boredom and tiredness among participants and facilitators. Using visual materials and activities are some of the possible methods that can be used. During the co-designing process with elderly people, the highly lonely elderly people became lead users, and they encourage others to use the platform. To keep the privacy of each other, they initially requested to remove video call function in the device. However, once the participants became familiar with each other, they willingly shared information and met each other through video calls. Elderly people can also adapt to new technology overtime. (Wherton & al., 2015.)

In a study about elderly people and social media in India, the social media which the elderly people use most are Facebook, WhatsApp and YouTube. In using social media, the social influence from close family, friends or colleagues is the major predictor which influences elderly people. The next important factor which influences elderly people in using social media is the hedonic motivation to enjoy entertainment. While elderly women use social media to maintain relationship, elderly men use social media to seek information. Social media usage can cause addiction to elderly people. (Praveena, 2021.)

Excessive screen time brings negative effects to children and adults, such as poor sleep, possibility of obesity, digital eye strain and lower quality in mental health. There is no exact data about the perfect screen time, however, if one can sleep well, eat well, stay social, can work well, and physically active, the person does not need to be worried about their screen time. People should spend three to four hours per day without a screen, stop using the screen an hour before sleeping, and take a break every 20 minutes for eye break. (Serrano, 2022.)

3.2.5 Theoretical framework

Figure 9 shows the proposed theoretical framework of this thesis. Family, government, and society have important roles in the well-being of the elderly women, whether the elderly women live in Finland or Indonesia. According to difference in culture, the elderly women in Indonesia might live together with their adult children. However, elderly women in Finland value their independence high and prefer to live alone, separated from their adult children (in Chapter 2).

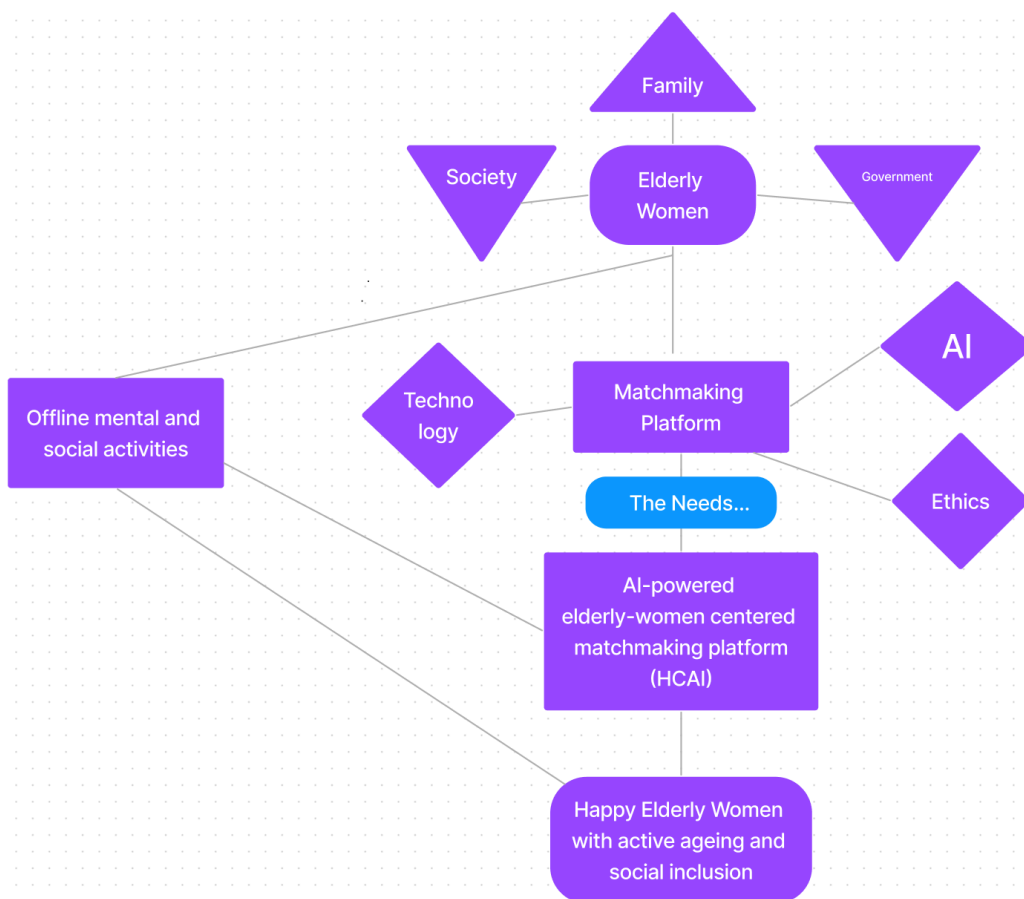


Figure 9. The proposed Theoretical Framework in this thesis

Different governments have different policies for the aging population. In Finland, an elderly person is guaranteed a minimum monthly pension after retirement and is actively encouraged to apply active aging in their life. Indonesia, with the percentage of its aging population is not as high as Finland, is still on its way towards an elderly people-friendly society, with the system that started to make it possible for more people to have monthly pension after retirement (in Chapter 2). The national pension program and encouragement to apply active aging are only some examples of an elderly people-friendly society. Beside the support of the family and government, the elderly-friendliness of a society would make a difference in the social inclusion and happiness of elderly women (in Chapter 2).

With family, government and society supporting the elderly women, the elderly women can use a digital matchmaking platform, which is enhanced by appropriate technology and AI, without forgetting all the necessary ethical points, to improve their well-being (in Chapter 3). The ideal online matchmaking platform should be having the element of friend-finder like in Bumble BFF, providing a pleasant friend-making experience, should have elements where the elderly women can actively join activities, get help, or communicate with other elderly women in real life like in Helsinki Missio and Senior Club Indonesia, and or getting a payable specialized help, like in Gubbe and Kanopi Insan Sejahtera (in Chapter 3).

In creating an AI-powered elderly women-centered matchmaking platform, elderly women's digital readiness, safety and security should be considered (in Chapter 4). The HCAI, in this case the AI-powered elderly women-centered matchmaking platform would help the elderly women to possibly find friends and start friendships online which could be extended offline. The combination of online and offline friendship and activities support active aging and social inclusion of elderly women, increase their well-being, resulting in less loneliness and more happiness.

This thesis aims to find the needs of elderly women in Finland and Indonesia in finding friends online to support active aging and social inclusion. It then tries to answer the needs by creating a base for an AI-powered elderly women-centered matchmaking platform. The friendship and activities on the online platform will then be extended offline, creating real friendship and real activities, in real community, and encourage elderly women to implement active aging to be less lonely and happier.

4 Research methodology

This chapter outlines the research methodology of this thesis, covering the research process, research method, research approach and the methods for data collection and analysis.

As shown in Figure 10, the writer of this thesis started the literature review process in January 2023 and completed it by April 2023, even though preliminary studies were conducted in the preceding year. The planning for the empirical study and interview questions formulation took place in March and April 2023. The empirical study for this thesis involved participants in Helsinki and Jakarta, and spanned from April to August 2023. The semi-structured interviews were conducted in April 2023 and were analyzed in April and May 2023. Based on the insights from the interviews, a simple prototype was created. The early prototypes were produced in June 2023, and they were tested in Jakarta in June 2023, and were tested in Finland in August 2023. The qualitative data were analyzed in July and August 2023. Following the validation in August 2023, the concepts and suggestions for this thesis were written, and this thesis was finalized in September 2023.

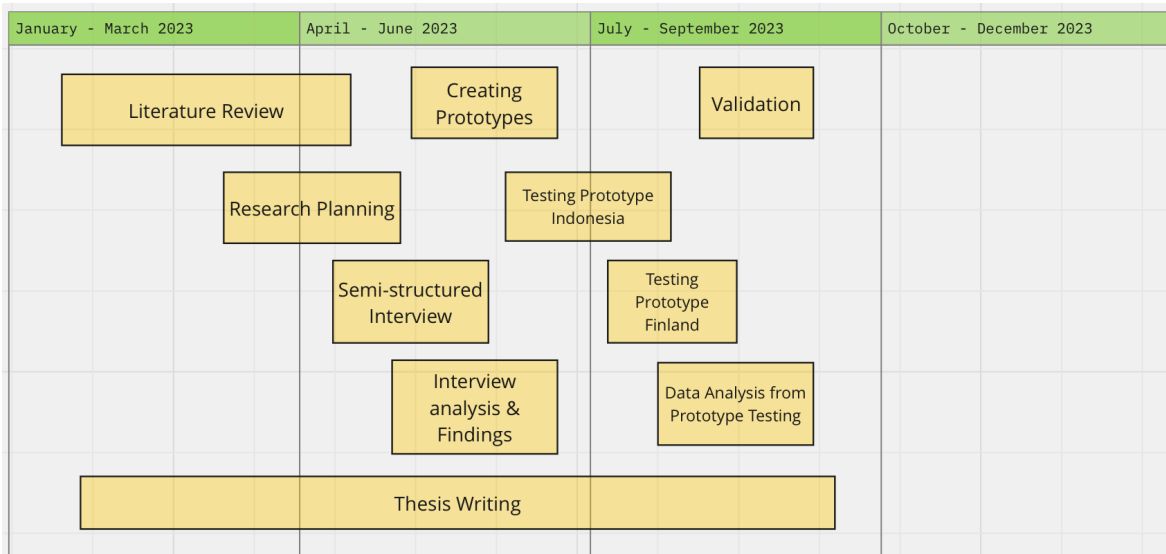


Figure 10. Thesis work flow January - September 2023

4.1 Qualitative research

Quantitative and qualitative methods are two main research methods. While “quantitative research examines relationships between variables, which are collected in a standard manner, measured numerically and analyzed using a range of statistical and graphical techniques” (Saunders 2023, 184), “qualitative research studies participants’ meanings and the relationships between them, using a variety of data collection techniques and analytical procedures, to develop a conceptual framework and theoretical contribution” (Saunders 2023, 185). In research with quantitative

method, the data collection method is rigorously defined and highly structured, the data is numerical and standardized, the analysis is conducted through statistics and diagrams, and the researcher is considered independent from those being researched. In research with qualitative method, the data collection method is either unstructured or semi-structured, the data is non-standardized and generally requiring classification, the analysis is conducted through conceptualization, and the researcher is not considered independent. (Saunders 2023, 184-185.)

Qualitative research methods are used in this thesis. Qualitative research methods are used to study topics which are not well-understood to understand them better. In qualitative research, the number of research participants is smaller than the number of respondents in quantitative research, but the volume of the materials to be analyzed can be large. This is done in purpose to obtain much information about a limited target, to be able to understand a phenomenon better and in a more holistic way. (Moilanen & al. 2022, 134-136.)

The study in this thesis is a multi-method qualitative study, where two or more qualitative data procedures and analytical techniques are being used (Saunders 2023, 186). There is a wide range of arguments why a multi-method qualitative study is preferable than a single method of qualitative study. Mik-Meyer (2020) suggests that the purpose of conducting multi-method qualitative study is not to get closer to the real world nor to present a more complete image of the phenomenon, but to enable a researcher to develop a more sensitizing approach. She also agrees in giving participants agency and letting them choose methods that are right for them, and that there are no right or wrong methods. There are only methods that are appropriate to the research topic and the model with which a researcher is working. Semi-structured interviews and testing through thinking aloud method are the qualitative data collection methods implemented in this thesis.

4.2 Service design approach

The study in this thesis is conducted using a service design approach. Service design approach is getting more popular because services have become more customer-oriented while at the same time facing financial challenges. Service design approach promises a clear process and provides various methods and tools which are easily applied and make it possible to define services in clearer concepts and test them. (Moilanen & al. 2022, 93-105.)

Service design is everything that can make a service useful, usable, effective, and desirable. With service design, companies and organizations place themselves in their customers' position, therefore the needs of both customers and companies or organizations are balanced by service design. Service design is iterative. Therefore, there is no need for companies and organizations to worry about making mistakes at the beginning. They can always go back to the previous steps when it is

needed, to process, and then reach a better state of condition later. Service design is started by finding out the needs of the customers by using qualitative research methods such as interviews. By understanding the needs instead of going directly to solution, service design makes innovation inside companies and organizations possible. Ideation will come after understanding the needs. Prototyping will then follow. Prototyping is a practical and useful step in doing quick testing in service design, which is also iterative and is done based on new insights and ideas. (Stickdorn & al. 2018a, 11-20.)

There are several service design models, such as the Design Squiggle by Damien Newman (Newman, s.a.), Service Design Tasks: Understanding, Thinking, Generating, Filtering, Explaining and Realising by Stefan Moritz (Moritz, 2005), IBM Design Thinking Model: Observe, Reflect and Make (IBM, s.a. b), and Google Design Sprint Process: Understand, Define, Diverge, Decide, Prototype, and Validate (Mignot, 2020). Anderson (2023, 6-9) proposes Design Thinking Model for technology as the combination between the Double Diamond and Project Management in technology. This thesis will use the Double Diamond model (Design Council, 2013), which is a popular model and has been used many times in various field.

The Double Diamond model is based on four distinct phases: Discover, Define, Develop, and Deliver. In the first phase, Discover, the challenge is questioned, and the research to identify users' needs is implemented. The second phase, Define, is to understand how the users' needs and the problem align. Defining the right problem is the purpose of this phase. Develop, the third phase of the Double Diamond model includes ideating, and this phase concentrates in developing, testing, and refining possible solutions for the problem. The last phase, Deliver, is selecting one solution that works and preparing it for launch. (Ball, 2019.)

In this thesis, the service design process will be conducted as shown in Figure 11. The phases Discover and Develop are divergent, while the phases Define and Deliver are convergent (Design Council, 2023). Semi-structured interviews, as a qualitative data collection will be implemented in the Discover phase. It will be analyzed in the Define phase, and insights will also be produced in this phase. The appropriate problems will be defined. The process will enter and diverge in the next phase, which is the Develop phase. The "How Might We?" questions will be prepared. In the initial plan, ideation was planned to take place by co-creation with the related stakeholders through workshop in the Develop phase. However, since it was not possible to gather all workshop participants during the summer holiday, the plan was changed. Instead of workshop, based on the insights produced in the Define phase, quick prototyping would be implemented in this Develop phase. The prototype will be tested in this phase by using a qualitative data collection method called thinking aloud. Based on the analysis from the thinking aloud method and insights from the

testing stage, the prototype will be updated, and the recommendation for the elderly women-centered AI-powered matchmaking platform will be written. Validation from related stakeholders will take place in the Deliver phase.

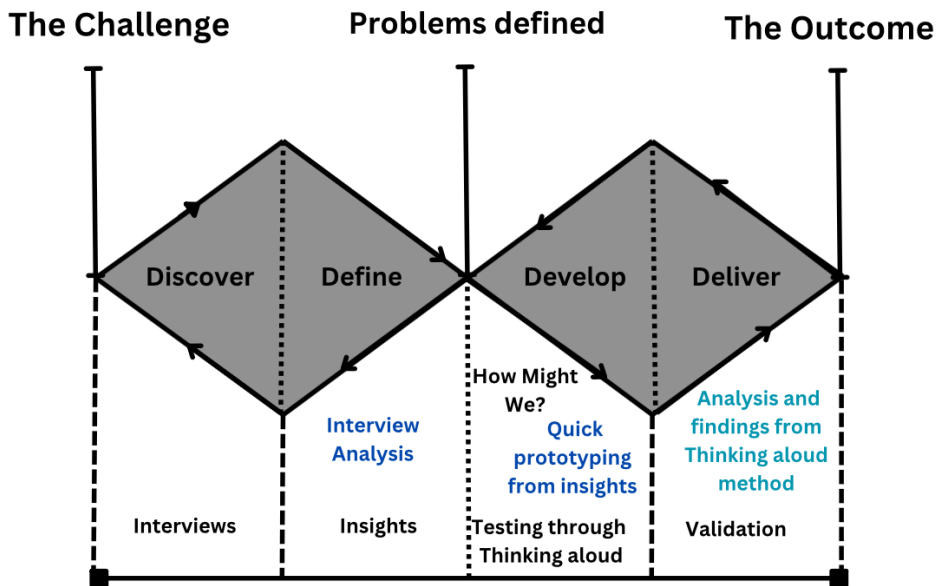


Figure 11. Double Diamond service design model, methods, and tools used in this thesis (Adapted from Design Council, 2023)

4.3 Data collection

As written previously, this thesis uses multi-method qualitative data collection procedures. Semi-structured interviews and prototype testing with thinking aloud method are the data collection procedures which are used in this thesis.

4.3.1 Semi-structured one-on-one online interview

Interview is a widely used data collection method in many research projects because interview makes it possible for the researcher as interviewer to collect in-depth information rapidly and to focus on the individual as interviewee, as the subject of the research, to bring up the matters from the interviewee's point of view. Interview makes it possible to gather data that can open new perspectives if there has already been a little research done on the research target. Interview can clarify some unclear aspects of a situation or enable the researcher to gain deeper understanding of a situation, or to get information about sensitive aspects of a theme. Interviews are often combined with other data collection methods because different methods support each other. (Moilanen & al. 2022, 136-142.)

Structured interview, semi-structured interview and unstructured interview are three types of interviews based on interview structure. While structured interviews are usually used to get data that can be analyzed quantitatively, semi-structured and unstructured interviews are usually used to obtain data that can be analyzed qualitatively. An unstructured interview starts with a broad topic, and the interviewer gives the interviewee an opportunity to talk freely. In an unstructured interview, the interviewee or the participant guides the interview process, while in a structured interview, the interviewer takes full control while asking the standardized set of questions. (Saunders 2023, 445-447.) Semi-structured interview is the type of interview where the freedom of the participant in answering the questions is between structured interview and unstructured interview. Semi-structured interview is implemented in this thesis. The questions for the semi-structured interview are planned and prepared before the interview. The interviewer can change the order or exact wording of the questions during the interview, can decide not to ask a question if it's considered inappropriate, or ask a new question which comes up during the interview. (Moilanen & al. 2022, 138-142.)

Since the objective of this thesis is to find out the needs of elderly women in both Finland and Indonesia when using AI-powered matchmaking platform in helping them to live with active aging, to be socially inclusive, and less lonely, interview questions were created by taking the thesis objective into consideration, as well as the RQ and Sub-Questions RQ1, RQ2, RQ3, and RQ4. There are no questions about AI and AI ethics included in the list of interview questions, for the purpose of not burdening the participants too much, who are elderly women aged 60 to 80s from technology matter. The interview questions focus on family, friends, their activities, their adoption of communication technology, their attitude towards it, their problems in using the technology, and the possibility to extend the online relationship to offline. The questions for the interview are then listed as a set of questions as shown in Appendix 1.

Six participants from each Helsinki Metropolitan area and Jakarta Metropolitan area volunteered for this study. Due to differences of geographic area and the limitation of meeting face-to-face, an online interview was conducted with each participant. The initial plan was to use Teams as a video conference platform. However, since not everybody knows how to access Teams, Zoom was instead used with the participants who could not access Teams. This happened mostly to participants who live in Jakarta Metropolitan area, where Zoom is more widely used than Teams. Online interviews using video conference platforms such as Teams and Zoom have become much more popular since the Covid-19 pandemic. The advantage of using video conferencing is that interviews could be conducted with participants who are in different parts of the world. The interviewer who is in the Helsinki metropolitan area could interview a participant who lives in another part of Helsinki without leaving home. The interviewer could also interview a participant who lives far away in Jakarta Metropolitan area in Indonesia. The limitation of this online interview is that participation

is limited only to participants who have access to internet and the agreed video conference platform. (Saunders 2023, 477-478.) In online interviews, how people perform online is shaped by the social structures where they live by online and socially located culture, social system and structure, and local history. To understand the performance is through the accumulation of cultural construction of time, space, and social relationship (James & Busher, 2009).

After the interview time is agreed, the writer of this thesis sent a video conference invite to each participant. Inside the invite, the writer wrote briefly about the thesis and why the interview is being conducted (Appendix 2). Participants were informed about the estimated length of the interview, which is around 30 to 45 minutes. They were informed that the data would be kept confidential, recorded, and would be used only for this thesis purpose. They were also informed that they have the right not to answer the questions if they do not feel like doing it. The interviews with the participants in Finland were conducted in English, and the interview with the participants in Indonesia were conducted in Indonesian (Bahasa). For the anonymity of the participants, their names are coded. The interview participants in Finland are named as IF1, IF2, IF3, IF4, IF5, IF6, and the participants in Indonesia are named as II1, II2, II3, II4, II5, II6. IF stands for Interviewee Finland, and II stands for Interviewee Indonesia. The actual time for the length of interviews varied from 20 minutes to 35 minutes, as shown in Table 2.

Table 2. Interviewees, interview platforms, and length of interviews

Interviewee	IF1	IF2	IF3	IF4	IF5	IF6
Location	Finland	Finland	Finland	Finland	Finland	Finland
Video platform	Zoom	Teams	Teams	Teams	Zoom	Teams
Length of interview (minutes)	28:07	28:53	23:44	28:12	34:06	20:24
Interviewee	II1	II2	II3	II4	II5	II6
Location	Indonesia	Indonesia	Indonesia	Indonesia	Indonesia	Indonesia
Video platform	Zoom	Teams	Zoom	Zoom	Zoom	Zoom
Length of interview (minutes)	31:58	20:55	25:41	27:22	22:37	22:37

The interviews were then transcribed with smooth verbatim transcript, where the transcription is done word by word but leaving out utterances and filler words such as uhms, yeah, you know, or comprehensive protocol when the interview materials are not too ambiguous, by summing up the

main content writing it down (Mayring 2022, 132). The transcriptions were also anonymized. For this thesis writing, the transcriptions of the interviews with participants in Indonesia were translated into English with the meaning as close as possible to the original interviews in Indonesian language (Bahasa).

To make sure interview questions were understood well, and if interviewees interpreted the answers to the interviews well, participant validation was done to one of the interviewees. The interviewer or the writer of this thesis read the transcribed interview to the interviewee and asked the interviewee if the content was the same as what the interviewee meant. Interviewee confirmed that the transcribed interview is according to the interview conducted previously.

4.3.2 Prototype testing with thinking aloud method

In this thesis, thinking aloud or thinking out loud method is used in testing the prototypes with intended customers, who are elderly women in Finland and Indonesia.

The thinking aloud method is one way to collect qualitative data, where participants are asked to verbalize in words what they are thinking while doing a specific task. The participants are asked to keep on talking and not leave any interruptions or questions to avoid interpretation and explanation of what they are doing while concentrating on the task. In this method, the participants are allowed to use their own language, and they might verbalize only parts of their thoughts (Someren & al. 1994, 26.)

The thinking aloud method can be used as a scientific research method and usability testing method. In the thinking aloud method as a scientific research method using the Ericsson and Simon protocol (Ericsson & Simon 1985, 78-90), the communication is just between the researcher and the participant. Participant is expected continuously to verbalize their thoughts, while the researcher is expected to only listen to what the participant says. In the Ericsson and Simon protocol, the rules are when the participant keeps silent for a long time, the researcher should remind the participant, other than that the researcher should not interfere in the thinking process of the participant. (Boren & Ramey, 2000.)

When employing thinking aloud method in usability testing, two interactions occur: one between the participant and the application, and another between the researcher and the participant. Boren and Ramey argue that in usability test, the Ericsson and Simon protocol does not work properly. They propose speech communication to be used for the thinking aloud method in usability testing. With this approach, the participant in the thinking aloud method does not exactly have to talk all the time, and the researcher does not have remain silent throughout. This allows a dialogue between the participant and researcher is possible when intervention is necessary. (Boren & Ramey, 2000.)

A MacBook laptop is chosen as the device for testing due to its larger screen compared to mobile phone, despite mobile phone being the most commonly used telecommunication device among elderly women in both Finland and Indonesia. Five women from each country, Finland and Indonesia, volunteered to participate in this testing.

Before the session started, participants were provided with an explanation that their data would be kept confidential, and their identities would remain anonymous. Brief explanation about the thesis and the thinking aloud method was also given, mentioning the need to verbalize their thoughts while performing assigned tasks. For anonymity, participants from Indonesia were coded as II2, II5, II7, II8, and II9. Participant II2 and II5 had previously participated in the semi-structured interviews in Indonesia under the same coded names. While most of the thinking aloud session with the participants in Indonesia were conducted in person, prototype testing with II5 was carried out via Zoom, since it was not possible to meet this participant in person. During this thinking aloud, II5 verbalized her thought, and the researcher operated the prototype based on II5's spoken sentences. Participant II7, II8, and II9 did not participate in the previous semi-structured interview sessions. Due to availability issues, it was not feasible to conduct a prototype testing session with the previous interviewees II1, II3, II4, and II6. Therefore, II7, II8, and II9 voluntarily joined this thinking aloud prototype testing upon the writer's request.

Similarly, for anonymity, the participants for the prototype testing in Finland were coded as IF2, IF7, IF8, IF9, and IF10. IF2 was the only participant who had previously participated as an interviewee in the previous semi-structured interview under the same name. Since it was not possible to arrange the thinking aloud prototype testing session with interviewees IF1, IF3, IF4, IF5, and IF6 due to availability issues, participant IF7, IF8, IF9, and IF10 were requested to participate in the testing session, and they agreed to participate voluntarily. The duration of the thinking aloud processes for this usability testing varied from 7 minutes to 14 minutes for participants in Indonesia and from 15 minutes to 21 minutes for the participants in Finland, as can be seen in Table 3.

'The core length in minutes' on the table means the duration of the prototype testing only, from the time when the first task was announced until the time when last task was completed. 'The total length in minutes' means the duration from the time when the first task was announced until the end of the post-thinking aloud session interview. The core length in minutes for the participants in Indonesia were comparatively longer than the core length in minutes for the participants in Finland because the ones in Indonesia included explanation and guidance from the writer, and opinions from the participants, while the core length in minutes in Finland concentrated on the prototype testing itself. Participants in Finland were asked questions about the prototype after the core testing session concluded.

Table 3. Thinking aloud participants and length of interviews in Finland and Indonesia

Participant	IF7	IF8	IF2	IF9	IF10
Location	Finland	Finland	Finland	Finland	Finland
Method	Face to face	Face to face	Face to face	Face to face	Face to face
Age (years)	70-80	60-70	70-80	60-70	20-30
The core session length in minutes	04:28	04:26	03:13	04:43	03:43
Total length in minutes	16:50	17:57	15:59	20:10	17:03
Participant	II2	II7	II8	II9	II5
Location	Indonesia	Indonesia	Indonesia	Indonesia	Indonesia
Method	Face to face	Face to face	Face to face	Face to face	Zoom
Age (years)	70-80	60-70	60-70	60-70	70-80
The core session length in minutes	05:42	09:50	08:15	08:35	09:58
Total length in minutes	07:01	13:53	12:41	09:27	13:52

The thinking aloud method for this thesis was conducted either face-to-face or online. Among the five participants in Indonesia, four participants participated in face-to-face thinking aloud sessions, while one participated online through Zoom. In the face-to-face sessions, the researcher sat alongside the participant and tried to create a relaxed atmosphere. Rather than strictly applying the Ericsson and Simon protocol by being silent all the time during the thinking aloud session, the researcher uses Boren and Ramey protocol by sometimes interfering when the participants were being silent for a long time, and interfered when interference was necessary. For example, during face-to-face session, the researcher provided guidance to participants who were not familiar with MacBook on how to click buttons and make selections. The researcher also helped clicking the necessary buttons, based on instructions from the participants, when the participants did not feel comfortable or were not able to do so themselves.

The purpose of prototype testing using thinking aloud method is to assess the ease of use of the prototype or mock website by the participants, and to collect input from the participants about their perception of the prototype, and suggestion for improvements to enhance usability.

The thinking aloud session was divided into 3 sections. The first section was the introduction about the thesis, about why the participant was asked to participate. The thinking aloud method was explained briefly here. The second section was the section where the participants experienced the thinking aloud session, verbalizing what they thought while completing specific tasks. This second section began when the researcher mentioned the first task, and ended when the participant completed the last task. The third section was the post- thinking aloud session, where the participants

were asked about their opinions about the prototype, whether it was easy to use, how they felt during the process, and whether they had input the prototype or its contents.

In the second section, the participants were given 3 tasks. The first task was to find somebody with the same interest on the platform to chat with. The second task was to find a specific hobby group (the reading group) and talk with the group members there. The third and last task was to find an upcoming event, which was the breakfast with online safety seminar, and register for it. Individual task in this thinking aloud method was announced only after the previous task was completed.

In the third section, the researcher conducted a post-thinking aloud session to the participants by asking them questions, which were:

- How was it? Is the website easy to use?
- What do you think of the first task?
- What do you think of the second task?
- What do you think of the third task?
- Which function of the prototype do you like the most from the first, second and the third task?

The order of how the questions were asked was not exactly the same as above. If the questions were already answered during the thinking aloud session, they were not asked anymore. When the participant strongly showed reaction to a specific part of the prototype, the researcher asked more about the subject during this post-thinking aloud session.

The thinking aloud process was audio-recorded and transcribed as verbatim as possible. The transcription for the participants in Finland was done in English language, while the transcription for the participants in Indonesia was conducted in Indonesian language (Bahasa). For this thesis purpose, the Indonesian transcription was translated as near as possible to its meaning in English.

Similar to the semi-structured interviews which were conducted previously, participant validation was done to one of the participants of the thinking aloud session a few days after the testing was completed. Participant validation was done only for the post-thinking aloud testing process, when participant and researcher discussed about the testing. The researcher read the transcription to the participant, and the participant confirmed that the transcription had the same understanding with the conversation which she experienced in the post-thinking aloud prototype testing.

4.4 Sampling

This thesis uses purposive sampling in selecting participants for the semi-structured one-one-one online interview and for the thinking aloud prototype testing. In purposive sampling, the researcher must choose the participants carefully, selecting them who are expected to answer the RQs and

meet the research objectives. Purposive sampling is used with a small number of samples and is not statistically representative of the target population. (Saunders & al. 2023, 322.) Purposive sampling is used in qualitative research, which purpose is to gain a detailed understanding of the study. This approach requires a small sample size to be able to explore the issues deeply, and to recognize the diversity of the issue by offering flexibility in sampling. (Hennink & al. 2020, 92-97.)

As the purpose of this thesis is to explore the needs of elderly women in the metropolitan area of Helsinki in Finland, and Jakarta in Indonesia, suitable participants for the semi-structured interviews were sought in both Helsinki and Jakarta. The criteria are as follows: participant should be elderly woman whose age is between 60 and 80 years old, living in either Helsinki or Jakarta metropolitan area, having never lived in an elderly home, and doing daily activities with little assistance. They are expected not to be related to other participants, ensuring their independence from one another and increasing the variation of data.

The criteria for the participants in the thinking aloud prototype testing are the same as those for participants in the semi-structured online interview, with additional requirement of being able to use at least one mobile app. During the thinking aloud prototype testing, participants would test an interactive mock website, and for this purpose, basic knowledge and experience in using mouse or mobile app would be helpful.

Since achieving diversity in the study issues is a goal in qualitative research (Hennink & al. 2020, 94-97), participants selection in this research was done so that there were as diverse participants as possible inside the criteria requirements. The diversity included variations in the age group within 60 to 80 years old, marital status, and experience in using ICT. The sample of participants were refined inductively (Hennink & al. 2020, 95) when after experiencing a specific stage of research process, the researcher realized that information could be collected from participant group which had not yet been inside the sample.

One participant of the thinking aloud prototype testing in Finland was not an elderly woman. This participant, however, was a volunteer who sometimes accompanied and assisted elderly women. Therefore, this participant could give valuable insights into the technology usage of elderly women.

4.5 Data Analysis

4.5.1 Thematic analysis

Thematic analysis is chosen as the method of data analysis of the qualitative data collected from semi-structured interviews conducted in both Finland and Indonesia. Thematic analysis is a popular type of qualitative data analysis, and this type of analysis is appropriate at the stage of research

when relevant important variables to the subject have not been known yet (Belotto, 2018). Thematic analysis has a flexible approach that can be adjusted to the needs of many studies. It does not need detailed theoretical and technological knowledge, is easy to grasp, and quick to learn due to its few procedures. It is also a useful method to study perspectives of different participants, highlighting the similarities and differences and generating insights. (Nowell & al., 2017.)

Thematic analysis is divided into 6 stages of data processing. Data set familiarization is conducted in the first stage. Coding process takes place in the second stage, and initial theme generation happens in the third stage. In the fourth stage, developing and reviewing those themes take place. While defining and naming final themes are conducted in the fifth stage, the sixth or final stage is when the report is written. (Terry and Hayfield 2021, 9-10.)

In this thesis, the data which was produced from the semi-structured interviews initially diverged during the 'Discover' phase of Service Design Double Diamond model. As the data progressed into the convergent 'Define' phase, it underwent analysis through thematic analysis. During this phase findings and insights were generated, as illustrated in Figure 11.

Using thematic analysis, the transcribed interviews were read several times, to familiarize the writer of this thesis with the obtained data, and to see if there are patterns in the data. A transcribed interview was placed on the left part of a Microsoft Word table, to prepare for the coding process. The transcription was read, and every time something relevant to thesis objective and RQs came up, that part of the text was coded, by writing the code on the right part of the Microsoft Word table. Both inductive and deductive coding were applied. Inductive coding was conducted for the first transcription, and deductive coding was carried out for the next transcriptions. When there were texts which could not be coded with existing codes, new inductive codes were added.

All the produced codes were listed, and the similar ones were slimmed down into one code. To simplify the process of creating themes, similar codes were grouped into relevant sub-categories. Several sub-categories were clustered into one category, and several categories with similar ideas were grouped into one theme. The codes, sub-categories, categories, and themes were looked again if it was possible to move them into another position in various categories or themes. Themes were then developed and renewed into more relevant themes, as near as possible to the thesis' objectives and RQs.

4.5.2 Template analysis

This thesis also used template analysis to analyze qualitative data which was obtained from the prototype testing by using thinking aloud method in both Finland and Indonesia. Template analysis

is one type of thematic analysis where a coding template is developed. The coding template summarizes the important themes and organizes them in a meaningful and useful manner. In template analysis, hierarchical coding is emphasized, and broad themes are used in the initial stage. (Huddersfield, 2023.) Template analysis is used in this thesis due to its adoption of higher level of structure in the development of coding template when compared to thematic analysis, and its flexibility to revise the initial coding template in the analysis stages in a more holistic way (Saunders & al. 2023, 675-678).

There are six stages of data processing by using template analysis. The first stage is to get familiar with the data to be analyzed. The second stage is to carry out preliminary data coding. This is the same process as in other thematic analysis, but in template analysis using *a priori* themes which are relevant to the analysis, and which are decided in advance is allowed. The third stage is to organize the emerging themes into clusters and see how they relate to each other, including the hierarchical relationships. The fourth stage is to develop an initial coding template based on a subset of data. The fifth stage is to apply the initial template to the next data and make changes to the template by deleting or adding or refining the themes. The sixth and last stage is to finalize the template by applying it to the full data set. (Brooks & al., 2015, 203-204.)

In this thesis, the prototype creation and prototype testing were in the diverging 'Develop' phase of the Double Diamond model, and the analysis of the prototype testing is in the converging 'Deliver' phase of the Double Diamond model.

There are 3 main differences between thematic analysis and template analysis. First, in thematic analysis, theme development and coding structure take place after initial coding of all data, while in template analysis the initial version of coding template is normally produced based on a subset of data. Second, in thematic analysis themes are defined on the later part of the analysis, while in template analysis theme definitions are produced at the initial part of the analysis. Third, in thematic analysis there are usually only one or two levels of sub-themes, while in template analysis 4 or more levels of sub-themes are used to capture the richest part of data. (Brooks & al., 2015, 206-207.) In this thesis, the final coding template would include 3 levels of sub-themes.

5 Analysis, findings, and service design process

This chapter consists of data analysis of the data collected in the previous chapter and the findings. The analysis and findings that came out from them will be written, and it will go through the Service Design process as shown in the previous Figure 11.

5.1 Interview analysis and findings

Table 4 shows four final themes for the semi-structured interviews in Finland and Indonesia with their categories. Using the same themes and categories would make comparison and analysis for further phases in the Double Diamond service design model easier than if they are under different themes and categories.

Table 4. Themes and categories for the thematic analysis of the semi-structured interviews

Theme 1: Social Relation & Activities	Theme 2: Technology	Theme 3: From online to offline	Theme 4: Values and Hopes
Family and relatives	Communication technology and the benefits	Interaction on the internet	Plans
Friends	Learning the technology	Meeting a new friend	To help or to be helped
Hobbies & Activities	Non-learning challenges	Event participation	Hopes

Theme 1 covers the background of the interviewee, where social connection with families, relatives and friends is covered, and activities are lined up. Theme 2 is about technology and is divided into 3 sub-categories. The first sub-category is the connection between interviewees and communication technology, and the benefits they experienced from the advancement of technology. The next sub-category is about their attitude towards learning and technology adoption. The third sub-category is the non-learning challenges, which are the challenges or negative effects of technology that the interviewee thinks or feels, which are not related with learning, but which improvement will increase the interviewee's customer experience. The categories of 'Learning the technology' and 'non-learning challenges' are especially important categories in the theme 'Technology'. Theme 3 is an important theme which helps expansion from online to offline activities, in the purpose to support active aging and to make the elderly women more socially inclusive. This theme covers their 'Interaction on the internet', how they extend an online friendship to an offline friendship in 'Meeting a new friend', and how they join an offline event from an online advertisement in 'Event participation'. Theme 4 is about the interviewee's values and hopes: their short-term and long-term plans, their attitude about help and being helped, and their hope. This will relate with Theme 1 and will also affect the other themes.

5.1.1 Finland

Theme 1: Social Relation & Activities

Table 5 shows the social relation and activities of interviewees in Finland. Most interviewees are married and retired. Their adult children do not live with their parents anymore. The interviewees whose siblings lived outside Finland maintain regular communication, often online. Most of the participants have a circle of close friends with whom they either meet or stay in frequent contact. Some interviewees have friends from different phases of life with whom they maintain good connections.

Table 5. Interviewees in Finland, their social relations and activities

Interviewee	Social relations and activities
IF1 (Zoom)	60-70 years old, married, retired, siblings outside Finland, adult children live outside home. <u>Hobbies</u> : reading, cooking, gym, club activities.
IF2 (Teams)	70-80 years old, married, retired, siblings, many friends, adult children live outside home. <u>Hobbies</u> : community volunteering, movies, theater, art exhibition, running, gym, doing something for the environment, bicycle tour, walking, talkoot. <u>Activities</u> : exercise every day, eat healthy, sleep enough, socialize.
IF3 (Teams)	60-70 years old, married, working, long-time friends, adult children live outside home. <u>Hobbies</u> : dancing, walking outside, summer cottage, reading, listening to music, being outside, theater, having dinner together, gymnastics.
IF4 (Teams)	60-70 years old, married, retired, siblings, friends from various phases of life, adult children live outside home. <u>Hobbies</u> : gym, studying foreign language, jogging, walking, retiring club. <u>Activities</u> : babysitting adult children's children.
IF5 (Zoom)	70-80 years old, widowed, retired, siblings outside Finland, many friends from various phase of life, no children. <u>Hobbies</u> : walking, being busy, gym, Nordic walking, reading, cooking for friends, virtual chess. <u>Activities</u> : being active physically and mentally.
IF6 (Teams)	60-70 years old, married, retired, a few good friends to meet sometimes, adult child lives outside home. <u>Hobbies</u> : gardening, walking, biking, tennis, shopping, watching movies. <u>Activities</u> : babysitting grandchildren, eating healthy, sleeping well and being outside.

The interviewees who are between 70 to 80 years old appear more socially and physically active than their younger counterparts. One participant in this age bracket is fond of socializing engaging with people and organizing activities. Unfortunately, the husband of the other interviewee in the same age bracket has passed away several years ago. When she was younger, she lived in many

different places, that made her used to being alone and adjusting fast to the new place and situation, and to making friends.

“Right now, I am talking and am also walking at home. I am moving a lot, but mentally also good to keep active and to talk to people. I have very many contacts at least half is virtual but then it is mentally good to keep your mind to have challenges not to say you are too old for this or to that.” IF5

Gym, reading, cooking, walking, watching movies and being outside are the most popular hobbies and activities among the six interviewees in Finland.

Theme 2: Technology

As shown in Table 6, most of the interviewees in Finland use WhatsApp, and most of them chose WhatsApp as their favorite communication apps due to its easiness of use. Facebook is used more for information channel and the interviewees do not post many things on their Facebook accounts to inform people about themselves.

All participants use mobile phones for their primary telecommunication devices due to their compact size and portability. Some interviewees also use other devices, such as laptops, tablets, and personal computers, for purposes such as looking up information, reading news, online banking, and playing online games. The participants chose these devices over mobile phones to do the activities due to their larger screens.

Table 6. Social media and devices for interviewees in Finland

Interviewee	IF1	IF2	IF3	IF4	IF5	IF6
Social media & apps	Email and facetime	WhatsApp, Facebook, Instagram, WordPress, Snapchat	WhatsApp, Facebook, Instagram	WhatsApp, email, messenger, Facebook, Helsingin Sanomat	WhatsApp, Zoom, Facebook	WhatsApp
Favorite apps	Facetime	WhatsApp	WhatsApp	Helsingin Sanomat	WhatsApp	WhatsApp
Telecommunication devices	Mobile, computer, laptop	Mobile, laptop, tablet	Mobile, computer	Mobile, laptop, tablet	Mobile, tablet	Mobile

All interviewees recognized the benefits of communication technology: its power to connect people, to make daily activities easier to do than before, and enable wide range of possibilities, which makes it easier to stay active and tackle loneliness.

“...especially In Finland, via internet you get many things done. Make an appointment with doctor, finding out where is what, of course as well the shopping, housing during Covid time, internet was a big help.” IF1

” Talking, being connected with people, being able to do much more, it is easier to be active.”
IF5

When the interviewees became aware of a new technology, they tried to find out whether the technology meet their needs. If the technology had what they needed, they would be interested in using the technology. To be able to use the technology, the interviewees would need to learn about it. The interviewees would first try to learn the technology by themselves, but if they found difficulties and required assistance, they asked other people, who were usually their adult children. The interviewees who used the same apps all the time do not experience as many problems as the interviewees who started using new programs or apps or technology. The interviewees who faced problems try to solve the problems by themselves before asking the others for help. If they had adult children, the children were usually their first point of contact for help.

“I can try to learn by myself, but many times I asked my daughters, and they are helping me.”
IF4

One of the interviewees explained in detail that in current technology, learning by doing is the norm. The way modern technology is learnt by the new generation was different from learning technology in the interviewee’s generation. Using modern technology these days involves learning by doing, and it can be overwhelming for the interviewee.

“... but I do not get it. These youngsters did not explain something to you in a way but is not full of blub blub blub, and then they have done something I do not have idea how the next thing popped up, but they cannot explain. People do not explain anything so much, they just blub, do it. And you do not get manuals anywhere anymore, for instance.” IF1

Besides the benefits, the interviewees recognized the negative aspects of communication technology and the challenges that accompanied it. Their concerns mostly revolved around scams, spams, viruses, and information security.

“But the problem is you have to be all the time aware that you do not do anything wrong. I mean I got a lot of blackmailing emails, because they have corrupted my account and so on. I never reacted to them and it was obviously the right thing.” IF1

The negative effects of the current communication technology include addiction to technology. Some interviewees mentioned that besides the many benefits of communication technology, it

sometimes consumes too much of their time. All the interviewees realized that it is easy to become addicted to or dependent on technology.

“I am a bit scared that I am dependent on it. I started to use less phone when I walk outside to be more in connection with whatever. I also started to read paper book, not all books, only the very good books.” IF5

There are challenges that arise not from the technology itself but from the people who use it. Examples of these challenges include the attitudes of people during online discussion, or the demeanor of technology store employees when assisting elderly individuals with their problems using communication technology products.

Despite the absence of specific questions about AI in the interviewer’s list of questions, some interviewees mentioned their concerns related with data privacy and how they should treat data.

“To get to know and to get the real information what they are meant for, how to use them, and to know if there is something to be aware of.” IF2

Theme 3: From online to offline

On social media and internet, the interviewees usually interact with the people who they already know. They do not usually interact with strangers. When the interviewees interact with strangers on the internet, they usually interact in the specific roles such as volunteers and online buyers.

“It might be about generation, because my generation is not open to people we do not know. So somehow, I need to know that they are the real people and that they are really interested in those things which we perhaps might be discussing and so on.” IF2

Even though the interviewees do not like to interact with strangers on the internet, they are open to the possibility of meeting face-to-face with the people they have become friends with online when they feel comfortable about it. Some interviewees mentioned that it is better to meet face to face before interacting on the internet. The interviewees suggested engaging in activities that they can share together, meeting and having conversations to get to know talk first to know the new their new friends better.

“If I meet someone on the internet and have a good feeling because of the interaction, why not meet face to face to find out if in reality the same. I may be open, but this is now difficult to give a clear answer. In principal if something feels good and safe, then I will try.” IF1

While the interviewees are selective in interacting with the people who they do not know on the internet, they are more enthusiastic about events that are advertised online. They have recognized

that the internet has replaced the function of the traditional newspaper in providing information about events, although some participants still prefer attending events organized by known organizations rather than unknown ones. For events that interest them, they are willing to attend either by themselves or with friends.

“Because if I want to go to a movie which nobody wants to see and only I want to see, it is better if I go myself. It is better to have good company than bad company. It is better to have no company than bad company.” IF5

Theme 4: Values and hopes

Some interviewees have short-term plans and long-term plans they look forward to, while some do not have any long-term plans. In general, the interviewees are content with their life.

“I cannot say because I am very lucky because every week I am in summer cottage and that is what I want, and I can see my grandchild and so on.” IF3

Most of the interviewees did not suggest any ideas about for the types of websites they need. Only one interviewee proposed the idea of a website focused on events, which would be extremely helpful for active elderly women. When asked about the help that they need, most of the interviewees mentioned that they do not need help. However, some interviewees who were born outside Finland mentioned needing assistance with matters related to authorities. Some interviewees expressed a desire for more companionship than help. The interviewees are also willing to help when asked.

“Moral support to some people in my family who live outside Finland, who have health or other problems. If the old lady neighbor needs some help or wants to walk, I try to be there. Or sometimes babysit someone’s grandchild or something like that. Nothing big.” IF5

All interviewees in Finland mentioned their hope for themselves and the people around them to be healthy.

“To stay healthy and clear mind as long as possible to be able to do nice things and to be able to be with people as long as possible.” IF2

5.1.2 Indonesia

Theme 1: Social Relation & Activities

Table 7 shows the result of interviews with the participants in Indonesia, focusing on their social relations and activities.

From 6 interviewees in Indonesia, 3 interviewees are widowed, and the remaining 3 interviewees are married and live with their husbands. All widowed interviewees reside with their adult children and families. The interviewees who live with their husbands also have adult children living together with them if the children are unmarried or have not relocated to other cities due to study or work commitments. One interviewee spoke positively about her siblings, describing them as her best friends, with whom she maintains frequent communication.

Table 7. Interviewees in Indonesia, their social relation, and activities

Interviewee	Social relations and activities
II1 (Zoom)	60-70 years old, married, siblings, active communications with friends, adult children live inside home. Physical limitation cannot walk far. <u>Hobbies</u> : reading, watching TV, cooking, praying. <u>Activities</u> : sports, visits to hospital, healthy eating habits.
II2 (Teams)	70-80 years old, widowed, good friends passed away, adult child and family live inside home. Physical limitation cannot walk far. <u>Hobbies</u> : gardening, cooking, trips with another adult child. <u>Activities</u> : light sport, sunbathing, careful eating habits.
II3 (Zoom)	70-80 years old, married, less communication with friends after Covid, adult children live outside home. <u>Hobbies</u> : cooking, shopping at the wet market, reading, watching movies, travelling with family. <u>Activities</u> : eating healthy and regularly, calming the mind, playing with grandchildren, trying to be patient. <u>Others</u> : The lack of pedestrian walking in Jakarta making it difficult for elderly people to walk.
II4 (Zoom)	70-80 years old, widowed, siblings who are 'the best friends', friends from various groups of activities, live together with adult child and family. <u>Hobbies</u> : reading and listening to the bible verses, watching TV, choir, walking around the housing compound. <u>Activities</u> : church activities, several clubs' activities, neighborhood activities, sports, morning walk, tai-chi.
II5 (Zoom)	70-80 years old, widowed, friends from choir and other groups, adult child's family live inside home. <u>Hobbies</u> : cooking, baking, sewing, singing in choirs, church activities. <u>Activities</u> : house chores, learning songs before teaching choir, riding scooter, or going by train to choir places.
II6 (Zoom)	60-70 years old, married, long-time friends in several groups, adult child lives inside home. <u>Hobbies</u> : morning sports, praying group, trips with husband, gardening, babysitting grandchildren, arisan, having coffee with friends, visiting social homes. <u>Activities</u> : morning walk.

There are 3 widowed interviewees in the age range of 70 to 80 years old. While two of them are actively engaged in various activities and enjoy their social circles, one interviewee mentioned that she lacks friends. The interviewee who said that she did not have any friends lost her husband the previous year, whereas the other two widowed interviewees lost their husbands several years ago in their 60s when they were younger. This early experience of losing their husbands allowed the two interviewees to better prepare for their elderly life, establish new social connection, and adjust

to widowhood while they still had the energy to do so, compared to the interviewee who lost her husband in her 70s.

One interviewee mentioned that Jakarta has a lack of proper pedestrian walking area. Additionally, there are 2 interviewees who have physical limitations which makes it difficult for them to walk for a long distance, resulting in more limited mobility compared to the other interviewees without physical limitations.

Religious activities, cooking, reading, trips with family, and watching TV or movies are among the most popular activities among the 6 interviewees in Indonesia. The religious activities vary from individual and group prayers, reading and listening to bible verses, church activities, reflecting the diversity of religious practice among the interviewees in Indonesia.

Theme 2: Technology

As shown in Table 8, all six interviewees in Indonesia use WhatsApp. However, only one interviewee considers WhatsApp as her favorite app among them. Three interviewees prefer Facebook as their favorite app. Those who favor Facebook have numerous friends on Facebook, and use Facebook for communicating with their children, as well as for watching religious preachers and listening to choir songs.

Table 8. Social media and devices for interviewees in Indonesia

Interviewee	II1	II2	II3	II4	II5	II6
Social media & apps	WhatsApp, Facebook, Instagram	WhatsApp, Facebook	WhatsApp, YouTube, Netflix, Gojek, Tokopedia	WhatsApp, email, Facebook	WhatsApp, Facebook, Telegram	WhatsApp, YouTube, Instagram
Favorite apps	Facebook	Facebook	YouTube	WhatsApp	Facebook	YouTube
Telecommunication devices	Mobile	Mobile	Mobile, smart TV	Mobile	Mobile	Mobile, TV

Two interviewees who selected YouTube as their favorite app mentioned that they use it to listen to old songs and religious sermons.

All interviewees use mobile phones. However, some of them opt for larger screen by using a smart TV to watch YouTube. The interviewees frequently check their devices and apps, although some make an effort to limit their usage. For example, one interviewee refrains from checking her device and apps when she is with others, and another checks her device and apps only after completing her work.

All interviewees recognized the advancement of communication technology now compared to 10-15 years ago and the benefits of communication technology in getting news about friends, families, relatives, in connecting people, in making daily activities easier, for example in shopping, registering for hospital visit, getting cooking recipe online, including religious activities. Most of the interviewees are interested in knowing about recent technology, especially if it is useful for them and better than the current one.

“When there is a new technology, I want to know. I am interested in knowing, but I still do not understand. I want to use it according to my needs. I do not need too many things.” II3

In learning and using technology, several of the interviewees first try to learn the technology by themselves, but the majority mentioned that they need to be taught by their adult children, grandchildren, or others to learn to use a technology. When facing problems using technology, they would also ask other people such as their grandchildren to help them. Problems in using communication technology include mistyping, sending messages to the wrong person, unstable internet connection, and the feeling of not being technologically capable. The thought of being technologically incapable and feeling confused when using technology were the biggest challenges for an interviewee in using technology. On the other hand, the success of being able to use technology brings confidence to some of the interviewees.

“I do not know how to use the technology that well. We can record happenings with our mobile phones. In the past I could not do that, but little by little I could do it. In the past I was dependent on my grandchildren, but now I can do it by myself. Technology can be learnt, if we want to do it.” II4

Besides the benefits, the interviewees recognized the negative aspects of communication technology and the challenges that come with it. There are worries of scams and becoming the victims of scams when using communication technology. In fact, two interviewees had interactions with scammers, even though the scammer’s efforts failed when dealing with one of the interviewees. Excessive time can be wasted when using communication technology, and the constant use of mobile phones often results in people not communicating, even when they are near to each other.

“People always hold their mobile phones. Therefore, even though they are nearby but they seem far away.” II5

“Once, somebody tricked me by impersonating my good friend, using that friend’s picture.” II4

Two interviewees mentioned that dependency on technology, especially for young people who work, is inevitable. One of the interviewees mentions that she does not need to be dependent on technology because she does not work. Excessive use of social media is also seen as a form of

over-dependence on technology. Another interviewee expressed concern that technology has hindered their ability to do things that they could easily do before.

“For example, my grandchild can type, but it is not easy for them to handwrite. To calculate we depend too much on calculators, and I look for recipes on the internet. Once the internet connection was off, I cannot see the recipes, and I cannot cook.” II3

Theme 3: From online to offline

Most of the interviewees do not interact with people who they do not know online. Only one interviewee enjoys interacting with both people who she knows, and she does not know online, to expand her knowledge. Another interviewee who interacts with people who she does not know online feels the need to be careful.

“When I interact with people I do not know on the internet, I need to be careful to avoid being scammed. Many people send messages which are strange.” II2

Among the six interviewees, only one had met an acquaintance she knew from the internet after checking the person's background and reviews. The rest either have no interest in meeting people they know online or feel uncomfortable meeting new online acquaintances.

“There are not any benefits from interacting with the people who we do not know. What if they are criminals?” II5

Regardless of their lack of interest in making new online acquaintances and meeting them in person, most of the interviewees could describe activities they would like to do with someone they met online when they meet in person. The interviewees will feel comfortable meeting a new online friend if the person has a positive attitude and the conversation goes well.

Most of the interviewees are interested in attending events which interest them. They have mixed feelings about events advertised online and the willingness to attend such events. Some interviewees are comfortable going alone, while others prefer to go with friends. One interviewee mentioned that she usually joins such events when invited by her friends.

Theme 4: Values and hopes

Most of the interviewees in Indonesia have done what they wanted to do. They also have aspirations they hope to fulfill in the future. When it comes to the long-term aspirations, they thought that the factors preventing their achievement are beyond their control.

“To use technology stuff like this, I still cannot do it myself, there should be someone to help me with it. I can use this Zoom myself, but the feeling that I am technologically incapable makes me afraid of making mistakes.” I15

“I want to do Haj trip but must be on the waiting list. I focus more on worship. Last month I went for the Umrah trip, next will be the Haj trip.” I16

Majority of the interviewees in Indonesia believe they can manage without assistance from the others. However, the interviewees with physical limitations, such as difficulty walking long distances mentioned that they need help in those specific situations. One interviewee mentioned that she needs help from the neighbors in checking on her sometimes, which shows a positive neighborhood relationship. When asked about what they can do to help others, most of the answers mentioned financial help to the others.

“When I get additional earnings, I regularly donate to social homes or help relatives who are poor.” I13

Most of the interviewees did not have any specific ideas about websites that could assist elderly women. Only one interviewee mentioned her interest in a website that could help her make friends while also providing opportunities to earn money. Additionally, only one interviewee used the word ‘healthy’ when describing their personal hopes, while the majority expressed hopes for other people when asked the same question.

“I want to do a lot of good things, to help others who need our help. In the rest of our old age, we need to do more in helping the others.” I16

5.2 Insights: similarities and differences between Finland and Indonesia

Similarities

In the theme of social relations and activities, the most popular activities among elderly women participants in both Finland and Indonesia are reading and cooking. In both Finland and Indonesia, elderly women between the ages of 70 and 80 who lost their husbands in their 60s, tend to be more socially active than those aged between 60 and 70. Losing their husbands when they still had the energy for social activities in their 60s, prepared them to be independent and to stay socially active later. One participant from each Finland and Indonesia mentioned their good relationship with a neighbor whom they can seek help or to whom they can provide help.

In the theme of Technology, most participants in Finland and Indonesia use WhatsApp for apps and utilize mobile phone as communication device. Participants in both countries recognized the benefits of technological advancements in connecting people and making daily activities easier to

do, even though technology can sometimes consume a significant portion of their time. They expressed their interest in new technology when it is useful for them and are eager to learn about it. When learning about new technology, they turn to their adult children and grandchildren when they need help. Concerns about scams, fraud, viruses, and security are the predominant challenges elderly women face with communication technology in both Finland and Indonesia. Most participants in both countries worry about becoming overly dependent on and addicted to technology.

In the third theme, 'From online to offline', most participants interact online with the people they already knew and are not comfortable interacting with strangers. However, they are open to the possibility of meeting 'new friends' if these potential acquaintances appear positive and pleasant. Despite their selectivity in making new friends online, they are open to attending events that interest them, that are advertised online. In both Finland and Indonesia, most participants are willing to attend such events alone, without friends.

In the fourth theme, 'Values and hopes', most participants in Finland and Indonesia mentioned that they do not require assistance and are more inclined to help others, showing their sense of independence in their old age.

Differences

In the theme of social relation and activities, among the participants, children in Finland usually no longer live with their parents when they become adults. Adult children in Indonesia no longer live with their parents once they get married or move to other cities for education or work. Widowed elderly women in Indonesia tend to live with their adult children and their families.

While the gym is one of the most popular activities among elderly women in Finland, it is not a popular activity among elderly women in Indonesia. In Indonesia, especially Jakarta, the lack of pedestrian walkways is one factor that prevents elderly women to be active. In Indonesia, religious activities such as praying gathering, bible study and church choir are some of the popular activities among elderly women, while none of the participants in Finland mentioned about religious activities as their favorite activities. Trip with family is a popular activity among elderly women in Indonesia, too, when their children include them in trips with their families. A similar pattern was not mentioned by participants in Finland.

In the second theme, Technology, besides mobile phones, the participants in Finland use other devices such as laptops, tablets, and personal computers. In contrast, participants in Indonesia mostly use mobile phones. While participants in Finland often ask their adult children when they learn about new technology or face problems with it, the participants in Indonesia often receive help from their grandchildren with whom they live.

Participants in both Finland and Indonesia recognized that people are dependent on technology. However, two participants in Indonesia mentioned that since they do not work, they are less dependent than those who work, indicating that there are segments of the Indonesia population who do not rely heavily on technology. The ability to use technology at their age brings confidence to elderly women in Indonesia, as mentioned by two participants. A similar sentiment was expressed by any participants in Finland. not mentioned by any participants in Finland. While two participants in Finland mentioned their concerns about data, data privacy and security, these concerns were not mentioned by the Indonesian participants. The participants in Indonesia may not have fully realized their rights to data privacy yet, especially since the Personal Data Protection law was newly passed in 2022.

In the third theme, from 'Online to Offline', most participants in Finland and Indonesia are not comfortable interacting online with strangers. In Finland, the reason participants avoid such interaction is mostly because they are not interested in people who they do not know. In Indonesia, they refrain from interacting with strangers online to protect themselves from the possibility of scams, frauds, and security issues which are quite common.

In the fourth theme, Values and hopes, most of the participants in Finland mentioned that they are currently doing what they want to do now, and they are content with their lives. Participants in Indonesia still have things that they want to accomplish, and when it comes to goals they cannot achieve in the near future, the reasons for not being able to do so are often beyond their control. When asked what they can do to help others, most of participants in Indonesia mentioned financial help as their way of helping, while no participants in Finland mentioned financial help in their responses. When asked about their hopes, participants in Finland mentioned 'health' as their hope for themselves and others. Indonesian participants gave more diverse answers mentioning their hopes for their children, grandchildren, and others before mentioning about themselves. Participants in both Finland and Indonesia mentioned that they typically do not need help, except when dealing with authorities (for two foreign-born participants in Finland), or due to physical limitations preventing them from walking long distances (for two participants in Indonesia with weak legs).

Insights

Figure 12 shows the insights and needs derived from semi-structured interviews with participants in Finland and Indonesia for this thesis. Color difference shows theme difference as produced in the previous Chapter 5.1.

Elderly women thrive when they have support of their families and friends, as well as opportunities to engage in activities they enjoy. These elements contribute to active aging, foster social inclusion, and reduce loneliness. On the technological front, elderly women may require assistance with using technology, learning new technology and when facing problems with technology. They also need a safe online environment and elderly women-friendly education about online safety. The AI-powered matchmaking platform for friends-making and community building would be needed to find friends and activities online that can be extended offline. To support the values and hopes of elderly women, they need to feel independent, and able to help, while at the same time being able to fulfil their plans and hopes.

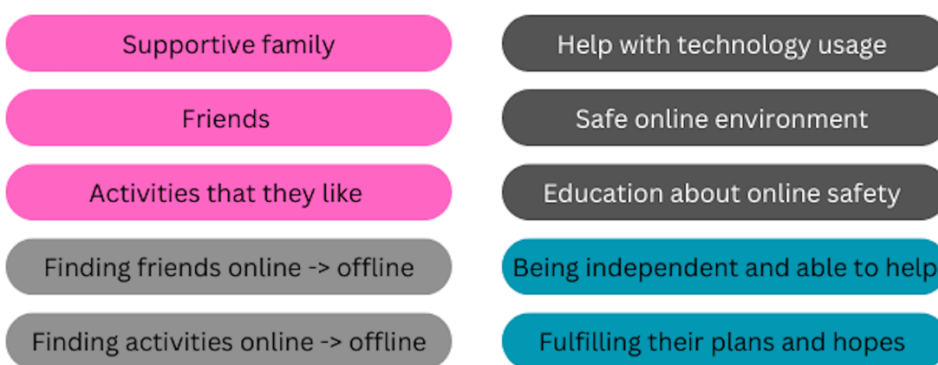


Figure 12. The insights and needs of elderly women in Finland and Indonesia

The participants of the research in Finland and Indonesia were all women. In this thesis, the research was not done to male participants, therefore an empirical comparison between elderly men and women cannot be written this time. However, since being a woman increases the probability of having close friends for both internet users and non-users (Gil-Clavel & al., 2022), it can be said that an online platform that can help elderly women make friends and stay active is very important for elderly women to respond to their needs, maintain close friends online and offline, and to learn to use technology more independently. The help with technology usage and education about online safety will help elderly women to use the platform more effectively according to their needs.

5.3 How might we?

'How might we?' is a pre-ideation step of service design process. In this thesis, it is situated in the beginning of Develop phase within the Double Diamond model. 'How might we?' can be initiated after the problems and needs of the project have been defined. It is "an excellent, systematic method to prepare for ideation which bases ideas firmly on research and existing knowledge" (Stickdorn & al. 2018b, 111-114). This method begins by taking key insights which are developed from research data and use them to formulate trigger questions. The trigger questions are then

grouped, and the most relevant ones are chosen. As the final step of this method, multiple answers are generated for the chosen questions. (Stickdorn & al. 2018b, 112-113). These multiple answers represent potential solutions to the defined problems.

Figure 13 shows the trigger questions obtained from the key insights and needs from Figure 12. Each trigger question is related either to the theme social relation and activities, or theme Technology, or theme from online to offline, or theme Values and Hopes as written in Chapter 5.1. In accordance with the topic of this thesis, the trigger questions which were related with matchmaking platform that can directly help the elderly women to find friends were chosen as the main 'How might we?' questions. They were chosen without ignoring the importance of other trigger questions when building up the concept. The chosen trigger questions were 'How might we help elderly women to create friendship online that can extend offline?' and 'How might we help elderly women to participate in events they find online that can extend offline?'. Ideation was then carried out by using these questions. Brainwriting was the ideation method which was used this time. In brainwriting, participants work in parallel and in silence, writing their ideas and observations on paper. Each idea is written on separate paper. (Stickdorn & al. 2018, 117-119.)

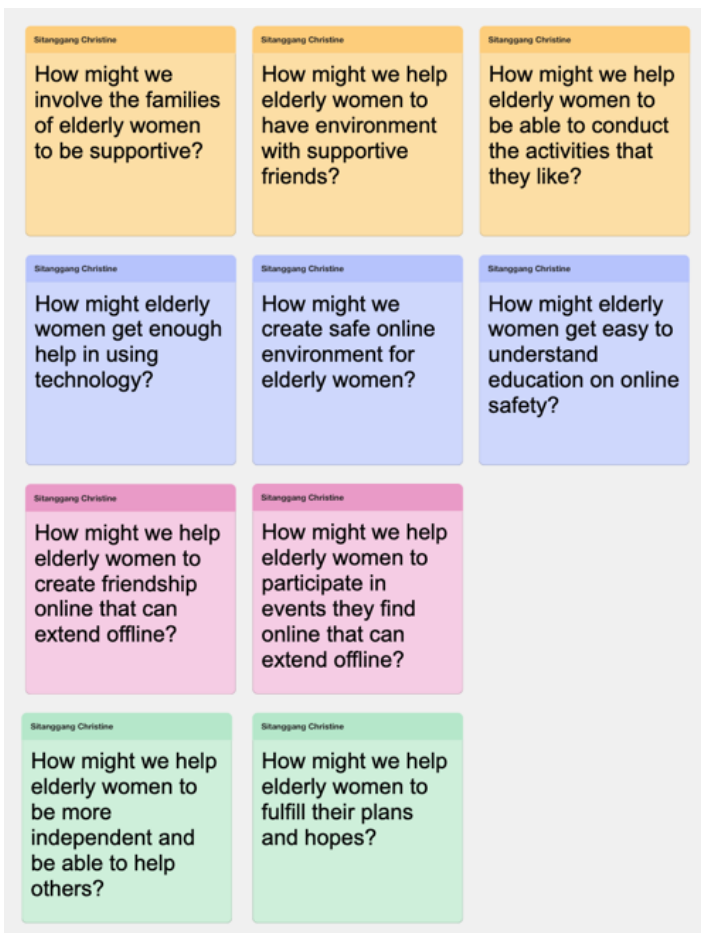


Figure 13. 'How might we?' questions that can help elderly women in this thesis project

During the brainwriting session, the thesis writer wrote as many ideas as possible about how elderly women can create friendship and find activities online which can be extended offline, as shown in Figure 14. Interaction with individual with the same interests, group chat involving people with the same interests, easy-to-understand instructions, activities, and topics which interest them, offline events with interesting topics, offline events which are easily accessed and understood, and AI or technology that can help create safe online environment for women are some of the ideas that were produced. Based on the ideas from this ideation process, the first prototype was created.

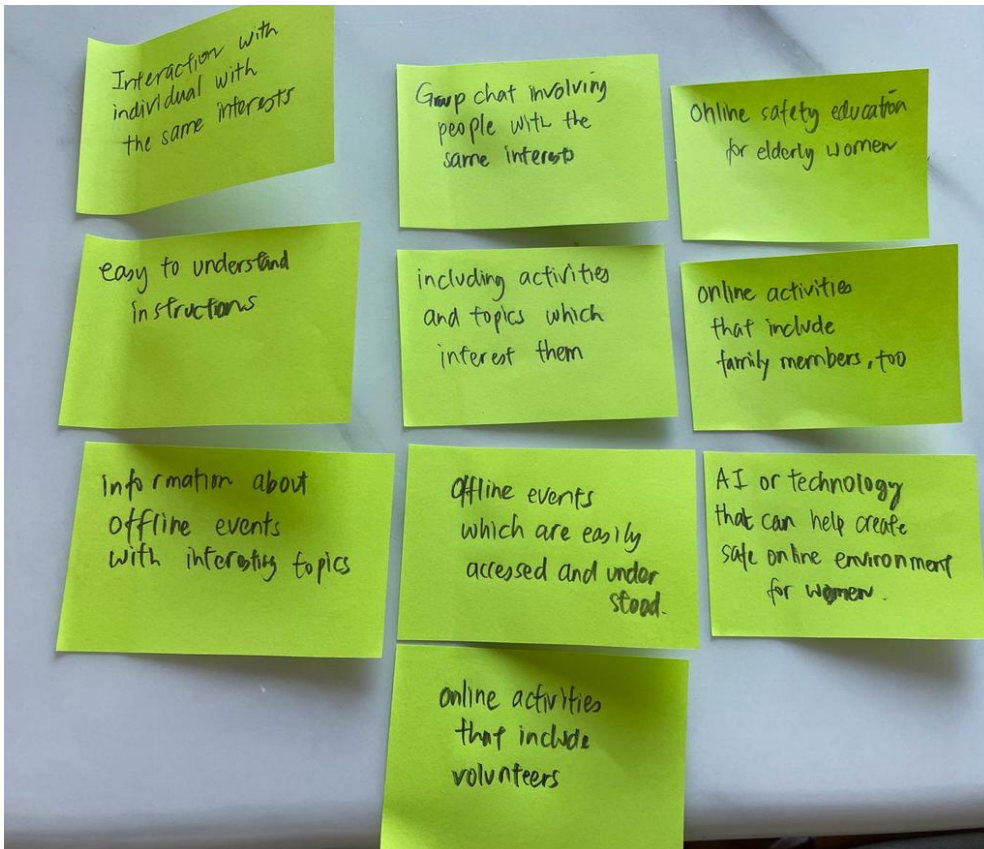


Figure 14. Brainwriting for the ideation of elderly women's friend-making and event participation

5.4 Quick prototyping from insights

"Prototyping is used to explore, evaluate, and communicate how people might behave in or experience a future service situation (Stickdorn & al. 2018a, 210)." By prototyping, important aspects of a new service and different alternative solutions can be quickly identified, solutions that might work can be systematically evaluated, and a shared understanding of ideas and concepts can be effectively created. Prototyping is used to reduce risk and uncertainty as early and as cheaply as possible to improve the result. By turning the ideas into prototypes and testing them with the real customers, personal biases are kept in check, and the produced work is grounded rather than assumptions. (Stickdorn & al. 2018a, 210.)

The first step in prototyping is deciding the purpose and what to achieve. The next step is to decide prototyping questions, which is followed by assessing what to make or build. Planning the prototype is on the next step of the process and is followed by running prototyping sessions. (Stickdorn & al. 2018a, 212-227.)

In this thesis, explorative prototyping was used to create new options based on the insights in sub-chapter 5.2, and ideas in sub-chapter 5.3. The early prototype is a mock website, which was created by using Figma, “a free, online user interface tool to create, collaborate, prototype and handoff (Figma, s.a).” Using this interactive mock website, elderly female participants can try to find friends and activities from the point of view of elderly women.

Figure 15 shows the steps that elderly women can take when using the mock website, from logging in, choosing chat and events, and reaching the intended destination page. The prototype is mainly divided into two main areas: the section for individual and group friend-making, where an elderly woman can chat and interact with other elderly women, and the section for events available for elderly women, where the elderly women can choose and participate in events which they are interested in. The friend making section itself is divided into individual sub-section and group sub-section. In the individual sub-section, with the help of AI, the elderly woman can find other elderly woman with the same interest to have one-on-one online interaction/ chat about a specific topic. In the group sub-section, the elderly woman will be guided to an activity group she is interested in and interact/ chat with the group members there.

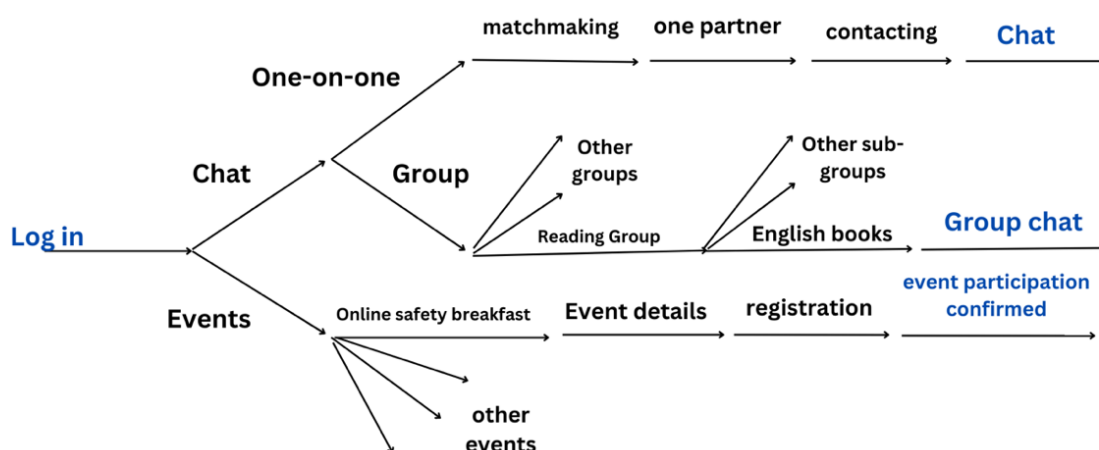


Figure 15. The steps of clicking options in the prototype, from logging in until destination

The prototype is then tested by using the thinking aloud method. In order to know how easy the prototype is used and whether the contents of the prototype need revisions, participants tested the prototype, by conducting these three tasks on the prototype:

- to chat with somebody individually online about a specific topic
- to chat with members of English books reading group
- to register to an event called 'Breakfast with seminar online safety for senior ladies'.

The prototype which was tested with participants in Finland (Figure 16) is similar with the prototype which was tested with participants in Indonesia (Figure 17). The prototype for Finland is in English language and the prototype for Indonesia is in Indonesian language (Bahasa). The groups of activities which were written on the prototypes are the activities which are popular for each country. There were slight differences in the prototypes on the activities organized in each area. For example, while the activities in the prototype for participants in Finland include Visiting Porvoo, Fun Gym, and Thai Cooking activities in Helsinki and around, the activities in the prototype for participants in Indonesia include Trip to the Old Town, Afternoon tea for the nationalist and religious, and Aqua Walk activities for elderly women in Jakarta.

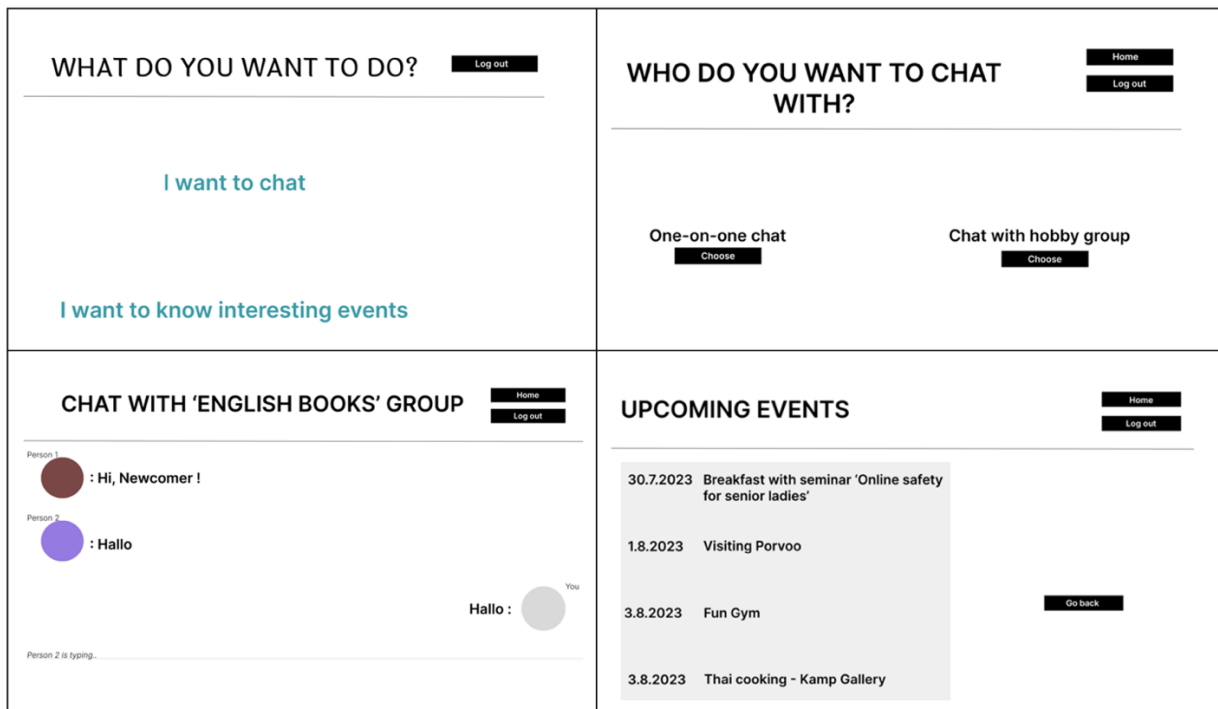


Figure 16. Screenshots of several pages from the prototype tested by participants in Finland

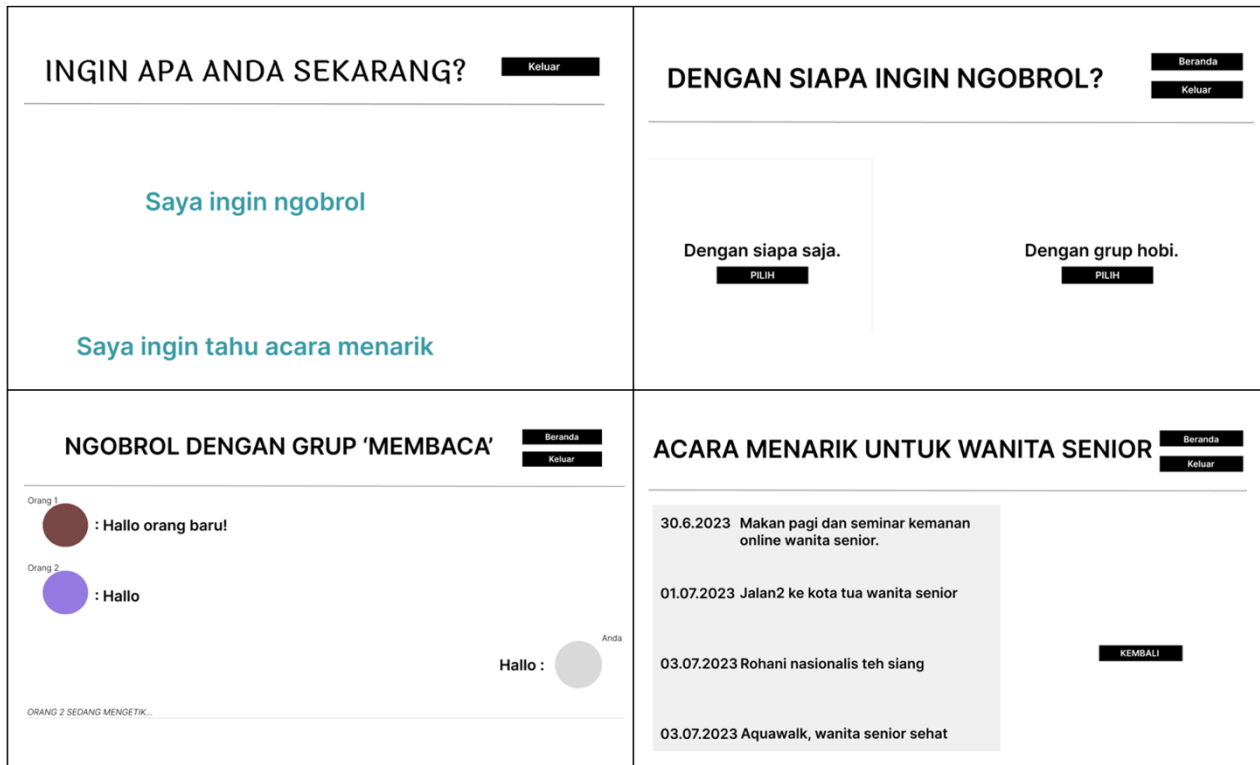


Figure 17. Screenshots of several pages from the prototype tested by participants in Indonesia

5.5 Analysis and findings from prototype testing

The qualitative data from the thinking aloud testing process for the prototype in this thesis is analyzed by using template analysis method. Since chronologically the prototype testing was conducted with participants in Indonesia first, this sub-chapter would start from the analysis of the prototype testing data from participants in Indonesia, before continuing with participants in Finland.

5.5.1 Indonesia

The initial coding template for the template analysis of the data gained from the prototype testing with thinking aloud method was built and is shown in Appendix 3. This template was applied to the rest of the data. Update was done by deleting, adding, and refining the themes. Details about the participants of the prototype testing in Indonesia can be seen in Table 9. The final coding template as the result of template analysis of the prototype testing using thinking aloud method can be seen in Appendix 5. The themes in the final coding template for the participants in Indonesia are: The prototype test flow, Social relation and activities, Opinions and emotions, and The challenges.

Table 9. Details about participants of prototype testing with thinking aloud method in Indonesia

Participant	I12	I17	I18	I19	I15
Location	Indonesia	Indonesia	Indonesia	Indonesia	Indonesia
Marital status	Widowed	Single	Married	Married	Widowed
Language	Bahasa	Bahasa	Bahasa	Bahasa	Bahasa
Age (years)	Mid 70-80	Early 60-70	Early 60-70	Late 60-70	Early 70-80
The core session length in minutes	05:42	09:50	08:15	08:35	09:58
Total length in minutes	07:01	13:53	12:41	09:27	13:52

Theme 1: The prototype test flow

The participants in Indonesia were not accustomed to the habit of verbalizing their thoughts while completing tasks. During the thinking aloud testing session, they tended to focus on the prototype displayed on the laptop screen, think, and click the intended button without verbalizing them. Due to that reason, the writer of the thesis asked them to read aloud the text on the prototype instead of thinking aloud, to let them freely express themselves.

To ensure a continuous testing process, if a participant took a bit longer time between steps, they were gently reminded about the task, and the task was read again to them. Especially at the beginning stage of the test, the participant would be asked about the option she would choose and would be guided on how to move the mouse to the intended button on the screen.

All participants in Indonesia read aloud the text on the prototype and asked questions during the process. Most of the questions were to confirm the choice they would make and what to do next. All participants answered and responded to the questions that the writer asked during the thinking aloud session.

Asking for confirmation and what to choose or to do next showed that the participants tried to be careful and not to make mistakes in choosing the options given on the prototype. Two of the five participants did not agree to the options they read aloud, and they instead mentioned an option which they were not supposed to choose. When these participants needed to choose between 'I want to chat' and 'I want to know interesting events', instead of choosing 'I want to chat', which was the choice they should have chosen to complete the task, they chose 'I want to know interesting events.' The participants preferred to participate in 'interesting events' as mentioned in the third task rather than chatting one-on-one in the first task or chatting in groups in the second task. Not being comfortable chatting with strangers was the reason why they did not like one-on-one chatting and group chatting.

“Not easy for me to talk with other people. It is such a hassle. I need to be careful. Even when I worked before, I was busy, and I needed to be selective with whom I talked to. That is why I cannot speak with random people.” 117

Beside the two participants, there was a participant who thought that she would not be able to do chat activities because she was busy, and another participant who concerned about whether the conversation in the chat would be relevant if done with people who she did not know. Only one participant whose age was 70-80 did not show criticism about chatting online, whether it was individual chat or group chat.

Most of the participants had not previously used the device, MacBook laptop, and needed guidance in operating the device. While they needed guidance at the beginning stage of the test, they became more adjusted in using the device, and more familiar with the pattern of the prototype at the later stage of the test. This was shown by their taking proactive steps by not asking what to do anymore, but instead confirming what they want to do next or choosing option proactively.

Theme 2: Social relation and activities

Among the participants of the thinking aloud prototype testing session in Indonesia, one participant was still in connection with her childhood friends. However, the friends she currently interacts mostly with are friends from church and choir circle. While friends with the same religion are important in social circle, another participant mentioned that she enjoys mingling with friends from different religions, too. A participant who maintained a close friendship with a long-time friend frequently discussed their shared interest and managed to stay connected even after the friend moved to a further place. Among the participants, friends are people with whom they can feel happy to be and to do things together, with whom they can share their topic of interests comfortably, and who have been in their circle for years.

During the prototype testing session, the participants mentioned about their adult children and grandchildren, but not their husbands. Playing with grandchildren is one source of enjoyment for participants with small grandchildren. These participants also helped their adult children take care of the grandchildren, which is also a responsibility for them.

For the topic of interest, health is the interest which most of the participants mentioned. The talk about funny and happy things, combined with music and dance is the topic of interest who one participant mentioned. Compared to the other participants, this participant is in the early group of age of 60-80 years old range, single and does not have any children nor grandchildren.

As for their current activities, some participants enjoy independent activities such as reading and gardening. In the second task of the thinking aloud prototype testing, finding an English book reading group and chat there was the task, a participant agreed to continue to complete the task, even though personally reading is not an activity she enjoys the most. Some participants are busy with their activities of combining work, taking care of her small grandchildren, and participating in volunteering activities in church. While a young grandmother in her early 60s is still busy with small grandchildren, an elder grandmother in her 70s no longer needs to take care of grandchildren, so that she can contribute more time to church and choir activities. A participant joins a monthly arisan gathering, a popular type of socialization in Indonesia among women.

“For activities, I joined an arisan gathering once per month. For the arisan, we enjoy food, which is not expensive, but it is still a fun gathering. It is an arisan, but each member pays for herself. So, the food is modest, let us go there...the food is cheap, not expensive.” I18

Arisan is a gathering where a decided amount of money is collected from each member monthly and is given to one lucky member. In the original arisan, the place of gathering is the house of the receiver of the collected money. The receiver hosts the gathering and provides food and drinks for the gathering. (Indra, 2022.) Compared to this original arisan model, in the modified arisan that the elderly participant participates in, the receiver of the collected money does not have to host the event at her home. Instead, members meet in a reasonably priced restaurant, making hosting arisan gathering easier for the host.

Theme 3: Opinions and emotions

After a guided testing for the prototype, participants were asked about their opinions. Most of the participants said that the testing was not difficult for them. A participant mentioned that for people who are good in using technology, the prototype might be easy, but not for her. When the writer praised the participant that she adjusted better and better to the tasks and did very well, the participant humbly mentioned that she might not be able to navigate a more complicated one.

The participants mentioned that the reasons why they were hesitant in going through the process in the prototype testing, and in using technology in general are because they are old, and they are not confident in using technology, are afraid of making mistakes.

“If there is nobody at home, and I need to use this kind of technology, I already feel nervous, for the fear of making mistakes.” I15

The participants use self-deprecating sarcasm (Barron, 2022) in some parts of the thinking aloud prototype testing session, joking at herself by overstating a sense of inferiority, in this case being an old grandmother.

“Opinion? For old grandma no need to go here and there...just need to wait for the call (from God).” I12

Communicating with friends with the same interests, exchanging information, solving problems together, chatting, having a fun talk with relevance, those bring happiness to the participants, and make the participants feel less lonely. Being religious is an emotion that could also be felt from the session where modesty and politeness were expected. Independence is when one can go and visit events by themselves without asking for help from their adult children. The participants showed humbleness when it took them a bit longer for her to navigate the prototype.

“Where is it? I do not understand... you see, I am a floor cleaner (mentioning her house chore at home which is different than navigating prototype when the participant could not find something on the screen).” I17

The participants showed that they are uncomfortable if they must communicate with strangers online. According to them, it would be awkward, and the talk can turn irrelevant. They are cautious in talking and communicating with people who they do not know. Cautiousness can be seen when a participant asked many questions about the person with whom she would chat online on the mock website and when the participant saw the event participation fee on the mock website. The participant then realized that it was a mock website, after getting the explanation.

Theme 4: The challenges

This theme is mainly divided into two: the challenges when participants use the interface (the prototype and the device), and the challenges from the contents in the prototype.

When encountering challenges, while using the prototype and device, the participants tended to self-blame themselves when it took them a long time to navigate the prototype. A participant complained that she could not see a page clearly. Another participant mentioned that she had stiff hands, and she is already old. Another participant expressed that she is not technologically capable and is not confident in using technology. When using technology, the participants often feel that they need help from others and feel nervous if they make mistakes when using technology. The participants mentioned that they had never used the device nor similar website before. Participants who usually ask for help from their adult children when they face problems in using technology rarely thought to reach out to customer service or help center. One participant mentioned being unaware about the existence of such resources for seeking help.

“Oh, I do not know how to ask ...I do not know. I am not clear about it, so I do not know (about the help center).” I15

The challenges in contents can be divided into two parts. The first part is the challenges in the chat section of the prototype, and the second part is the challenges in the event section of the prototype. For the chat section, which consists of one-on-one chat and group chat, the challenges in the contents can come from habits and thoughts. For example, the participants are selective in choosing friends and prefer not to interact with strangers. One participant even mentioned that online chat is unimportant for her. Several participants avoided making online acquaintances and were worried that the talk with strangers turn irrelevant.

“Very seldom, if I do not know the person that well, I do not (talk with him/ her). If it is not important. The talk will be irrelevant.” I18

For the group chat, some participants could not find the specific groups that they wanted to join. An inevitable reason which challenges the contents, no matter how good the contents are, is the non-availability of time. For example, as a participant is busy with her work, taking care of grandchildren and various regular activities, she is unable to join events even though she finds them interesting.

Even though the participants tend to favor the event section than the chat section on the prototype, there are still challenges within the event section on the prototype. One participant whose feet have weakened in the last few years mentioned that other than the regular programs she has joined, she seldom goes to attend new events. Another participant showed her interest in joining events, however she prefers to join events which are near her place, to avoid asking help from her adult children to take her there. The participants are interested in joining events which are relevant to their interests. They prefer events with reasonable or even free admission fees, modest gatherings where they can enjoy themselves in good company.

“If going to event like seminar, I am ok in joining. But if the place is too far, it is difficult for me to reach it. So sometimes my interest to go to the event became less and then I have no more interest (because of the distance).” I15

5.5.2 Finland

The 2-layer version of final coding template for participants in Indonesia served as the initial coding template for the template analysis of the thinking aloud method from the prototype testing with participants in Finland (Appendix 4). Coding template was developed, and the final coding template for the prototype testing for participants in Finland is presented in Appendix 6. Details about participants of the prototype testing in Finland can be found in Table 10.

The themes in the final coding template for the participants in Finland are: The prototype test flow, Social relation and activities, Opinions and emotions, and The challenges.

Table 10. Details about participants of prototype testing with thinking aloud method in Indonesia

Participant	IF7	IF8	IF2	IF9	IF10
Location	Finland	Finland	Finland	Finland	Finland
Marital status	Single	Single	Married	Married	Single
Language	English	English	English	Bahasa	English
Age (years)	Early 70-80	Early 60-70	Early 70-80	Early 60-70	Late 20-30
The core session length in minutes	04:28	04:26	03:13	04:43	03:43
Total length in minutes	16:50	17:57	15:59	20:10	17:03

Theme 1: The prototype test flow

The participants in the thinking aloud prototype testing combined reading aloud and thinking aloud in doing the tasks they were assigned. Not only did the participants read the text on the screen, but they also verbalized what they thought. In addition to thinking and wondering what option they should take next, many of the participants explained or mentioned additional things that supported the verbalization of their thinking to complete the given tasks. Sometimes participants forgot that they needed to verbalize what they thought and went quickly to the next stage by clicking the buttons on the laptop. However, they would stop and resume verbalizing their thoughts again after being reminded to do so.

The participants selected and confirmed their options. They asked questions when there were uncertain about things, particularly during the initial stage of the testing. They also answered the questions which were asked to them. When they noticed there were mistakes on the prototype, they recognized the mistakes and expressed them to the researcher. The participants did not need guidance on how to use the mouse of the laptop, or on how to move from one page to the other page on the prototype. All participants had the basic knowledge to operate mock website and navigate the prototype.

Theme 2: Social relation and activities

All participants have friends, and some connect to their friends on channels such as Facebook and WhatsApp. These friends are people with whom the participants go to events together, who help them when they have problems with computers, who help them with their dog and pets, or who they met in the club for dog or pet owners. Besides being busy with their own activities, some participants are also busy with their husbands and their families.

The elderly participants in this prototype testing have interest in music, theaters, concerts, and cinemas. They are interested in events organized in nearby areas, including events such as visiting a specific area, or a cooking class. Associations and churches have tried to keep people active by

organizing events. The participants know that there are already online groups on Facebook. The topics about cultural talk and presentation which people can discuss are interesting topics for the elderly participants. The groups discuss different topics, from the talk about dogs to the talk about politics. The participants expect a positive group experience.

“Even though I did not know anybody before, we had a little talk. There was some laughing because somebody said some kind of joke or something like that. So, it was very nice, that is good to go there. Feel, so you do not have to go there and see that everybody looks at each other how much he can weigh up or something like that. (Laugh) It was nice, yeah.” IF2

Theme 3: Opinions and emotions

The participants mentioned that the tasks that they completed were easy to proceed, because there was clear explanation, instruction, and there were not too many details on the pages. However, it would also depend on the elderly women’s experience in using technological devices and websites, with age being one of the important factors. For example, it would be challenging for an elderly lady aged 80-90 to complete the tasks due to the lady’s not having exposure to the technological advancements that would enable them to use technology effectively to complete the tasks.

“...she could not even send an email so..it could have been interesting to see how she goes with that kind of thing. But I think the instructions on the website itself are very clear. It is like click on here click on there, because sometimes on the website it does not say click. You have to know that this is the place to click.” IF10

Trust is an important quality for elderly women in Finland. Different generations have different attitudes towards trust. In Finland, the older the people, the more important trust is for them. To be able to establish trustworthy relationship among individuals who do not know each other online, elderly women often prefer to observe and experience interactions before trusting.

“...but for us the seniors, we need to see first before trusting. This trust is important...” IF9

These days, there are numerous platforms where people can express their opinions through writing. However, with this online freedom, it is easier for people to be rude when they are not in face-to-face interaction. The participants mentioned that people need to follow group chat rule and administrator can give penalty to the people who do not follow the rule.

Two of the five participants in Finland mentioned that Finnish people are shy, and it is not easy for them to communicate with strangers. However, one participant mentioned that online one-on-one chat is easier to do and needs less courage than face-to-face meetings. According to the participant, online one-on-one chat is suitable for casual conversation, while group chats is a better

choice when one wants to get into deeper conversation. Engaging in hobbies and joining communities are recommended ways for elderly women to be active.

“Maybe it is easy to say, but to really go to an event maybe not be that easy. If there is a neighbor or other person who can go together, they will have the courage, but to go alone will need more courage.” IF9

The participants mentioned that elderly people and young people have different attitudes towards online environment. Young people are already in other platforms outside Facebook, while elderly people still stay on Facebook. Elderly people feel more comfortable if there are some people who they know inside the online group. For elderly people in Finland, being alone is a choice, and being alone does not mean that they are lonely.

Participants were asked which task from the mock website they liked most. Most of the participants answered that they liked the third task most, which is finding events. The second one they liked is the group chat where they can chat and discuss their topic of interest. The one-on-one chat is the last choice that the participants would use. However, one participant mentioned that due to her wide social life, it is easier to do online one-on-one chat with a light topic. If she chooses group chat it might be tiring for her, even though it is exciting. It would depend on the purpose of a person whether she prefers one-on-one chat or group chat.

“Nowadays, I do not seek chatting options on the internet. I can look for different kinds of events there.” IF7

“I think it depends on the person. But I think if someone is not very active maybe they want to leave the house.” IF10

“The second one (group chat) can support that (finding events) perhaps if you could find a group that can do these things together, they can support each other.” IF2

There are both positive and negative emotions in this prototype testing. For the positive emotion, all the elderly participants feel content about having friends. Some participants mentioned that they do not need online friends because they have enough offline friends. They do not seek online chat friends and are more interested in events.

Based on previous findings, it was thought that participants felt inconvenient communicating with strangers online. However, some participants did not feel uncomfortable when communicating with strangers on Facebook. Despite not being as comfortable as a face-to-face meeting, the elderly women mentioned that using video platforms such as Teams was not inconvenient for them. They

mentioned that it is helpful to use the platform during the Covid-19 pandemic, especially because the members already knew each other before video meetings.

Curiosity is one positive emotion that could be felt from one participant when she was interested in knowing what is behind a mock event mentioned on the mock website, even though it was not the main task. Another positive emotion is that in the spirit of doing hard exercise of a sport, one participant talked about her experience being in a fun and nice group environment with whom she had exercise together. Positive emotion is also when a participant mentioned that she thought about joining an English book club before knowing that group chat with an English book club would be one of the tasks in this prototype testing.

“OK, actually I would like to see what is behind the fun gym (after noticing the option).” IF2

“Something like..it could be just anything that gives strength to your muscle but something that it is something fun, so you have nice group and laugh in the between but sound very...” IF2

While the participants did not have problems in completing the given tasks, some mentioned that certain elderly women might not feel confident in using technology. They have a fear of computer and worry about the complexity of operating devices and apps. Another negative emotion is caused by limited sight. One participant mentioned that it was annoying to have to locate her eye-glasses before being able to answer a ringing phone.

One participant expressed her interest in a specially designed online channel for elderly people. For online groups, participants mentioned that there should be rules in online groups and consequences if not following the rules. People need to learn new things such as listening, to be able to create dialogue. Smaller online groups are good for deeper topics, where members receive more attention than in bigger groups with more general topics, which are harder to keep up with.

For events which are advertised online, more detailed information about the events is needed. Events located nearby are also preferred. If there are no issue with mobility, events that can keep the elderly women engaged offline could be the most popular feature to keep the elderly women active. To create a successful event, the organizing association should be active in arranging it.

Theme 4: The challenges

The fear of computer is one of the challenges in using technology interfaces for elderly women. The fear might come from their lack of familiarity with devices and apps. The elderly women who hardly use computers, or hardly use apps or website may face problems using them if the website is not user-friendly, or if they have limited hand movement.

One participant mentioned that whether elderly women can easily complete the tasks or not depends on their familiarity with technology. Some elderly women are comfortable using computers and social media, while others may not be familiar with one or both. It would also depend on age and their career before retiring, whether they experienced technological advancement in the past. Some elderly people do not have email addresses, and they do not use the internet, either.

“Let us say you are in your 70s and you retired 10 years ago. Computers were already, even mobile phones already...technology was pretty advanced, and you somebody works in IT (Information Technology) or something, of course they have more knowledge than somebody who works as a kitchen cook or something.” IF10

A guidance on how to use the program or website is needed to let elderly women use the website well. Help button on the first page is helpful, to help them navigate the website. The language used should be the daily used one with clear explanation, easy to understand, and step by step process. They need to be encouraged to learn new things, especially recent technology.

“... there should the system the guidance on how to use this program. Nothing like professional language, but like everyday language, slowly, step by step show how it goes. And then, how do you get... older people they want to learn new things.” IF8

For the problem in viewing screen, using a big screen to view website is one option that can be done. The letters which are used on the screen should be big enough for elderly women to see, and the page should be made simple with a few options to choose.

The challenge for the one-on-one chat for the elderly is that it is not easy for Finnish people to talk to strangers. Since elderly women in Finland are not used to one-on-one online chat, it is good to exchange contacts and meet face-to-face later. Two elderly participants mentioned that even though they feel comfortable chatting one-on-one with strangers online, they do not think Finnish elderly are used to the idea. Participants prefer online group chat to online one-on-one chat.

There are various kinds of online groups, but the effects of group chats to elderly women differ from those on younger generation. A group with different kinds of people and different ideas and opinions, can lead to arguments among the participants, and rude comments were sometimes posted on groups. While diversity is a good element in a group, people also quarrel because of differences among themselves. For elderly women, even though there are many challenges in group activities, a group which is interested in the same topic would make it easier for elderly women to talk to strangers online. If one is interested in a topic, but they do not know anyone who is interested in that topic, it is good to know more about the topic from people who are interested in it.

“...it would work better if there was group with just the same topic ...maybe that would even make it easier to talk with strangers. Because its maybe would be harder to start the conversation if you do not know someone just if nothing...maybe that would be even a better way to talk about something...with about the same topic.” IF10

When the participants were asked about their ideas about a good group, they mentioned that a big group is good to discuss general issues, and a small group is good to discuss sensitive issues. One participant suggested that a group size of 5 to10 people is ideal for discussing topic. There should be a way to remove disruptive members from group to ensure a positive group experience. A person should participate in more than one group to gain a broader perspective. Before meeting online, it is always good to meet group members face-to-face at least once. Rather than visiting it once or twice in a while, staying active in a group is one way to make the group stay longer. To unite a group with diverse types of people inside, they should do something together.

“I think one person should have more than one group, because then you get a wider picture about the world. And of course, also some of the groups have different kinds of people who have different ideas about issues. And then hopefully there would be fruitful discussion about different perspective.” IF8

Events with good program, located nearby, charging reasonable or free-of-charge event fees, and providing fun activities are liked by participants. The participants also suggested an online event website that they can be search based on their interests. Clear explanation and useful information about the events are important for elderly women. Events can be supported by group chats, and organizers need to be continually active in creating and organizing events. Most of the participants mentioned they liked the events part of the prototype most and would use the events first among other features in the prototype if there is such website of matchmaking platform.

Other challenge for elderly women in the online matchmaking platform is the security, with one participant mentioned that she had anti-virus and VPN (Virtual Private Network) installed in her device. She also mentioned that in online platforms, she only befriends people who she met previously offline. One participant mentioned the challenge of keeping up with the technology after retirement, since she did not receive information about recent programs and that recent programs are expensive. When facing problems with technology, elderly women tried to find people who can help them with technology, whether they are the family, adult children, neighbors, friends, or places like libraries.

6 Discussion

This chapter covers recommendation, and validation as the last stage of the Double Diamond service design model (Figure 11). RQs are answered as well. Research ethics, reliability and validity of the thesis, limitation and recommendation for further research, and reflection will be written in the later part of this chapter.

Elderly female participants in both Finland and Indonesia shared a common preference to maintain and nurture relationship, the preference which is shared by elderly women in another place in the world (Praveena, 2021). Trust was an important factor for online interaction among elderly Finnish women, while elderly Indonesian women showed bigger cautiousness in interacting with strangers online. Overcoming the fear of technology (Johnson & Finn 2017, 145-157) and problem of limited vision (Johnson & Finn 2017, 27-53) were challenges for both elderly women in Finland and Indonesia. The women in both countries expressed a desire for user-friendly platform that can facilitate meaningful social interactions and events.

The participants in both Finland and Indonesia in the semi-structured interviews and the prototype testing with thinking aloud method in this thesis recognized the importance and benefits in communication technology in daily life and in connecting people. However, insufficient skill to use technology often prevents them from utilizing communication technology well. The skill in digital literacy and information on relevant technology are crucial for digital inclusion for elderly women (Akinola, 2021).

The findings from this empirical study show the differences of the ability to use technology among elderly female participants living in the Helsinki metropolitan area and the Jakarta metropolitan area. Variables such as age (Koironen & al., 2020), career before retirement (Arief & al., 2018), the length of time after retirement, the usage of technology after retirement (Rinderud, 2021), their activities, their interest in technology, the help that they can get from the others, the necessity of technology in their life, affect their capability in using technology.

The higher the age and the less connected their previous career with computers and IT, then the less likely they are capable in using technology. The longer it takes from retirement and the less they use technology after retirement, the less likely they can use technology. The less their current activities involve them in technology and the less they are interested in it, the less likely they can use technology. The less help they get from others and the less necessity they have in using technology in daily life, the less likely they are capable in using technology.

During the prototype testing using thinking aloud method, the participants in Indonesia needed guidance in completing the tasks given to them. They became better in operating the prototype at the later stage of the testing. The participants in Finland on the other hand did not need as much guidance. One participant in Finland made mistake at the beginning of the testing, but that participant managed to go back to the right track by herself. The followings might be the reasons of why the participants in Finland seemed more capable in using the prototype and laptop than the participants in Indonesia:

- While participants in Indonesia use mostly mobile phone as device, participants in Finland use other devices such as tablet, laptop dan desktop as well. This made participants in Finland become more experienced in using various devices, including MacBook laptop which was used during the testing.
- Digitalization is applied more widely in Finland than in Indonesia in daily life. For example, banking transactions are often conducted online, and people seldom go to the bank in Finland, while in Indonesia people often go to the bank for transactions, even though digital banking is available. The necessity to use technology in the digitalized era in Finland made the elderly people inevitably need to be able to use technology.
- The fact that elderly women in Finland tend to live by themselves and do not live together with their adult children made it necessary for them to use the technology well and independently from their adult children, while the elderly women who live with their adult children in Indonesia (Cameron, 2000) can always ask the children how to use technology.
- The retirement in Finland starts between the age 64 and 68 years (Finnish Center for Pensions, s.a.), while in Indonesia retirement age is 58 years old (Timorria, 2022). An elderly woman in Finland would have shorter time from the time she retired than another elderly woman with the same age in Indonesia. The IT capabilities of the elderly women in Finland that they got from work is more recent than their counterparts in Indonesia.
- Volunteering is a popular activity among elderly people in Finland (Tedre & Pehkonen, 2014), and some volunteering activities in their neighborhood require operating computer, while in Indonesia elderly people are not expected to do volunteering work. When elderly people do activities or hobbies in their old age in Indonesia, the activities do not usually involve computer.
- Beside asking their adult children, elderly people in Finland can ask library or join a class for the elderly when they want to know more about how to use technology. In Indonesia elderly people usually ask their adult children or grandchildren, and there is no service for teaching elderly people computers.

Some attitudes in choosing options while testing the prototype also show cultural differences between Finland and Indonesia. For example, when elderly women were asked to find one-on-one chat partner, the Indonesian elderly participants who did not feel comfortable in communicating

one-on-one with strangers tried to divert the choice by choosing another option which was supposed to be chosen for another task. Elderly participants in Finland, even though they did not feel comfortable in communicating with strangers, they still silently followed and chose the option they were supposed to choose. During the testing, participants in Indonesia also used self-deprecating sarcasm, joking at themselves exaggerating their inferiority. This type of sarcasm is used to show humility, to relate and connect better with others, and this can help people to open easily to the person who mentioned the sarcasm. (Barron, 2022.)

Even though in this thesis the participants in Finland were able to test the prototype smoothly, some elderly ladies aged 60 to 80 in Finland might not be able to do it smoothly. They need people who can guide them on how to use technology. For both elderly women in Finland and Indonesia, they need people who can guide them on how to use technology, and to teach them about online safety and data privacy, especially with the AI technology progressing fast.

Regarding the prototype of the AI-powered matchmaking platform for elderly women, the most popular function among elderly women in both Finland and Indonesia is the event participation function, where elderly women can join an offline event which they are interested in. This function provides real activities that can keep them as social creatures (Span, 2016) active, and give possibility to meet other elderly women. However, these offline activities are more suitable for elderly women who do not have physical limitation or mobility problem.

In the prototype, group chat is the second most popular function among elderly female participants in Finland. Group chat would be good to support the event participation function. The least popular function for the participants in Finland is the one-on-one chat function, in which somebody who shares the same interest or topic is assigned to chat individually. In Indonesia, the participants preferred event participation function to chat functions, and did not show much preference between one-on-one chat function and group chat function. The reason of chat function being unpopular is because in both Finland and Indonesia, most elderly women are not comfortable in communicating with strangers. The problem in trust, shyness, the fear of scams and online crime, the fear of having irrelevant talk, simply not interested, or just busy are the reasons why the elderly women are not comfortable in communicating with strangers. While one-on-one chat is considered too individual and group chat is too big as group, a smaller group of 5 to 10 members with good compatibility is liked by elderly participants to discuss about common topics well.

6.1 The concept recommendation

After the participants tested the prototype, the needs were understood, and they were shown on the left column of Table 11. The needs are numbered inside the brackets, and these numbers

would be referred in this sub-chapter and the next sub-chapter later when needed. On the right column are the recommended solutions that can be added to the prototype, especially the parts that AI might be able to help.

Table 11. The needs that elderly women have from using the prototype and recommendation

The needs	Recommendation for the needs
I do not know how to use the website. (1)	Easy, clear, simple, interesting video explanation about how to use the website.
I do not know about online safety and data privacy. (2)	Easy, clear, simple, interesting video explanation about online safety and data privacy.
I do not know where to ask for help. (3)	There is 'Do you need help?' button on the first page and on the corner of every page when one needs help.
One-on-one chat. (4)	Finding and recommending the most compatible chat partner. (AI)
Group chat. (5)	Finding and recommending the most compatible group. (AI)
Group chat is too big a group and one-on-one chat is too individual. Is there another option for me? (6)	Creating a new small group of 5-10 people who are compatible with each other. (AI)
Some people posted rude comments. Is it possible to have a nice online community? (7)	Moderating groups and warning people when they post rude comments. (AI)
I cannot find events that I am interested in. Can you help me? (8)	AI that can match or recommend events. (AI)
I have low vision and I cannot see what it is on the screen. (9)	AI that can change speech to text or vice versa. (AI)

For an elderly woman who need to know how to use the website (1) and to know about online safety & data privacy (2) to protect themselves, there will be easy, clear, and video explanation for website usage and online safety & data privacy. The elderly women can click on the website page to watch the videos. There is no AI needed for those videos.

When an elderly woman has questions or faces problems with the technology, she can click the 'Do you need help?' button (3). She would then be connected to the help forum, where a Help Desk or volunteer who is available to answer can assist her in answering the question. The volunteer should be trained to answer the elderly women's questions. The volunteers can be family members or relatives from the elderly women. No AI would be needed for this.

For one-on-one chat (4) and group chat (5), AI can be used to recommend individual who has the same interest or would like to talk about the same topic and recommend group which the elderly woman is interested to join, to discuss about a specific topic with people with the same interest.

In the small group which consists of 5 to 10 people (6), people with good compatibility with each other are chosen to be the members of that group. AI is expected to select the members with good compatibility to be in that group.

In a group chat where some people posted rude comments (7), AI will act as a moderator, detecting rude words and giving warning to the rude persons. When a warning is ignored, a penalty could be given.

In the most popular function of the website, the event participation (8), AI will help in recommending events to the elderly woman and to match her interest with the event available.

For the elderly women who cannot read the text clearly (9) because of low vision problem, there is possibility to change text into sound or vice versa, so that rather than reading text, they can listen to the message. And when they send messages, they can send messages by writing or by saying them verbally. AI will be used, too, for this part of the website.

6.2 Validation

Even though this thesis has no commissioners, this thesis had three validators who separately viewed the prototype and the recommendations mentioned in the previous Table 11. The validators were then asked about their opinions on the AI parts of the recommendations whether the AI ideas are implementable.

The first validator is VF (Validator Finland), a senior data engineer from a marketing company in Finland. The second validator is VI1 (Validator Indonesia1), a country sales manager from an AI company which is based in Indonesia. The third validator is VI2 (Validator Indonesia 2), a sales director from an AI company in Indonesia, whose previous experience includes being a developer. The validators viewed the items in the recommendation, and commented especially on the sections where AI is thought to work.

For video explanation in how to use the website (1) and video about online safety and data privacy (2), all validators agreed that the videos are technically easy to implement. VI1 and VI2 agreed that videos which are made clear and easy to understand without any AI involved are good in reaching the purpose well in guiding the elderly women. VI2 recommends that these video instructions

should be put at the very early stage of using the website, so that it is accessible to the users at the beginning.

For the 'Do you need help?' button (3), VI1 suggested adding AI so that when an elderly woman pushes the button, she would be directed to whoever who can help to her, whether it is the Help Desk, volunteer, or other member who has been a member of the website for a while and knows how the website works. VF and VI2 suggested that this 'Do you need help?' button can be combined with the chat function rather than standing alone by itself and that it is possible to implement this 'Do you need help?' without AI. VI2 took an example by using non-AI algorithms.

VI2 suggested that rather than categorizing chat function into one-on-one (4), small group (6) and big group (5), it is good to be as simple as possible and categorize the chat function into one-on-one and small group only.

All the validators VF, VI1 and VI2 agreed that AI solutions for the needs (4), (5), (6), (7), (8) and (9) could be feasible and doable, with one recommendation might have a bit more difficult implementation than the others due to different level of AI complexity, and the specialization of the validators or the companies where the validators work. To make sure that the proposed solutions are feasible and doable, more work and tests on each of them are needed. The ideal final website should be a website that is easy to use by elderly women, and do not require them to go through long and complicated process to get to the intended destination.

As validation is the last step in the Double Diamond service design model as shown in Figure 11 in Chapter 4, the service design phase of this thesis ends here. Since Double Diamond service design model is iterative, changes and updates can always be made if there are new findings from the collected data and obtained analysis.

6.3 The new framework for the elderly women-centered AI-powered matchmaking platform

While Figure 9 in Chapter 3 shows the proposed theoretical framework for this thesis, Figure 18 in this chapter shows the framework for the elderly women-centered AI-powered matchmaking website for the purpose of active aging. The framework shows that the elderly-women-centered AI matchmaking website already includes the answers to the needs of elderly women and is in good balance between the AI technology and the ethics of AI. By the support of family and their close circle, society and government, elderly women can use the elderly-women-centered AI-powered matchmaking website where online activities and offline activities support each other, where they can make friends, do the activities they like, help the others, to be helped by the others and create a community for themselves. The result which is expected is elderly women who are happy, through active aging, social inclusion, and decreased loneliness.

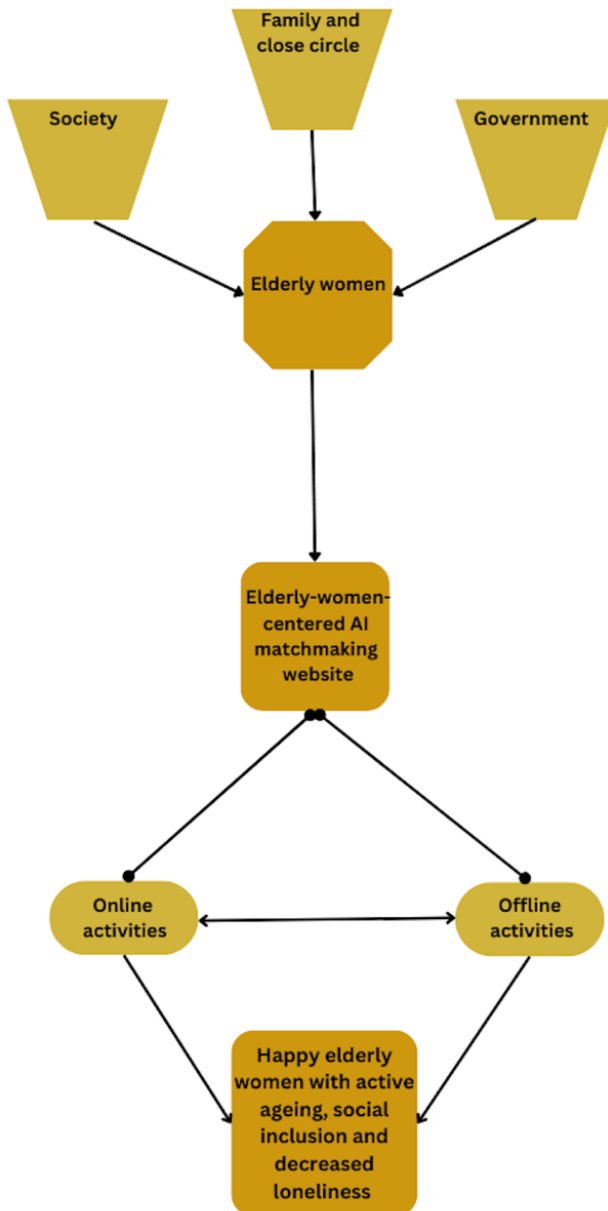


Figure 18. The new Framework for the elderly women-centered AI-powered matchmaking platform

6.4 Answering research questions

Finding out the needs of elderly women in both Finland and Indonesia when using AI-powered matchmaking platform in helping them to enhance their well-being, promote active aging, foster social inclusion, and combat loneliness is the objective of this thesis. From the needs, a concept of AI-powered matchmaking platform to find new friends, engage in activities and build community has been created. The needs and the concept were already written. Here Sub-Questions RQ1, RQ2, RQ3, RQ4 will be answered before answering the main RQ (Research Question).

RQ1: What kind of activities and services are available for elderly women in Finland and Indonesia now to promote active aging and make them less lonely?

In the literature review of this thesis, this sub-question has been answered in sub-sub-chapter 2.2.1 and 2.2.2. In the empirical part of this thesis, activities and services could be found in the analysis and findings from the semi-structured interviews and the prototype testing. The activities and services to promote active aging and make them less lonely in Finland include gym, walking around the neighborhood for physical activities, volunteering for the neighborhood and organizations, and elderly people-oriented classes such as language class and dance class. In Indonesia, the activities include arisan social gathering, ex-school mate gathering, religious activities, and other gatherings of groups that the elderly women have joined for many years.

RQ2: In what ways do the service needs of elderly women differ between Finland and Indonesia?

The earlier part of this chapter mentioned some differences between elderly women in Finland and Indonesia. To add, several factors caused difference in service needs between elderly women in Finland and Indonesia. Elderly women in Finland tend not to live together with their adult children, and this brings necessity for them to do things independently and at the same time gives them freedom to choose the activities that they like. The elderly women in Indonesia who tend to live with their adult children can get easier and faster access of help from their adult children and grandchildren, and this does not make it necessary for them to do as many things as elderly women in Finland do. At the same time, they have less freedom compared to their counterparts in Finland. While the elderly women in Finland seem to be more independent than the elderly women in Indonesia, cautions should be made to the elderly women who live alone in Finland so that they can receive proper help which they need when they need it.

There is lack of pedestrian walk in Jakarta Metropolitan area, therefore it is not easy for an elderly woman to walk on the street in Jakarta. There are few parks, and there is no forest in Jakarta. In Helsinki Metropolitan area there is forest inside the city where elderly women can walk and enjoy physical activities outside their home, surrounded by nature. Physical activities as ways of active aging seem to be more popular among elderly women in Finland than in Indonesia.

Many of the participants in the interviews and prototype testing in Indonesia involved themselves in religious activities, and they gave financial help to social homes or other people who need the help, while elderly women in Finland involved themselves in different activities such as volunteering for the neighborhood, joining elderly people-oriented classes, or keeping themselves fit.

RQ3: What kind of improvements can be made to the current situation?

In relation to skills to use technology, in this case the skills to use AI-powered matchmaking website to be able to find friends, groups with mutual interests, and activities, elderly women need an easy-to-understand guidance to be able to use the technology well. The elderly women also need to know about online safety and data privacy to protect themselves online. These can be implemented through video instructions and a help function to connect them to the available person who can answer their questions. Since the online website is only one of the channels, combination with offline programs which are organized by the government, association, and community to help them to use technology better will be helpful. For example, a coffee or tea session where they can get explanation on how to operate websites in a nice atmosphere might encourage the elderly women to learn on how to use technology better.

The concept of AI-powered matchmaking platform in this chapter and previous chapter was created in the simplest way. However, changes or additions could be made so that it would apply better to elderly women in each Finland or Indonesia. For example, to let elderly women in Indonesia be more active physically, more programs and promotions about how to keep themselves fit could be included on the website. For the elderly women in Finland, more programs and promotions on paying attention to elderly female neighbors living alone could be included, so that they could get the help which they need when they need it.

RQ4: How can AI and AI ethics be mixed well to maximize friend-making and activity-finding experience for elderly women?

While elderly women are minorities who face bias in the usual online platforms, this AI-powered matchmaking platform is purposed as an elderly women-centered matchmaking platform where elderly women are prioritized. On the data privacy side, disabling the function that uses data to train AI model and choosing cloud computing platform which promises not to use the data to train AI model are ways to protect the elderly women's data privacy (as mentioned by validator VF). The elderly women themselves need to know how to protect their data and to know about online safety. Before collecting the data from the elderly women, their approval should be gained, and explanation should be given on how the data would be used.

For the AI technology itself, it should be designed and created so that the elderly women can operate the website easily, and do not need to go through many steps and complicated process before getting to the intended destination. The high level of human control and high level of automation is expected for an AI to be an HCAI (Shneiderman 2022, 60), and in this website case it is an elderly-women-centered AI.

RQ: How might we help elderly women to apply active aging, to be socially inclusive and less lonely by using AI-powered matchmaking platform?

Through the proposed simple elderly women-centered AI-powered matchmaking website, which framework is in the previous Figure 18 in this chapter, elderly women can communicate with other elderly women and discuss about the topic of their interest. Not only to gain knowledge and different views on the topic they are interested in, communicating online or offline is good in getting connected with the others, to feel less lonely and keep being active. Offline events that the elderly women are interested in would need physical participation from the elderly women which means that the women need to leave home and move physically. Not only for physical activities, by meeting face-to-face with other elderly women and communicate with them, elderly women will feel that as social creatures they are socially inclusive, aging actively and feel less lonely.

6.5 Research ethics, reliability, and validity

Ethics is an important issue during all stages of the research process. During the stage of research topic and clarification, integrity, fairness, and open-mindedness are the important aspects of research ethics. During the stage of research design and data access, researchers should not attempt any pressures on individuals to gain access or to participate. Participants have the right to be informed and to ask questions in this stage. The right to privacy is essential in all research stages that involve participants. (Saunders 2023, 262-276.) For this thesis, the participation in the interviews, prototype testing and validation is voluntary. When contacting prospective participants for interviews and prototype testing, the researcher mentioned about why the participants were contacted, explained about the thesis briefly and about their rights to privacy and that the interviews would be used only for the purpose of this thesis.

During data collection through interviews, prototype testing and validation in this thesis, participants had the rights to confidentiality and anonymity. Confidentiality and anonymity are also important in the next research stages of data processing & storage, and data analysis & findings. (Saunders 2023, 262-276.) Confidentiality means not disclosing what was discussed between the researcher and participant. In qualitative research such as in this thesis, it is not easy to ensure complete confidentiality because the quotes in the interview transcripts which is shown on the thesis are the words of the participants, even though those cannot be linked to a specific participant. Anonymity is the condition when all identifiable information is removed from interview transcripts so that the participants cannot be recognized directly or indirectly, and this can be ensured in this thesis. Using coded names for participants in transcriptions, stored data, and the data during analysis,

as well as removing information that otherwise if being put would make it possible for the participants to be identified are what researchers can do for participants' anonymity. (Hennink & al. 2020, 74-84.)

Cultural sensitivity is an important element in this thesis which covers two different locations in the world and cultures. One matter that can be done well in one place does not mean that it could be done well in another place under the same circumstances due to cultural differences. Interviewees were also informed that they are free not to answer questions if they do not want to. In online interviews which were done to the elderly participants in this thesis, the handling of online data, how they are stored, and how they are used during analysis are also important. Mistakes that are prone to be made online that can reveal participants' identities must be avoided.

Reliability of research is achieved when the same findings with the previous research are consistently obtained when the same or different researcher conducts the research again. Validity is whether what is intended to be measured is measured accurately. Since qualitative research only reflects the conditions of the participants in the setting at the time it is conducted, qualitative research is not necessarily intended to obtain replicable results. Qualitative research which is usually done with small samples limits the generalizability of the research. To validate the quality of the research, triangulation and participant validation were conducted. Triangulation is using more than one data source and data collection method to confirm the validity, credibility, authenticity, analysis, and interpretation of research data. Participant validation is confirming the accuracy of the research data by sending them back to participants to comment and correct on it. (Saunders 2023, 214-222.) This thesis uses multi-method qualitative study, with different data collection methods, which were semi-structured interviews and thinking aloud methods. Participant validation was conducted to one participant of each data collection method in the research.

6.6 Limitations and recommendation for future research

This study consists of two data collection methods which are semi-structured online interviews and thinking aloud method in prototype testing. The limitation in the semi-structured online interviews is even though the participants fulfilled the criteria for interview participants in Helsinki metropolitan area and Jakarta metropolitan area, only participants who had access to internet and could use the decided video platform were able to join the interviews. Interviewing participants who could not use video platform might have added diversity to the collected data, analysis, and findings.

For the prototype testing with thinking aloud method, there were two elderly ladies in their late 70s who might have become the participants, but they could not join at the end because they fell sick. With the age range 60 to 80 years old as one of the criteria to be a participant, getting participants

who are in their late 70s is not easy due to their fragility in health. In the case of the participant in Finland, a younger participant who used to volunteer in helping one of the sick elderly ladies replaced the elderly lady as a thinking aloud participant and contributed to the triangulation of data in this research.

While the interviews and prototype testing in Indonesia were conducted in Indonesian (Bahasa), the official language in Indonesia, the interviews and prototype testing in Finland were conducted in English and Indonesian, which are not official languages in Finland. Adding participants who use Finnish language in Finland and who use English in Indonesia might have resulted in more diversity in the collected data. Using Finnish language in communicating with the participants in Finland would have decreased the limitation of not getting participants who can only speak Finnish.

The longer-term purpose of this study is to build a community that can help elderly women for active aging, to be socially inclusive and less lonely. However, most of the participants were either socially active or might not need immediate help to be less lonely. The participation in this study was voluntary, and participants who agreed to participate in this study tended to be socially active elderly women. The elderly participants would not be willing to participate if they are not in a good condition physically or mentally. Their families or relatives who introduced them to the researcher would not be willing to introduce them if the participants were not in good condition physically and mentally for the sake of their health. While this was not thought at the beginning of the study, it might not be easy to reach the elderly women who need the matchmaking platform the most as participants, because they might not be socially active, not healthy, and not willing to participate in the interviews or prototype testing.

As recommendation for future research, research which include elderly women who can only speak Finnish beside elderly women who can speak both English and Finnish in Finland will bring more diverse collected data and might result in different findings. Another research which includes elderly women who might need the matchmaking website the most would be good in resulting to know the needs of those elderly women. The elderly women in that research would include those who are not socially active and who do not use communication technology often.

According to the Double Diamond service design model, the process in this thesis to help elderly women use AI-powered elderly-women-centered community building platform is iterative. There is always a door to go to the needed step to make the process better. The thesis objective, finding the needs of elderly women in Helsinki and Jakarta metropolitan areas is reached, and recommendations for the early proposed solutions are validated by AI experts in Finland and Indonesia. However, to be able to create a good matchmaking platform for the elderly women, more study about

their needs while using the website, the detailed contents, the plan for the AI technology usage, and the financial cost to build the system still need to be conducted.

With the fast-changing technology, especially in the AI field, the needs of elderly women now could be different than the needs of elderly women 5 or 10 years later. Elderly women 5 or 10 years later might have more technological skills than the current elderly women with the same age. However, technology might advance more than now and new skills in technology are needed to use the technology of that time. When that time comes, new research with new points of view will be needed.

6.7 Reflections

This is the first thesis that the writer of this thesis has written using the structure and methodology for a master's thesis in Finland. The writer has been exercising learning through doing in writing this thesis: looking for information, reading and writing continuously during the process. Even though the thesis writing started in January 2023 this year, the preliminary work towards this thesis started already in Summer 2022, with changes in topic and plans taking place until the end of 2022.

While having a good project plan for a thesis is good, thesis writing is also the matter of flexibility in dealing with changes. For example, even though workshop was planned as the second research of the thesis, it had to be changed into another method because it was not possible to gather participants during summer. The newly chosen data collection method was thinking aloud method, where participants tested the prototype one by one, and each participant could do the test according to their availability.

There were 25 interviews and interview-like sessions conducted for this thesis, with the participants being coded and mentioned in it. The number of interviews did not include preliminary interviews done in 2022 and other informal interviews needed to support thesis writing. The researcher who is also the writer of this thesis gained valuable experience in interviewing participants, from deciding the criteria of the participants, contacting them, conducting the interview, following-up with the interviewees, transcribing, coding, analyzing the data and writing about them in this thesis. Cross-cultural differences such as area difference and expertise difference are some of the interesting things that the writer experienced. The way interviewees reacted in interviews in Finland is different than in Indonesia, and the way elderly interviewees responded in the interview about their life and technology usage is different than the way validators who are experts in AI responded in interviews about the possible AI usage for the matchmaking platform.

Haaga-Helia UAS divides thesis work into three phases: literature review, methodology & findings, and discussion. While the three phases are equally important, the writer needed to learn many new

things in phase 2: the suitable data collection method, the way to transcribe the data, to code them, to preserve them, to analyze them, and to write down the findings.

Library is an essential existence in thesis writing. Physical and online books, online journals and other reading materials were easily accessed from the library during the thesis writing process. When a book which the writer needed for thesis writing was not available in Haaga-Helia UAS library, the writer looked for the book and managed to find and borrow it from another university's library.

This thesis has no commissioners. There are positive and negative sides of conducting a thesis without commissioners. In the thesis without commissioners, the writer is free to decide which destination she wants to go, where and how she wants to go. Since freedom also means responsibility, the writer of the thesis understands the meaning of having own drive to direct herself towards thesis completion. This is not easy, but it is possible.

ChatGPT was used in the editing stage of this thesis, to correct grammatical errors and increase the readability of the thesis. ChatGPT was used in a way so that the meaning of the thesis did not change before and after ChatGPT usage. The writer checked the resulted text after ChatGPT process. The quotes which were collected from interviews and prototype testing were not included nor processed inside ChatGPT.

The writer deeply appreciates the tremendous support received from:

- The thesis advisor who has given guidance every time the guidance is needed, which is extremely helpful for a first-time researcher like the writer.
- The willingness of all elderly participants to be the participants of this thesis project, even though it is unpaid research.
- The library that has been an endless source of knowledge, in the forms of books and explanations from the staffs about books and thesis related matters.
- All the teachers, staffs and students in Haaga-Helia UAS who have helped in making this thesis completion possible.
- All friends and acquaintances who have helped giving valuable information and provided support during this thesis process.
- The writer's family who has been supporting the writer throughout the thesis writing period.

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Appendices

Appendix 1. Semi-structured interview questions in English- first research

1. Are you between 60-70, or 70-80 years old?
2. Do you work?
3. Please tell me about your family briefly.
4. Please tell me about your friends briefly.
5. How often do you communicate with your family and relatives?
6. How often do you communicate with your friends?
7. What are your hobbies or activities that you like?
8. What kind of activities that you like to do alone?
9. What kind of activities that you like to do with others?
10. How often do you have activities which involve people other than family and friends?
11. How do you keep yourself healthy?
12. What is the thing that you want to do and you are capable to do it now/ soon?
13. What is the thing that you want to do but you cannot do now/ soon?
14. What kind of help do you need from the others?
15. What kind of help can you do to the others?
16. What social media, websites, apps do you use? Why do you use them?
17. Which one is your favorite? Why is it your favorite?
18. What device do you use? Why do you use that device?
19. How often do you check your social media? How often do you use your device?
20. What do you think about the technology now compared to 10-15 years ago?
21. Are you positive about the technology? Explain.
22. If there is a new technology, are you interested in knowing more about it? Do you want to use the technology?
23. If you are interested in the new technology, do you learn it by yourself, or do you ask people?
24. What kind of good experience do you have with technology (social media, internet, device)?
25. What kind of bad experience do you have with technology?
26. How do you feel about interacting on the internet with people who you know and you don't know? Why do you feel that way?
27. Do you communicate with people you don't know on social media or internet? Why?
28. What do you think about being addicted to technology?
29. What are your biggest problems when using technology?
30. When you face problems using technology, what do you do?
31. When somebody can build a website especially for you, what kind of website do you like to be made (currently existent or not)?
32. Have you ever met people who you knew from the internet? Tell me about the experience.
33. Do you feel comfortable meeting people who you knew from the internet but you never met in daily life? Why do you feel that way?
34. What would make you feel comfortable meeting them?
35. Do you feel comfortable joining event that you don't know exist but is advertised on the internet? Why do you feel that way?
36. When you join such event or meet people who you don't know, do you join the event or meet them alone, or with other people who you already know? Why?
37. If you make a new friend from the internet, what kind of activities you'd like to do together with that friend?
38. What are your hopes for yourself and the people around you?

Appendix 2. Interview explanation sent by email

This is a brief explanation about the interview and the thesis.

The interview is the data collection method for the thesis, with the topic of "Building community for elderly women using AI-powered matchmaking platform (the case of Finland and Indonesia)"

Population aging is now already happening in Finland, and it will happen in Indonesia, too. There are and there will be more women than men in the aging population (in all countries in the world), therefore it is important to keep elderly women happy, less lonely, and socially inclusive.

The interview will be about elderly women, the social needs, and the interaction with technology that might help women to be healthy, not only physically but also mentally and socially.

The interview will take 30-45 minutes. The data will be kept confidential and will only be used for the purpose of this thesis/ research. The interview will be recorded, and the data will be confiscated when the thesis is completed.

Appendix 3. Initial coding template for template analysis in prototype testing in Indonesia

1. The testing process

1.1 Chat one-on-one

1.1.1 Process flow

1.1.2 Family, social relation and activities

1.1.3 Technology

1.1.4 Online to offline

1.1.5 Values and hopes

1.1.6 Group chat

1.2 Events

1.2.1 Process flow

1.2.2 Family, social relation and activities

1.2.3 Technology

1.2.4 Online to offline

1.2.5 Values and hopes

2. The Challenges

2.1 Chat one-on-one

2.2 Group chat

2.3 Events

Appendix 4. Initial coding template for template analysis in prototype testing in Finland

1. The prototype test flow
 - 1.1 Thinking
 - 1.2 Questions
 - 1.3 Options
 - 1.4 Relief after finishing task/ realizing
 - 1.5 Disturbance and expressions
 - 1.6 Disturbances and expressions
2. Social relation and activities
 - 2.1 Social relation
 - 2.2 Interests and activities
3. Opinions and emotions
 - 3.1 Opinions
 - 3.2 Emotions
4. The challenges
 - 4.1 Interface
 - 4.2 Contents

Appendix 5. Final coding template for template analysis in prototype testing in Indonesia

1. The prototype test flow
 - 1.1 Thinking
 - 1.1.1 Thinking/ wondering what to choose
 - 1.1.2 Reading aloud
 - 1.2 Questions
 - 1.2.1 Asking questions
 - 1.2.2 Answering questions/ responding
 - 1.3 Options
 - 1.3.1 Choosing option
 - 1.3.2 Agreeing to do something
 - 1.4 Relief after finishing task/ realizing
 - 1.5 Disturbances and expressions
2. Social Relation and Activities
 - 2.1 Social Relation
 - 2.1.1 Friends
 - 2.1.2 Family
 - 2.2 Interests and activities
 - 2.2.1 Interests
 - 2.2.2 Activities
3. Opinions and emotions
 - 3.1 Opinions
 - 3.1.1 The prototype interface
 - 3.1.2 Reasons
 - 3.1.3 Self sarcasm
 - 3.2 Emotions
 - 3.2.1 Positive
 - 3.2.2 Negative
4. The challenges
 - 4.1 Interface
 - 4.1.1 Self-blame
 - 4.1.2 Experience in using
 - 4.1.3 The feeling
 - 4.2 Contents
 - 4.2.1 Chats
 - 4.2.2 Events

Appendix 6. Final coding template for template analysis in prototype testing in Finland

1. The prototype test flow
 - 1.1 Thinking
 - 1.1.1 Thinking/ wondering what to do
 - 1.1.2 Explaining/ mentioning things
 - 1.1.3 Quickly going to the next step
 - 1.1.4 Reading aloud
 - 1.2 Options
 - 1.2.1 Choosing and confirming option
 - 1.2.2 Agreeing to do something/ what to do next
 - 1.3 Questions
 - 1.3.1 Asking questions
 - 1.3.2 Answering questions/ responding
 - 1.4 recognizing mistakes
2. Social relation and activities
 - 2.1 Social relation
 - 2.1.1 Friends
 - 2.1.2 Family
 - 2.2 Interests and activities
 - 2.2.1 Events
 - 2.2.2 Groups
 - 2.2.3 Interest
 - 2.2.4 Others
3. Opinions and emotions
 - 3.1 Opinions
 - 3.1.1 Easy enough
 - 3.1.2 Trust
 - 3.1.3 Finns are shy
 - 3.1.4 Online freedom
 - 3.1.5 Young and old
 - 3.1.6 Alone doesn't mean lonely
 - 3.1.7 Which is easier for the elderly: chat one-on-one, group chat, or events?
 - 3.2 Emotions
 - 3.2.1 Positive
 - 3.2.2 Negative
 - 3.3 Conditions
 - 3.3.1 The channel
 - 3.3.2 Online group
 - 3.3.3 Events
4. The challenges
 - 4.1 Interface
 - 4.1.1 Not used to it
 - 4.1.2 The fear of computer
 - 4.1.3 How to
 - 4.1.4 Sight problem -big screen at home
 - 4.1.5 Easy to use?
 - 4.2 Contents
 - 4.2.1 Chat one-on-one
 - 4.2.2 Group chat
 - 4.2.3 Events
 - 4.3 Others
 - 4.3.1 Security
 - 4.3.2 ICT friends
 - 4.3.3 After retirements
 - 4.3.4 Help