DESIGN THINKING TO CREATE PRODUCT INNOVATIONS FOR IMPROVED HEALTH OF THE AGING POPULATION IN THAILAND

DESIGN THINKING TO CREATE PRODUCT INNOVATIONS FOR IMPROVED HEALTH OF THE AGING POPULATION IN THAILAND

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ABSTRACT

The presented research applies a design thinking framework intended to gain meaningful insights about the thoughts, attitudes, and emotions towards exercise and technology within the Thai aging population. A cross-section of 80 elderly in Thailand will be selected to match the nation's demographic profile and serve as a paradigm for other emerging economies in the APAC region. The study uses in-depth interviews, focus groups, and observational analysis to guide the creative process of developing integrated product/technology concepts to test with the participants. The elderly population is segmented based on three main criteria to produce an interchangeable system: (1) physical capabilities, (2) financial situation, and (3) technological understanding. The research will develop various modular/technology platform concepts with low, medium, and high-tech solutions to meet the needs of the elderly segment.

Keywords: Product Innovation, Design Thinking, Aging Population, Exercise Technology, Emerging Economy, Concept Testing

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CHAPTER 1

INTRODUCTION

1.1 Background

Based on the National Economic and Social Development Board (NESDB) of Thailand, the nation will be a fully aged society in 2021, with roughly 20% of the country's population being elderly (i.e., age 65 years and above) (Chittinandana, Kulnartsiri, Pinthong & Sawaengsuksant, 2017; Knodel, Prachuabmoh & Chayovan, 2011; Prasartkul, 2013; World Health Organization, 2015). Thailand has numerous technology clusters, government agencies, and private entities positioned to respond to the impact on Thailand's shrinking workforce, public spending to care for the elderly, and families' survival and well-being. These three factors intersect with Thailand's future economic health, so Thailand can have a competitively skilled workforce to attract investment opportunities and raising capital returns. By extending the amount of time, skilled people can remain in the workforce, maintain their independence, and not burden working family members.

The premise of this paper is to research the understanding, behaviors, and attitudes of Thailand's aging population towards exercises in an attempt to develop a combination product/service platform designed to influence positive attitudes concerning health and exercise in the aging population segment. This research uses a Design Thinking framework (Design Council UK, 2005; Plattner, Meinel & Weinberg, 2015) to understand the aging population segment in Thailand and then develop and test product/service combinations with them. The overall aim is to develop a healthier aging segment that will extend their period of independent living and have the ability

to stay in the workforce longer if so desired. Improving the aging population's overall health reduces the burden on the national healthcare system. A keyword for users (not an academic reference to this paper) is independence. As long as the elderly can remain independent, it will remove a significant burden from the family's working members.

According to research conducted by the Director-General of the Mental Health Department in the Ministry of Public Health (Chittinandana et al., 2017; Prasartkul, 2013), Thailand's current population is approximately 67 million 14% are age 65 or older. By the year 2020, that percentage will increase to 20%, and by 2030 it is expected to increase to 50% of the population. It is important to note that experts anticipate Thailand's population reach over 90 million by 2030, which means that more than 45 million people will be age 65 or older. That number of elderly would be equal to 70% of the current national population being age 65 or older (Prasartkul, 2013; World Health Organization, 2015).

The remaining portion of this introductory chapter provides an overview of the research by discussing its motivation and offering a problem statement. The subsequent sections then provide a research objective with several research questions and conclude the chapter by providing the project's scope and discussing its significance.

1.2 Rationale and Problem Statement

The Asian Pacific (APAC) region is undergoing rapid and profound shifts in the aging population (Chittinandana et al., 2017; Prasartkul, 2013; Sanderson & Scherbov, 2019). This paper categorizes the aging population in the region in four main categories:

1.2.1 Increase in the proportion of older persons, Increase in the pace of aging (i.e., the time it takes to move from aging to an aged society)

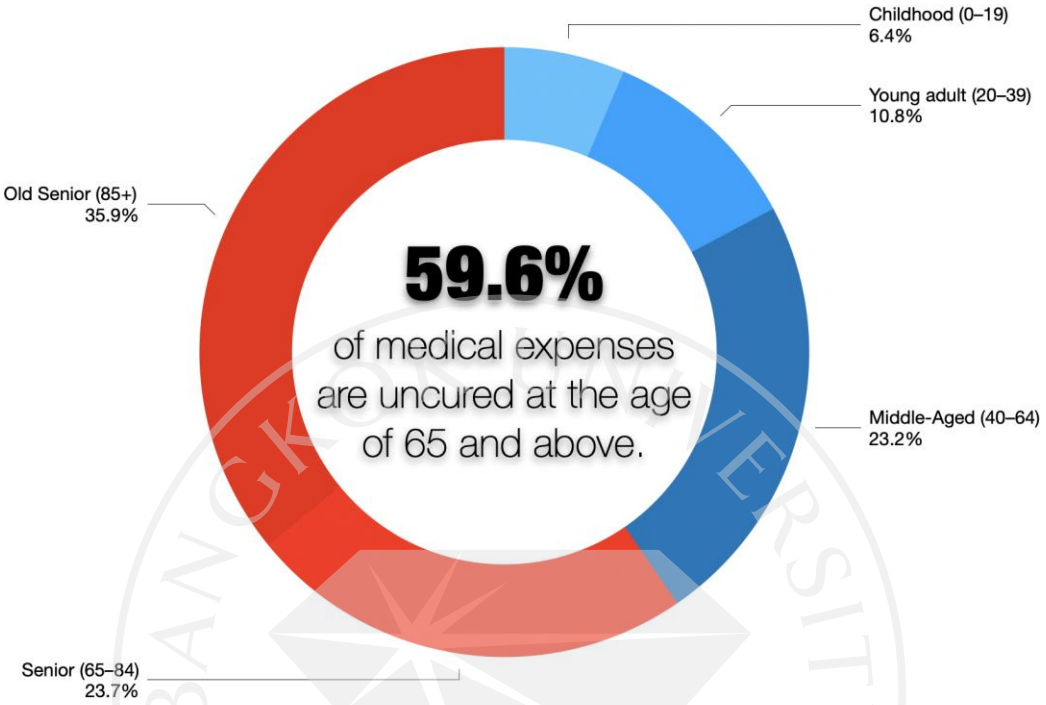
1.2.2 Countries not yet considered as an aging society, but the absolute numbers of older people are significant

1.2.3 Increase in the proportion and number of people considered “oldest old” (i.e., people over 80 years old).

1.2.4 The APAC region is likely to be the world’s 4th largest economy in 2030 (Nortajuddin, 2020), and Thailand will need to remain competitive compared to Vietnam, Indonesia, and the Philippines.

An aging society profoundly impacts a nation’s healthcare system since the medical expenses over a person’s lifespan peak once they reach over 65 years old (Berhanu & Warner, 2004).

Figure 1.1: Relative Lifetime per Capita Healthcare Expenditure at Different Age



Sources: Berhanu, A., & Warner, K. E. (2004). The lifetime distribution of health care costs. *Health Services Research, 39*(3), 627-642.

According to data provided by the World Bank, in 2018, the average healthcare expenditure per capita in Thailand was US$ 276 (3.8% of GDP). Since 2000 the per capita healthcare expenditure of Thailand has risen from US$ 62 to US$ 276 (3.0-3.8% of GDP) (World Bank, 2018). Because of this, Thailand's aging population will absorb a large portion of the annual national healthcare spending. Moreover, some research shows that many of the elderly Thai population is substandard in personal health because they do not engage in a proper exercise routine (Knodel et al., 2011; World Health Organization, 2015). Moreover, this lack of

optimal health in the aging population creates an increased dependency on the government's financial support based on Thailand's current national healthcare model (Jitsuchon, 2012). For the reasons mentioned above, the Thai government needs to create a trend in the aging population that inspires senior citizens to improve their health through a safe and effective routine exercise program.

1.3 The Objective of the Research

While there is a vast amount of research available concerning aging populations around the world and research dedicated to health, fitness products, and the benefits of exercising in all age groups, this research focuses on behavior and motivations just as much as on the target population and the products/equipment itself. The researchers recommended dedicating a significant portion of the research to the habits and motivations of the Thai elder community and practical research related to safe exercise practices for seniors and the benefits of exercising.

This research project aims to obtain a deep understanding of the lifestyle of the Thai elderly related to health and exercise by focusing on the internal influences of Thai seniors. Uncovering the behavioral and motivational factors of the Thai elderly to exercise will provide the design team with a knowledge base for developing new product/technology platforms.

The research objective outlined in this thesis is to create a combination of service(s) and product(s) that inspires the elderly in Thailand to exercise, improve their overall health and have a more independent lifestyle.

1.4 Research Questions

This section formulates the central research question (RQ) with five sub-questions (SQ_i) that focus on understanding the hierarchy of wants, needs, and values of the target population (i.e., elderly). This knowledge base is required to develop an innovative combination of product(s) and service(s) to attract those who currently exercise and inspire those who do not currently exercise.

RQ: What are the motivational factors of the Thai elderly to engage in physical exercise?

SQ_1: What is the general perception and understanding of the elderly in Thailand towards physical exercise?

SQ_2: What is the level of primary health knowledge and understanding of the elderly in Thailand?

SQ_3: What is the health-related lifestyle of the elderly in Thailand (i.e., sleeping and eating habits, exercise routines)?

SQ_4: What is the overall condition of the elderly in Thailand (i.e., current health issues, regular hospital visits, medications, family, and living arrangements)?

SQ_5: What product and service combination can inspire the elderly to modify their exercise behavior (e.g., motivational factors, products, technologies, supportive services & programs)?

1.5 Research Scope

The study executed a design thinking framework to uncover the main motivational factors of the elderly population segment in greater Bangkok. The design thinking process applied for this project covers five main phases, which are (1)

Understand, (2) Define, (3) Create, (4) Prototype, and (5) User Testing. The process includes several rounds of interviews and aims to produce a combined product/technology platform to improve the participants' health and quality of life. The developed product concepts are then tested with the target user to finalize the product and service combination, which is most effective for the elderly. The participants selected from the elderly Thai population classify into three groups to obtain a representative cross-section of the entire target population, which are (1) physical capabilities, (2) financial situation, and (3) technological understanding. The research team assesses this classification as part of the interviews. To measure physical capabilities, the researchers inquired the target respondents about any pre-existing conditions. Whereas geographical location, physical appearance, and insights from the stories respondents shared about themselves are used as proxies for their financial situation. The technological understanding is determined by what kind of mobile device they owned, their apps, how they used the apps, and their responses to standard products found in an average gym.

1.6 Significance of the Research

The insights gained from this research support the application and understanding of the design thinking process to new product development. The outcome of this project provides insights into the motivations of the aging population segment towards exercise. These insights can offer valuable benefits to academics, practitioners, and the Thai government.

This research project offers academics a better understanding of the design thinking mechanics and provides an example application in new product development

for an aging population. On the other hand, practitioners can observe an example of a complete process that aims to develop a modular platform consisting of low, medium, and high-tech solutions. The modular platform can then demonstrate how users receive health and wellness benefits suited to their physical, cognitive, and emotional abilities.

The research project intends not to create a "one-size-fits-all" end product but to create a modular platform customized for individual needs. Such a modular platform will offer unique benefits by supporting a healthier lifestyle and subsequently lessening the stakeholders' (i.e., family, caretaker, hospitals, and the Thai government) financial and physical burden.

The study will also build a better understanding of the participants regarding exercise and personal health and their attitudes towards exercise and maintaining a healthy lifestyle. As a result elderly can effectively manage their daily routine-related behaviors, internal and external forces, influences, or challenges that prevent them from maintaining a healthy lifestyle.

1.7 Definition of Terms

Aging Population: Population aging refers to a demographic trend in which the average age of society continues to rise, resulting in fewer young people and older people within the society (Sander et al., 2015).

Aging Related Illnesses: Age-related illnesses or age-associated diseases are complications arising from increased biological aging. Such "diseases of the elderly" should not be confused with the aging process because all adult animals age (e.g., hypertension, cancer, diabetes, osteoarthritis, respiratory disease, or dementia).

Design Thinking: This study defines design thinking as an analytic and creative process that engages a person to experiment, create and prototype models, gather feedback, and redesig (Razzouk & Shute, 2012).

Elderly: What constitutes an 'elderly' individual varies based on classifications by different governments. Typically, an individual who has reached the retirement age of 60 or 65 is deemed elderly (Sanderson & Scherbov, 2019). This research considers an individual as an elderly at the age of 65 and above.

Exercise: Most of the standard dictionaries available define exercise as a form of "bodily exertion for the sake of developing and maintaining physical fitness." (Merriam-Webster Dictionary) or a "physical activity that you do to make your body strong and healthy." (Cambridge Dictionary). However, medical dictionaries have a more detailed definition of the term by stating that "exercise is a physical activity that is planned, structured, and repetitive for the purpose of conditioning the body. Exercise consists of cardiovascular conditioning, strength and resistance training, and flexibility." Winter and Fowler (2009) offer a revised and more scientific definition of the term exercise as "a potential disruption to homeostasis by muscle activity that is either exclusively, or in combination, concentric, eccentric or isometric."

Financial Situation: Financial situation refers to the financial resources available to the elderly and their ability to cover the costs of housing, food, healthcare, transportation, and long-term care if needed.

Motivational Factors: Motivational factors are modifiable attributes used as predictors of success in motivating older adults to adapt to and maintain recommended exercises (DeGroot & Fagerström, 2011).

Physical Capabilities: The physical capability of the elderly is the ability to move with competence in various activities, ranging from simple walking to complex movements such as Tai Chi or Yoga.

Product Innovation: Product innovation introduces a product or service that demonstrates incremental or radical improvements concerning its characteristics or intended uses to increase the value to the target users (Frederiksen & Knudsen, 2017; Hoonsopon & Ruenrom, 2012; Organisation For Economic Co-Operation and Development, 2005).

Product Platform: This thesis adopts the definition proposed by Harland and Uddin (2014), who define a product platform as a "collection of modules or parts that are common to a number of products, and this commonality is developed intentionally to attain certain effects" (i.e., to create customer value).

Technological Understanding: Technological understanding refers to the elderly's comprehension of exercise equipment with various degrees of technological complexity and their understanding of operating them.

CHAPTER 2

LITERATURE REVIEW

This chapter provides theoretical support for the concepts used in this thesis. The chapter intends to establish research gaps and problems with existing knowledge to determine what the research could most usefully address. The first part of this chapter provides a definition and overview of the proposed design thinking approach. Following this, the chapter addresses product innovation concepts and evaluates their relevance to research in the context of the aging population. Third, the chapter discusses the aging population, including its definition and effect on society. Next, it examines the role of wellbeing and exercise in the aging population as an aspect of a healthy lifestyle for the elderly.

2.1 The Design Thinking Approach

Design thinking is one of the predominant theoretical paradigms of technical creativity and innovation in the 21st century (Razzouk & Shute, 2012; Thompson & Schonthal, 2020). According to the authors, the initial interest in design thinking came from business research. During the development stage, Razzouk and Shute (2012) view design thinking as a source to achieve a competitive advantage through creative product innovation rather than improving the fundamental design. However, design thinking has not remained a business or marketing concept; instead, interest has grown throughout different disciplines, and it is now considered an interdisciplinary theory (Johansson-Sköldberg, Woodilla & Çetinkaya 2013). As the authors determined in their investigation of design thinking within the academic literature,

there are now at least five distinct discourses of design thinking, each of which have come from a different epistemological school of thought about what designers do and how they do it. These different epistemological positions are often used in parallel and do not necessarily conflict, but they have developed along different lines and have different design thinking insights (Johansson-Sköldberg et al., 2013). Following this diversity of the academic literature on design thinking, the literature review draws from multiple disciplines, including engineering, marketing, and creativity studies, to understand design thinking as a concept.

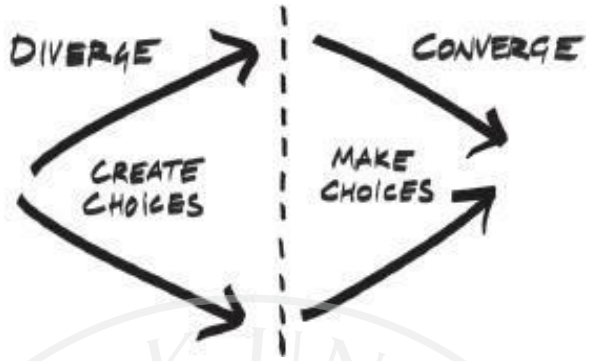
The first question investigated is the origin and history of design thinking and its role in creativity studies. Following this historical context, the discussion of design thinking moves to its current definition. Next, the processes of design thinking are evaluated and discussed. This discussion serves as the foundation for the chapter and provides a theoretical approach to orient the research.

2.1.1 History of Design Thinking

While Design Thinking's roots date back to the professional and academic studies of creativity in the 1950s, it has evolved into a robust strategic problem-solving methodology within the last twenty years (Martin, 2009). Currently, many experts believe that one of the most important human skills for the twenty-first century is "learnability," which refers to the ability to unlearn information, which is no longer relevant and relearn what is more relevant (Melles, Howard & Thompson-Whitesidec, 2012). Simon (1996) was the first to mention design as a science or way of thinking in his 1969 book, "Sciences of the Artificial." The notion also appeared in "Experiences in Visual Thinking," a book by Robert H. McKim, a mechanical engineering professor (McKim, 1972).

Razzouk and Shute (2012) define Design Thinking as an analytic and creative framework that engages a person or a team in opportunities to learn about and understand other people on an empathetic level. The learned and observed are then synthesized to experiment, create, and prototype models and gather feedback to refine prototypes into meaningful solutions for the people they have engaged. Figure 2.1 in Tim Brown's (former CEO of IDEO) book Change By Design (Brown & Katz, 2009), shows the broader context of design thinking in a straightforward graph, which shows on the left side of a dotted line "diverge" create choices and on the right side of a dotted line "converge" make choices. The book further discusses the Design Thinking Process by focusing on Converting Needs into Demand or Putting People First. During this stage, user research and an empathetic understanding of the user's and stakeholder's perspectives are essential. Later he introduces a "Mental Matrix," or "These People Have No Process," which is where we see this larger diverge/converge framework and "Analysis and Synthesis" become equally crucial as each component is essential to the process of creating options and making choices. The book concludes the process by outlining "The Power of Prototyping" or "Building to Think" and validating or invalidating the design experiences through creating user experiences.

Figure 2.1: Convergent and Divergent Thinking



Sources: Brown, T., & Katz, B. (2009). *Change by design: how design thinking transforms organizations and inspires innovation*. New York, NY: HarperBusiness.

Existing literature has developed a variety of particular naming systems for the phases of Design Thinking. However, this thesis classifies the phases into Understand/empathize (UE), Define/Synthesize (DS), Create/Ideate (CI), Prototype (P), Test (T), and Refine (R).

The first notable books on creativity methods were “Synectics: The Development of Creative Capacity,” by Gordon (1961) and “Applied Imagination: Principles and Procedures of Creative Problem-Solving,” by Alex F. Osborn (1953) (co-founder of BBDO). Osbourne published his original work in 1953, but the third revised edition, published in 1963, is more recognized. In the 1970s, “The Universal Traveler” by Koberg and Bagnall (1974) pioneered a theory of a ‘soft systems’ approach, which is a design process for dealing with everyday life issues. The 1980s brought about user-centered design and design-centered business management.

During this time, Schön (1983) published “The reflective practitioner: How Professionals Think in Action,” a book which sought to establish epistemology of practice inherent in the artistic, intuitive processes that design and other creative practitioners bring to situations of uncertainty, instability, uniqueness, and value conflict. 1991 ushered in the age of design thinking with the first symposium on Research in Design Thinking held at Delft University and the establishment of IDEO, one of the world’s most famous design companies.

2.1.2 Design Thinking Defined

The definition of Design Thinking is not clear and concise, nor is it a step-by-step linear process to be followed. Design, engineering, business, and advertising have differing definitions of Design Thinking due to how each discipline has interpreted and evolved their profession/academic area relative to the nature of each discipline’s type of work. Additionally, how each discipline may define the nature of the problem which Design Thinking applies to, as either ill-structured problems (Simon, 1973) or wicked problems (Rittel & Webber, 1973) as well as the final output: product, service, product & service combination, strategy and communication (Camacho, 2015).

All sources seemingly have a similar definition of Design Thinking, using different terminologies to “make it their own.” Another factor that comes into play is that each project is different, and thus the activities within the steps will vary.

2.1.3 The Design Thinking Process

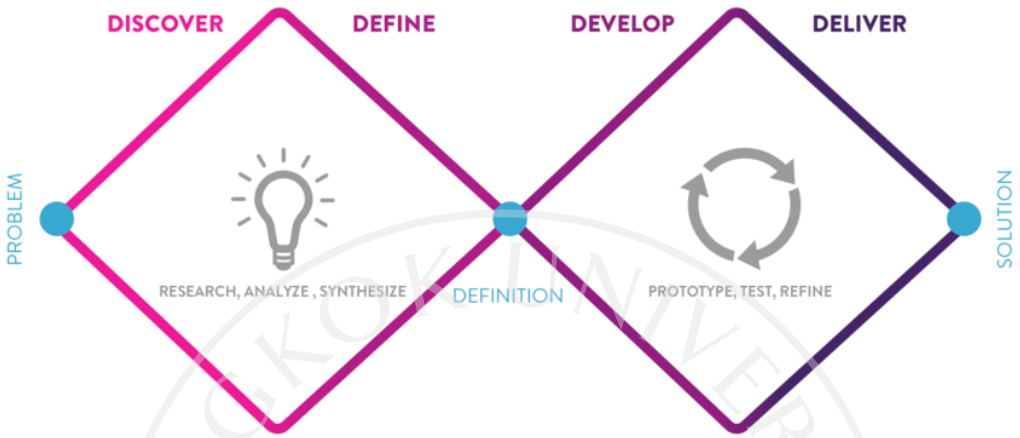
Because there are many different ways of considering design thinking and its processes (Johansson-Sköldberg et al., 2013), no single process is appropriate for any application (Liedtka, 2014). Instead, design thinking applications require designers

and creators to customize the process to suit the creative activities' specific requirements (Liedtka, 2014). At the same time, the process of design thinking is customizable and flexible, making it far easier to implement in such a way compared to other techniques of innovation, as explained by Serrat (2017):

"…design thinking revolves around three key phases: inspiration, ideation, and implementation. During these phases, problems are framed, questions… are asked, ideas are generated, and answers are obtained. The phases are not linear; they can take place concurrently and can also be repeated to build up ideas along with the continuing of innovation."

The implication of this is that there is no single design thinking process that applies across all situations. Instead, a process needs to be developed that meets the specific needs of the design activity's creative objectives (Serrat, 2017). This research uses a design thinking process adapted from previous design thinking process models (Design Council UK, 2007; Plattner et al., 2015). The Design Council UK's (2007)' double diamond' design model (Figure 2.2) is a two-stage model in which a process of discovery and definition in response to a challenge is followed by developing and delivering a solution or outcome to meet this challenge. The double diamond model executes in four steps that include (1) Discover, (2) Define, (3) Develop, and (4) Deliver.

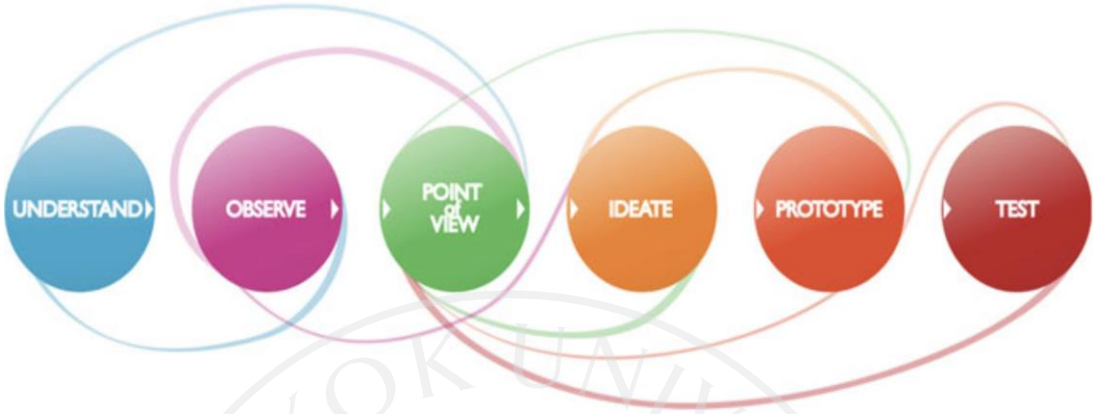
Figure 2.2: The Double Diamond Design Thinking Framework



Sources: Design Council UK. (2007). *A study of the design process*. Retrieved from https://www.designcouncil.org.uk/sites/default/files/asset/document/ElevenLessons_Design_Council%20(2).pdf.

The model presented by the Hasso-Plattner Institute (Plattner et al., 2009; Thoring & Müller, 2011) expanded the double diamond model through a six-stage process. The first three steps in the process belong to the first stage of the double-diamond model, and the subsequent steps belong to the second stage of the model.

Figure 2.3: The Iterative Design Thinking Process



Source: Plattner, H., Meinel, C., & Weinberg, U. (2009). Design Thinking: Understand–improve–apply. New York: Springer.

Thoring, K., & Müller, R. M. (2011). *Understanding the creative mechanisms of design thinking: An evolutionary approach*. Retrieved from https://www.researchgate.net/publication/234065407_Understanding_the_Creative_Mechanisms_of_Design_Thinking_An_Evolutionary_Approach.

The integration of these two process models for design thinking is presented in which resulted in a five-step process to achieve the following objectives:

Understand: the design team collects information from key stakeholders, using observation, interviews, and other research methodologies, to understand what the problem is;

Define: Establish a problem and investigate what potential solutions;

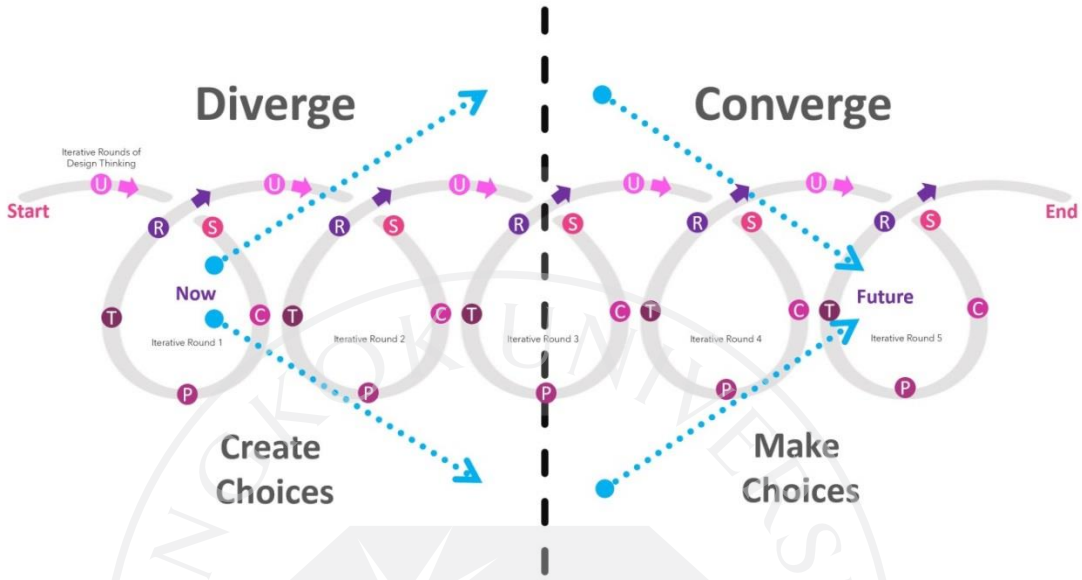
Create: Explore potential solutions, and select the most promising choices;

Prototype: Implement potential solutions to determine how well they work in practice;

User testing: Submit the developed prototypes to target users and determine whether the solutions solve the problem.

The critical part of this model is that all actions are iterative in both stages; that is, they continue until a suitable outcome is produced. Furthermore, these processes are not necessarily linear (Nakata & Hwang, 2020); for example, there could be a problem in the Understand Stage if the Define Stage encounters a problem. The design team should double back to the previous stage to avoid additional work in subsequent stages. In summary, although this process appears linear, it is only loosely so, with circular iteration among and between stages. The design thinking process used here is a circular and iterative process that allows the design team to understand and define a problem and then create prototypes and test possible solutions until they find a suitable solution. Because this research project uses the design thinking approach for product innovation, it is necessary to understand it.

Figure 2.4: Iterative Stages of Design Thinking Diverge to Converge.



2.2 Product Innovation

One of the first and most common design thinking applications was product innovation (Johansson-Sköldberg et al., 2013; Liedtka, 2014). Moreover, recent research shows that product innovation teams that apply a design thinking approach outperform those using alternative approaches (Meinel, Eismann, Baccarella, Fixson, & Voigt, 2020). Considering this fact raises the question of what product innovation is and how to implement it. This section of the chapter defines product innovation, offers an overview of the methods and tools used in product innovation, and summarizes the product innovation process from a design thinking perspective.

2.2.1 Product Innovation Defined

Product innovation relates specifically to creating new products or tangible goods intended for a specific market (Harland, Uddin & Laudien, 2020;

Kotler & Armstrong, 2018). One of the most commonly used definitions of product innovation is “the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses” (Organisation for Economic Co-Operation and Development, 2005, p. 48). Frederiksen and Knudsen (2017) argue that this definition, which the OECD employs, addresses several key aspects of the innovation process, including novelty, usefulness, and commercialization, though it does not address adoption. Adoption is a crucial aspect of innovation because users will not adopt the innovation if they do not find it valuable (Frederiksen & Knudsen, 2017). Another aspect of product innovation that is important for a full definition is that it may be either incremental (i.e., an improvement on an existing product) or radical (i.e., creation of an entirely new product) (Hoonsopon & Ruenrom, 2012). Thus, while the Organisation for Economic Co-Operation and Development (2005) definition is instrumental, this research also includes adoption as part of product innovation’s fundamental definition.

2.2.2 Methods and Tools for Product Innovation

Product innovation uses various methods, and one of these methods is outcome-driven innovation (ODI) (Ulwick, 2017). The critical insight of ODI as a product innovation process is that the customers of a given firm are not interested in a specific tool but instead in a specific outcome (which can be physical, emotional, social, and so on) (Ulwick, 2005). Therefore, the purpose of the product innovation process is not to design and produce a specific product (e.g., a fitness tracker) but to achieve a specific outcome (e.g., a way to monitor and improve fitness quickly) (Ulwick, 2005; 2017). As later work with this model has explained, ODI is fundamentally a practical implementation of the jobs-to-be-done (JTBD) theory of

product innovation theory, in which innovation focuses on specific user requirements (Ulwick, 2017).

Although each product innovation process is distinct, the process stages use some shared tools. At the preliminary stages, when the objective is to define the job at hand (Ulwick, 2017), tools such as brainstorming and user-centered and collaborative processes may be used by the design team members (Beckley, Paredes & Lopetcharat, 2012). The product innovation team may also use market research tools to investigate user requirements (identifying their desired outcomes) and their responses to proposed solutions (Beckley et al., 2012).

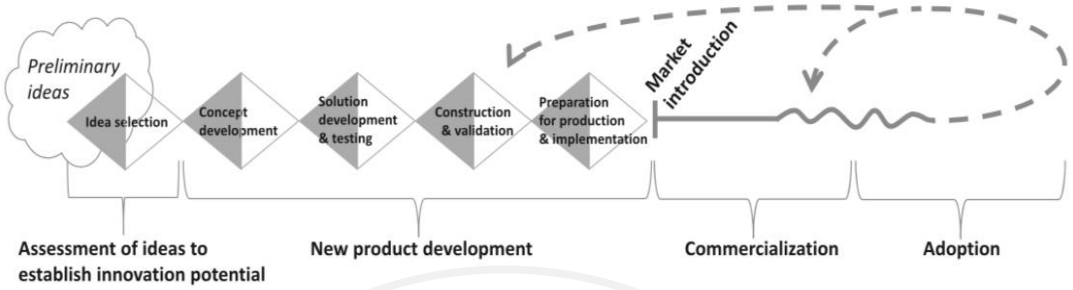
2.2.3 Process of Product Innovation

There is no single model of the product innovation process, as innovation process models have changed over time. The earliest models propose a simple linear process, and later models were moving toward cyclical and nonlinear processes (Alekseevna, 2014). However, the product innovation process components are likely to be shared between products (Frederiksen & Knudsen, 2017). The simplified product innovation process model presented by Frederiksen and Knudsen (2017) includes the internal design team (product designers, marketers, and production specialists), as well as other stakeholders outside the organization (including representatives of other organizations like suppliers and buyers, agencies, and institutions, and individual customers).

The four stages of the process model in outline a five-step process of idea selection, concept development, solution development, and testing, and construction and validation (Frederiksen & Knudsen, 2017), can be directly associated with stages of the design thinking process profiled in Figure 2.2 and 2.3. For example, idea

selection is consistent with the Understand stage; concept development is consistent with the Define stage; solution development and testing encompass the Create and Prototype stages, and construction and validation are consistent with the User Testing stage. The later stages of the product innovation stage, including preparation for production and implementation, commercialization, and product innovation adoption, do not fall directly into the design thinking model. Therefore, while the design thinking model and its tools can be applied to the product innovation process defined within this model, the two models do not entirely overlap. Thus, the product innovation process must be understood to extend beyond the initial development process, incorporating commercialization and market introduction of the product (Frederiksen & Knudsen, 2017). The implication is that it is worth considering product innovation to be a distinct process to which design thinking can be applied, but not merely a form of design thinking.

Figure 2.5: A Simplified Product Innovation Process Model



Source: Frederiksen, M. H., & Knudsen, M. P. (2017). From creative ideas to innovation performance: The role of assessment criteria. *Creativity and Innovation Management, 26*(1), 60-74.

2.3 Aging Population

The global increase in life expectancy and aging embodies the success of medical, social, and economic advances over illnesses. However, it also presents tremendous challenges to the world's nations (U.S. Department of State, 2007). Experts are confident that the global aging population with persons aged above 65 will increase healthcare costs worldwide. The demands associated with long-term care will especially pose significant challenges for personal, family, and public resources (Goulding, Rogers & Smith, 2003). While the world has successfully learned to live longer, this longevity presents many new challenges that will require cooperative planning by the world's nations.

2.3.1 Aging Population Defined

Population aging refers to a demographic trend within a society where the average age increases, resulting in fewer young people and more elderly (Sander et al., 2015). At the society level, population aging occurs due to a demographic transition process, where changes in economic wellbeing, medical care, and other long-term trends reduce birth rates and increase the lifespan (Paltasingh & Tyagi, 2012). Although history sees population aging as a problem of advanced economies, which have had access to improved nutrition, healthcare, and other factors that affect child mortality and lifespan, population aging is now a significant factor in developing countries (Higo & Khan, 2015).

A critical question is how populations can be aging and what constitutes an 'aging' or 'elderly' individual. Typically, population aging is measured at the societal level using statistics like median age or old-age dependency ratio (or the ratio of older people to working people), although newer measures can be used (Sanderson & Scherbov, 2019). At the individual level, what constitutes an 'elderly' individual is determined differently by different governments but is typically set at retirement age (60 or 65 years) (Sanderson & Scherbov, 2019). This research uses the retirement age of 65 as the basis for defining whether an individual falls into the target group.

2.3.2 The aging population and its Effect on Society

Aging populations represent a range of diverse challenges for societies. (Bloom, Canning & Fink, 2010) argue that one of the most fundamental problems is the loss of economic productivity and growth that results from an increasingly large portion of the population that is not economically productive (having retired) or is less productive than previously (working part-time). A related economic problem caused

by an increasingly large population of the elderly is a shift in resource demands to support the medical and social care needs of this segment of the population, which can cause conflicts in resource allocation, e.g., diverting resources away from education (Bloom et al., 2010).

While economic challenges predominate in the literature, there are also social and health challenges posed by aging populations (Sander et al., 2015). For example, social structures may need to be revised to be more appropriate for supporting the social, physical, and emotional needs of the elderly. Another problem is restructuring societies to support aging in place, rather than requiring the elderly to be disrupted by moving into specialist facilities. Furthermore, the elderly have different healthcare needs than children or younger adults, which means that medical systems need adjustments to account for their needs (Sander et al., 2015). Thus, the challenge of aging populations is severe and could impose significant restructuring demands on both the economy and institutions of a society.

2.3.3 Exercise and Wellbeing for an Aging Population

Since one of the core challenges of an aging population is maintaining good health for as long as possible (Sander et al., 2015), this raises the question of what tools are appropriate to maintain health. Physical activity, including daily activity and intentional exercise, is one tool for an aging population to maintain health and wellbeing (King, A. C., & King, 2010; Pekalee, Ingersoll-Dayton, Gray, Rittirong & Völker, 2020; Phulkerd, Thapsuwan, Chamratrithirong & Gray, 2021). According to a review of King, A. C. and King (2010) on physical activity in aging populations, physical activity is one of three factors that delay the onset of age-related diseases and reduce their severity and impact on life quality and wellbeing. (The other two factors

cited by these authors included tobacco use and diet) Furthermore, they noted that it is not intensive or historical exercise and activity that makes a difference in age-related disease susceptibility. Instead, it is the maintenance of ongoing physical activity–even mild to moderate physical activity like walking, yoga, or tai chi – that makes a difference in the susceptibility to age-related disease. Thus, physical activity provides a protective effect for an aging population against the diseases of age and becomes more prevalent as the population ages.

In addition to physical health, physical activity may also provide benefits for the social and mental well-being of the elderly (Aoyagi & Shephard, 2010; Phulkerd et al., 2021). The elderly may be socially isolated, especially in poorly structured societies for aging in place, and may suffer from various mental illnesses such as depression. Structured and unstructured physical activity can both reduce symptoms of mental illness, even in small amounts. Furthermore, structured physical activity, in which individuals participate with others, offers a point of social contact for the participants, reducing social isolation and increasing well-being (Aoyagi & Shephard, 2010). Thus, even when physical activity is mild, it can positively affect the mental and social wellbeing of the elderly.

Although the elderly benefit physically, mentally, and socially from continuing even mild physical activity, there are some challenges for participation (Aoyagi & Shephard, 2010; King, A. C. & King, 2010). For example, individuals already suffering from age-related illnesses or problems such as osteoporosis (which weakens the bones) may need to have adapted physical activity programs that do not leave them at risk of injury. Furthermore, there may be mental and social barriers to

participation, such as a lack of history of physical activity or stereotypes about such activity's appropriateness. Thus, programs do need to take these barriers into account.

2.4 Literature Review Summary

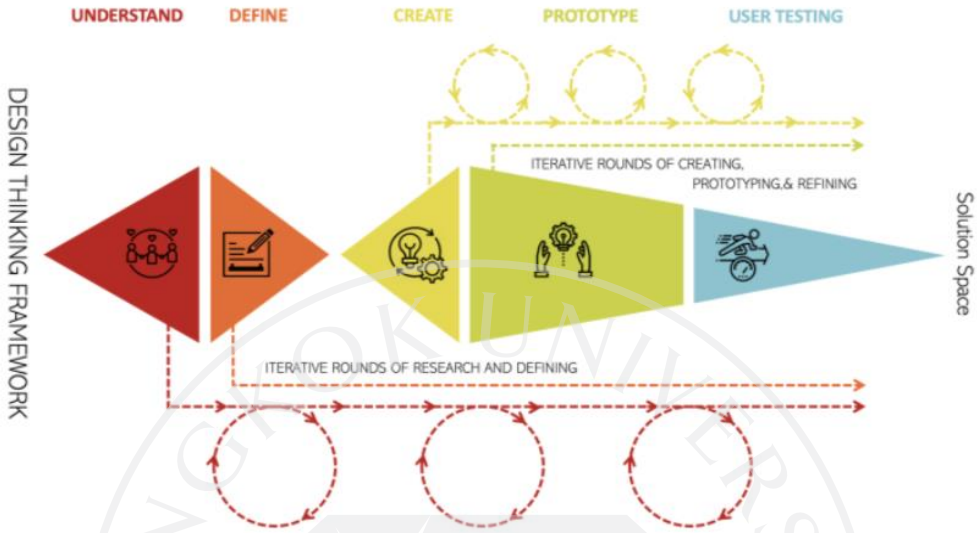
This chapter has reviewed the theories and literature that are relevant to the research proposal. The theoretical foundation of the research is that of design thinking. Design thinking was chosen as the basis for the research because it encourages flexible and nonlinear thinking about problems and how to resolve them. The research also draws on product innovation, using the outcome-driven innovation (ODI) concept (Ulwick, 2005; 2017) and Frederiksen and Knudsen (2017) simplified process model of product innovation. These concepts have some things in common, including orientation toward problem-solving, non-linearity, and focus on identifying and solving problems through innovation. It is fair to argue that using the ODI principle of product innovation, the research's desired outcome can improve physical, mental, and social wellbeing for the elderly in an aging society. Continuing physical activities, including everyday functional activities and planned and structured exercises, is one of the main tools used to improve the physical wellbeing of the elderly and protect against the adverse effects of age-related illness. It can also positively affect the mental health and social integration of the elderly, affecting individuals' wellbeing as their age. Thus, the targeted innovation for this research will be something that can help promote and encourage physical activity in the elderly, enabling them to achieve these positive outcomes. The next chapter explains how to achieve this outcome in the context of the proposed research.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

The research employs the five-step Design Thinking framework, as depicted in Figure 3.1 The process begins with “Understand and Empathize,” where the researcher aims at understanding target users and stakeholders on an emotional level. Followed by “Synthesize and Define,” which describes the research organization and what actionable insights emerge. Then the team consisting of the researcher and collaborators “Create and Ideate” by generating a variety of potential solutions that address these actionable insights gained in the previous step. The next step is “Prototyping,” to develop a minimum viable product (MVP) concept model by creating a mock-up least expensively. Target users can then test the MVP and provide valuable feedback. A final step is to Test by gathering the perceived strengths and weaknesses of the prototypes for refinement, and further prototype testing, until the best possible solution can be presented to the target users.

Figure 3.1: The Design Thinking Approach for New Product Development



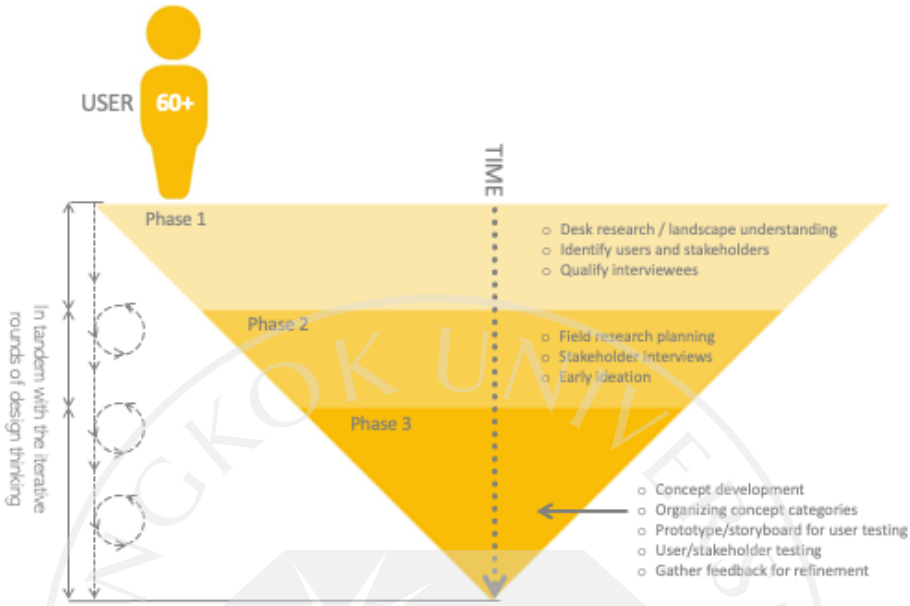
This chapter describes applying the design thinking approach for new product development to create a combination of service(s) and product(s) that inspires the elderly in Thailand to exercise and improve their overall health. The purpose of this chapter is to outline and discuss the individual components of the field research process used to collect and process primary and secondary data to achieve the research objective mentioned above. First, the field research setup with its three phases is introduced, followed by a description of the project's target users and stakeholders. The following section provides details about the data collection methods used in the study. The chapter concludes with a discussion on limitations and strategies to overcome them.

3.1 Field Research Setup

Field research is a systematic and qualitative method that collects primary data through participant observations and interactions to understand and emphasize with the target population in their natural environment. The method originates with social anthropology and has gained extensive acceptance throughout the social sciences to study real people and real problems (Edmondson & McManus, 2007). Schatzman and Strauss (1973) state that field research encompasses a diverse range of social research methods. As a result, the researcher needs to apply a strategic mindset, where methodological choices depend on the research questions. They continue to explain that "Field [research] is more like an umbrella of activity beneath which any technique may be used for gaining the desired information, and for processes of thinking about this information" (Schatzman & Strauss, 1973, p. 14).

Field Research is a powerful component of the design thinking process to collect customer input, which is essential throughout the development process to create a successful new product (Gruner & Homburg, 2000; Henard & Szymanski, 2001). As presented in Figure 3.2, the adopted field research process separates into three overall phases. Each phase of the field research includes iterative rounds of feedback loops that work in tandem with the design thinking framework.

Figure 3.2: Field Research Setup



Phase I consists of (1) Desk Research, (2) Identify Users & Stakeholders, and (3) Sample Selection. Fundamental aspects of the desk research consist of a Competitive Analysis of the industry, a Technical and Clinical Analysis of elderly-related issues, and Elderly Related Topics dealing with internal and external influences and users' perceptions. The desk research facilitates the identification and selection of appropriate respondents for the data collection of the project.

Phase II concentrates on (1) Planning, (2) conducting Field Research (Understand & Empathize), (3) organizing and grouping of primary data, and (4) Ideation. The second phase contains the crucial first part of the design thinking process to obtain consumer input. During this phase, the research team obtains the necessary data used to generate new product concepts.

Phase III incorporates the analyzed data to (1) Generate Product Concepts, (2) Prototyping, and collect user feedback through (3) Concept Testing. Concept testing aims to understand the prototypes' effectiveness in providing health benefits to the user and their willingness to use them. It also intends to engage the target consumers in discussions to identify each concept's strengths and weaknesses.

3.2 Selecting Target Population, Stakeholders, and Decision-Makers

The researcher needs to solicit a variety of sources to gather the necessary information for the project. The project's stakeholders and decision-makers are experts on Sports Medicine, the Aging Population, Geriatric Medicine, and Healthcare Professionals in clinical settings. The information gathered from them provides a reference frame used to collect data from the target users. The research objective is to create a combination of service(s) and product(s) that inspires the elderly in Thailand to exercise and improve their overall health. The project defines the target user as senior citizens in and around greater Bangkok. The research team selects participants from the target population based on age (i.e., 65 years and above) and willingness to participate in an ethnographic behavioral study. The selected sample of participants also needs to come from population segments that mirror the nation's financial demographics (Figure 3.3).

Figure 3.3: Wealth Distribution of Target Users

Though most ethnographic studies conduct 30-60 interviews (Bernard, 2017), Beraux (Bertaux, 1981) claims that 15 is the smallest admissible sample size for qualitative studies. On the other hand, Creswell, J. W. & Creswell (2017) proposes five to 25 interviews for phenomenological research. However, based on their research, Guest, Bunce & Johnson (2006) claim that data saturation occurs with 12 interviews.

Since the study wants to mirror the nation's wealth distribution, the research team aims to sample at least 100 Thai seniors and caregivers to ensure data saturation. Moreover, to provide a better cross-section of the target users, the researchers will classify the elderly into three groups (i.e., physical capabilities, financial situation, and technological understanding) as mentioned in section 1.4.

Data collection will occur at community events, public/community exercise places, public parks, elderly home care facilities, hospitals, and individual homes. To ensure each person's anonymity, the research team will only record their age and the personal story related to this research. The researcher also approached life science experts from Mahidol and Thammasat University, nurses and medical doctors from

major hospitals, and people from rehab centers, elder community centers, and retirement homes for the data collection from stakeholders and decision-makers.

3.3 Research Methods

The research uses field research, a qualitative approach most commonly used in design thinking (Brown & Katz, 2011; Brown & Wyatt, 2010), to investigate the perception towards exercise and technology within the Thai aging population. Primary data was collected using multiple methods, which consisted of user-environment observational analysis, in-depth interviews of potential users, and focus groups. Desk research was conducted before the first data collection to obtain secondary data. The desk research consisted of numerous activities to gain a broad body of knowledge about the aging population, exercise for the elderly, and the effects on health from exercise. The secondary data collection aims to build the research team's knowledge and understanding to prepare for the upcoming user field research (Brenner & Uebernickel, 2016). The secondary collection and research continued in tandem with the user field research throughout the project (Brown & Katz, 2011). The research project divides into three main phases, with the field research at its core (Figure 3.2 Field Research Setup).

3.3.1 Desk Research

The purpose of desk research is to generate secondary data to outline existing knowledge, identify problems or issues in the area of interest. According to Baker (2002), this initial data collection is crucial to start a research project. This secondary data review is more than just a literature review. It goes beyond academic literature analysis and includes all kinds of sources, ranging from internet websites to internal

documents. The desk research intends to re-analyze data gathered by other researchers (Hakim, 2000) and then compare and contrast them with the primary data collected. This type of research's main goal is a competitive analysis, where the research team surveyed the industry's landscape about product and service offerings currently available internationally. Technical and clinical analysis of research reports funded by the Thai government and NGOs focused on seniors' physiology, exercise, physical therapy, sports medicine, kinesiology, and cognitive health states. Besides local literature and reports, an additional investigation of international research literature, online blogs, and websites related to topics about the elderly helped to broaden the understanding of the research team. The investigation concentrates on internal and external influences, current international policies related to the aging society, financial systems, healthcare practices, healthcare, and insurance systems, as well as the users' perceptions of these systems, their personal feelings about being elderly in today's society, and how they perceive the current societal attitudes towards elderly.

3.3.2 In-Depth Interviews

Interviews are a form of qualitative research to extract data from a single respondent of the target population. An interview represents a dialog between the interviewer and respondent about a particular topic to elicit underlying beliefs, attitudes, and motivations (Hague, P. N, Hague & Morgan, 2004). Interviews have different levels of structure, ranging from structured to semi-structured and unstructured. In a structured interview, the researcher asks a predefined set of questions to each respondent in the same order and expects short answers. On the other hand, unstructured interviews give a different perspective from a structured interview by encouraging respondents to discuss specific topics through a

conversation with the interviewer (Moser & Kalton, 1971; Rowley, 2012). One significant advantage of in-depth interviews, as opposed to structured interviews or questionnaires, is their adaptability. A skillful interviewer can follow up on ideas, probe responses and investigate motives and feelings (Moser & Kalton, 1971).

This research uses semi-structured, in-depth interviews to build a trust relationship with the target respondents, which is necessary to obtain an in-depth understanding of their knowledge, attitudes, and motivations towards exercising (Hague et al., 2004). As part of the design thinking process, interviews explore the target consumers' involvement and offer a different perspective to the new product development team. Moreover, an in-depth interview will also allow a certain level of observations of the respondents in the context of exercising (e.g., asking them to demonstrate what an exercise is). Selecting in-depth interviews as one of the data collection methods is appropriate when considering the need for rich data from stakeholders, decision-makers, and target consumers (Alam, 2005). Unstructured observations are an integral part of the semi-structured, in-depth interviews to determine the classification criteria mentioned in section 1.4.

The target respondents are classified into three categories to mirror the wealth distribution of Thailand, and a minimum sample size of n = 100 is specified to ensure data saturation. To produce the targeted cross-section of respondents, the research team aims to include 5% (n = 5) wealthy, 35% (n = 35) middle-class, and 60% (n = 60) low-income elderly for the in-depth interviews. The researcher team will begin the interviews by introducing the purpose and expected outcomes of the project. Then explain the interview process and expected duration. The semi-structured interviews will include, but are not limited to the following set of questions:

1) Are you over 60? (Screening Question).

2) Do you mind telling us your actual age?

3) Do you have any illness or injuries which make regular doctor visits necessary?

4) Do you take any medications regularly? If so, what are they?

5) Have you ever suffered a significant injury or illness in the past? If so, what was it, and how was it treated?

6) How would you describe your daily diet? Why is it this way?

7) Do you require assistance with any of your daily activities (e.g., house chores, doctor visits, or any other personal tasks)? Please explain why or why not.

8) Do you exercise? Please explain why or why not.

9) How frequently do you exercise?

10) Describe and demonstrate the exercise you do.

11) How consistent are you with your exercise regimen?

12) Would you be willing to make changes to your current lifestyle (i.e., diet & exercise)? Please explain why or why not.

13) What if regular exercises meant extending your independence and making you able to take care of yourself without assistance?

3.3.3 Observations

A widely used method of qualitative data collection is observation Trochim, Donnelly & Arora, 2016). Collecting observational data offers a firsthand encounter with the phenomenon under investigation (Merriam & Tisdell, 2015). A researcher can engage in direct observation or participant observation to investigate a phenomenon (Trochim et al., 2016). For this research, the researcher engages in an

observer as participant capacity (Gold, 1958) to interact with the target users. As part of the participant observation method, this specific technique allows the researcher some interaction with the subject. However, it is essential to provide some information about the research goals to the participant.

This research does not quantify the behavioral data collected from observations (Marczyk & DeMatteo, 2005). Instead, it uses the ethnographical context to understand the target users' attitudes and behavior towards exercise. The data gained through this observation is recorded in field notes and then used to contrast and compare with the data collected from individual interviews and focus groups. The aim is to confirm differences between the target users' perception and their fundamental understanding (behavior) of exercises.

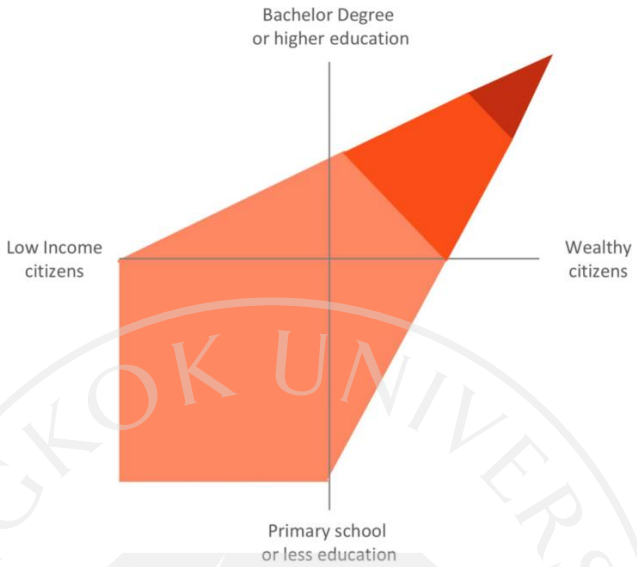
CHAPTER 4

FINDINGS

The research team interviewed 116 Thai seniors and, in some instances, their caregivers. The respondents are classified into high-income (n=9, 5.6%), middle-income (n=39, 33.6%), and low-income (n=68, 58.6%), which is consistent with the wealth distribution of Thailand (Figure 4.1 Wealth Distribution of Target Users). Interviews took place in a variety of places in and around Bangkok. These interview locations consisted of community events, public/community exercise places, public parks, elderly home-care facilities, hospitals, and individual homes, where the desired population segments congregate. From the sample size of 116 respondents, 63.8% (n=74) were females, 68.1% (n=79) of the respondents suffer from age-related illnesses, and 29.3% (n=34) of the respondents claim to exercise at least once a week.

Based on the field research to date, there appear to be drastic differences in the perception of exercise. Lower-income and less educated people typically had a positive response when asked if they exercise regularly. However, when probed deeper and ask what exercises they do, they list daily activities like sweeping and cleaning or other everyday household chores as exercise. In contrast, when interviewing higher income and more educated seniors, they describe cardio exercise routines, tai chi, yoga, and weight training as their forms of exercise depicts a simplified representation of the income to education distribution of the selected respondents.

Figure 4.1: Correlation between Education and Wealth of the Respondents



Initially, the researchers approached Community Volunteers in some of the selected communities. The community considers these volunteers as government coordinators working with small branches of the local government. Their tasks vary from education, organizing events, collecting data, and facilitating healthcare services. The majority of them are elderly, and some are a part of the local government committees. The aim of approaching this group of volunteers is to gain access to the local communities of the elderly.

Product and technology platform concepts are created based on the interview results from the target consumers. The platform concepts are designed in a modular form, consisting of low, medium, and high levels of technology to meet the range of physical capabilities of the target consumers. During concept testing, the researcher presents the platform concepts to the audience to gain feedback for refinement.

4.1 Field Research Findings

Interestingly enough, the interviews revealed that whether Thai seniors were rich or poor, educated or not, those who considered themselves to be Active Elderly opposed to those who consider themselves Inactive Elderly appears to be roughly a 50/50 split. In this context, the researchers created two groups of elderly, Active Elderly and Inactive Elderly.

Active Elderly were typically lifelong active people. They participated in recreational sports or other fitness activities as children and either moved into physically demanding jobs, military careers or followed a regular exercise routine in their adult lives. In their senior years, they now engage in regular exercise routines, with most of them exercising in the morning when they first wake up.

Inactive Elderly claimed they had no time for exercise since they cannot afford to retire and still need to work to generate income. Another sub-segment of this group claimed they needed to participate in daily house chores like shopping, cooking, cleaning, and babysitting, leaving them too tired to exercise. Some of the interviewed elderly claimed to have attempted some exercise regimen but did not experience improved health, so they felt discouraged, demotivated, and quit. Many of the interviewees in this segment fear that they cannot keep up with others, possess the ability to perform the exercises correctly, or do well with exercise in general. They have expressed anxiety and shyness to “lose face” when asked about the willingness to start a new exercise routine.

In general, both groups of elderly have a habit of waking up early every day and claim that they enjoy social benefit activities. For instance, activities that help family, friends, and neighbors. Moreover, both groups like to “make merit” in a

cultural and religious sense. While the education levels of active elderly varied, most completed high school or had some professional training in their younger years. The Inactive Elderly have mostly a lower level of education, and the researcher observed that some of the participants were even unable to read and write. They had a humble understanding of their bodies and their health. Many believed that engaging in daily house chores is sufficient exercise.

The research team asked the elderly to demonstrate what they believe is a proper exercise to observed their true understanding. An overwhelming majority of Thai seniors are unaware of what classifies as aerobic or anaerobic exercise, which is the type of exercise that improves people's health (Knodel et al., 2011; Prasartkul, 2013).

One dominant similarity found in all seniors interviewed is independence. To them, independence is not only the ability to care for themselves and not needing care providers but also their ability to provide different forms of care to people in their lives if needed. In geriatrics, practitioners determine the elderly's levels of independence by using of the Berg Balance Scale (BBS) or the Functional Independence Measure (FIM) (Cheng, Weng, Chang, Tan & Tang, 2014). Both scales determine the level of independence of an elderly on a seven-point Likert scale, where the higher scores reflect a higher level of independence. However, where the BBS measures only motor skills, the FIM also assesses independence based on cognition.

The Motor skills subscale focuses on self-care (i.e., eating, grooming, bathing, dressing, and toilet use), sphincter control (i.e., bladder and bowel), transfer (i.e., motions from bed, going to toilet, sitting up, and bathing), and locomotion (i.e., being able to navigate stairs, ramps, or walk). Cognition is concerned with communication

(i.e., comprehension and expression) and social cognition, which deals with memory, problem-solving, and social interactions. In addition to these more clinical scales, the research team also asked about their ability to run errands by drive their car or take public transportation.

Even though more basic forms of independence ranked high emotionally, like the ability to get their food, go to the bathroom independently, or bathe on their own. At the same time, many claimed they fear losing higher levels of independence like driving or public transportation, shopping, preparing meals, living according to their savings, or having the ability to earn extra. Based on the responses, the higher-level forms of independence are significant, but the more basic forms of independence rank higher on an emotional level.

The research also shows that the main reason for inactive elderly to transform themselves into active elderly is independence and the ability to be self-sufficient. However, the only distinguishing factor between the different income levels of the respondents is their intention. High-income segments aim for a better quality of life, while the low-income segments need to be active to survive.

One main concern of the elderly is maintaining all the current levels of independence they experience. They fear being a burden to their already financially struggling families. They fear losing their independence and not contributing to the rest of the family's current status of well-being. One example quoted from the interviews is, "I worry about where the money for food will come from tomorrow; I do not think of exercise." The elderly face additional challenges in the low-income community that many respondents claim to prevent them from engaging in a regular exercise routine.

The interviews and observations also revealed a lack of understanding about personal health, hygiene, and fitness among the lower educated and low-income segments. Much of their perception of health is based on verbal traditions and superstitions. Many also believe that if they did some activity that causes them to sweat qualifies as exercise.

It is important to note that there is a more significant amount of diversity in the physical condition of the elderly user group, and age does not necessarily correlate with health or ability. For example, one respondent of the target group who looked to be in his 60's was already 83 years of age. When we asked what his secret to good health was, he proudly explained his daily exercise routine. He stopped drinking alcohol and smoking when he was a young man. He was in the military and had always exercised. He also rides a bicycle around his local neighborhood to socialize and check in on friends in the community every evening. In contrast, another female respondent who was 72 was perceived to be in her 90's due to her frail condition. The in-depth interview revealed that she never drank alcohol or smoked cigarettes. However, she is diagnosed as a person with diabetes who ignored the diet and drug regimens recommended by her doctor.

According to the majority of the interviewed respondents, independence is their primary value, next to this the three most common values are: (1) Financial, which is a combination of concerns for different demographics, ranging from a fear of outliving their savings, not having personal value they could get paid for, and not being a financial burden to the family. (2) Safety, as respondents recognize the loss of strength and traits of physical cognition like balance, they do not want to get injured or at the very least end up in a situation where they will be injured or embarrassed. (3)

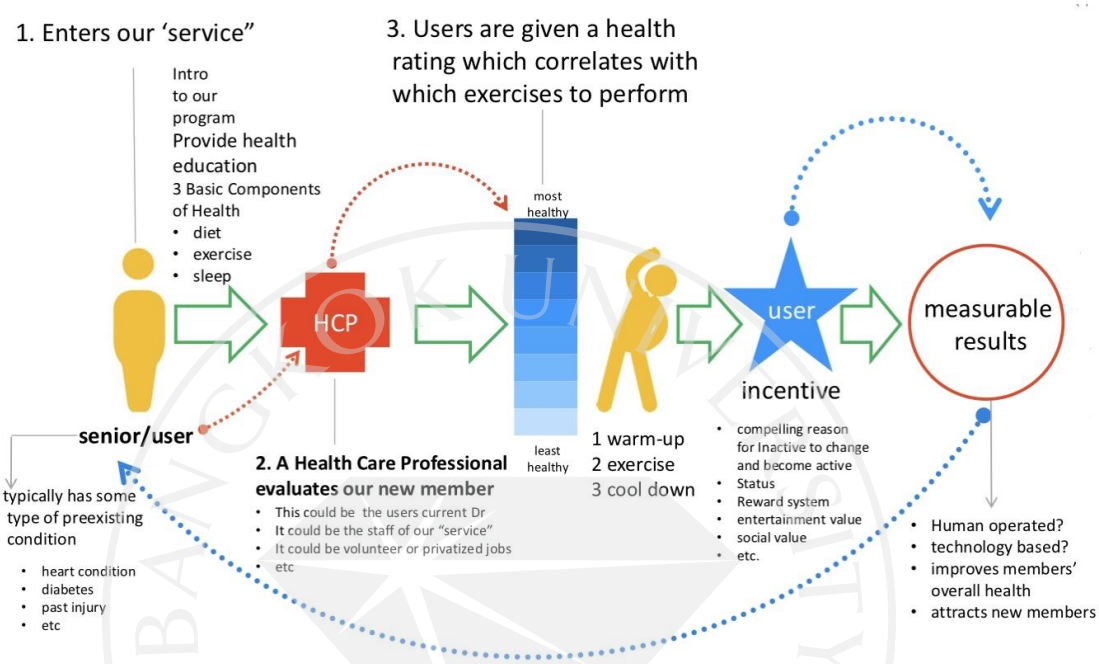
Family Support, in every demographic segment, the elderly are concerned about the care of their families. The vast majority of elderly interviewed expressed a strong desire to be of use to their family and care for their children and grandchildren in any way they can.

4.1.1 Synthesis of Research

Upon reviewing the data collected from the field and desk research, it was evident that some of the initial preconceptions were correct. No new product will incentivize Inactive Elderly to change their current habits and adopt an exercise regimen. It has to be a product paired with some particular service, and it is that service, which will provide the primary incentive. The attributes of such a new product will serve as a secondary incentive, i.e., the ability to achieve an optimal level of fitness in just 5 minutes a day.

The research data was organized and placed into several different analysis frameworks for the research team to review individually and as a group. Discussion and brainstorming sessions helped to rearrange the research data and generate various early conceptual ideas for future testing with the target users. In addition, a review of the competitive analysis highlighted the positive and negative attributes of the products and services researched.

Figure 4.2: Straw Man Proposal shows the created straw man proposal for a new product-service combination.



The key aspects for the success of this program are (1) Safety & efficacy and (2) Cost safety and efficacy ensure people of different ages and in different levels of physical health get the intended physical benefits from this new product/service system safely and effectively with as little risk of injury as possible. This aspect also brings into play the target users' perceptions of the new product/service offering. If the elderly see it as a risk to their safety or too challenging to use it, it will be unsuccessful. It will also be unsuccessful if they view it as too simple or too easy to use and do not believe it will provide health benefits. Cost, be it fully funded by government organizations, partnerships between government and the private sector, or

pay for use by the participants themselves, the cost must be such that it does not limit access to the target users.

4.1.2 Success Factors

Success is gained based on a deep understanding of the users' internal and external influences and knowledge of what drives their values system as a population segment. Such understanding will enable the research team to create a suitable system for the elderly. Referring to Figure 4.2 it is clear that the success factors categorize into (1) Educate, (2) Health Exam, (3) Exercising, (4) Incentives, and (5) Measurable Results.

Educate addresses the knowledge gap of the elderly towards exercises the handling of the developed platform. The elderly receive training on the benefits and values of physical exercise and information on the proper levels of exercise to achieve an improved state of health.

Health Exam, the elderly will get an examination from a healthcare professional providing them with a fitness rating to correspond to a specific exercise level. Providing a baseline of the physical fitness level of the elderly is crucial for the system to work since not all exercises are suitable for individual cases. The different levels will contain various safe and effective exercises based on each elderly's current physical state and capabilities to perform specific exercises. The health exam helps to attain the proper physiological cardio zones, to develop strength and flexibility training for the elderly. It is important to note that there are numerous ways to manage this. For example:

1) Provide a health check for the elderly from their primary care physician to establish an initial baseline. This baseline allows the elderly and their physician to track their progress and improvement.

2) Generating new jobs and train people to perform the physical evaluations.

3) Initiating a hospital or university-sponsored program with the help of the government.

These initiatives should also include a data tracking process, followed by regularly scheduled follow-up checkpoints tracking the elderlies' health conditions in predetermined regular intervals.

Exercising: A suitable exercise routine is designed based on evaluating current exercise products and the fitness status from their health examination. The exercise routines are developed based on the elderly's current levels of health. The product-service combination should contain social elements, entertainment value, the highest safety precautions, be adaptable for various user sizes and physical conditions, contain warm-up, exercise, and cool-down routines, and above all generate measurable health improvements for members with prescribed use in a relatively short amount of time.

Incentives focus on internal motivations, which deal with think, do, feel, and external motivations, which deal with social, political, and economic factors that affect the elderly lives. Incentives could be actual rewards, social value, status, recognition, not to mention improved health and cost savings associated with healthcare expenses. It is important to note that this must be the most creative part of the project since this is where the most effective influence resides.

Measurable Results should have multiple metrics in place to accurately and adequately evaluate the success or failure. Results should quantify in various ways like individual growth, health statistics, personal cost savings, governmental healthcare expenditures, scalability of this product-service combination, cost/benefit analysis, and potential others.

Early conceptual ideas focus on the combination of incentive and exercise activity. The design team held several rounds of brainstorming and generated over 50 possible concepts combining exercise methods, exercise products, and incentive systems. The following list includes some of the additional and noteworthy ideas:

1) Design an exercise machine, which can power a water pump and filtration system to generate free clean water for users.

2) A pyramid-style network recruiting methods.

3) Lighted foot pad where users react to the light with dance steps.

4) Specially designed athletic shoes for seniors with information tracking technology built into the sole of the shoe.

5) A variety of outdoor public activity exercise products.

6) Group exercise product where users are on the back of a platform bus and pedal power generates the electricity for the batteries which power the bus and safely move the seniors through the city.

7) Hospital privileges and emergency response network.

8) Visualization of health states while users interact with the product (s).

9) Information alert providing feedback when the user has achieved aerobic and anaerobic states.

10) User pairings with everyday activities.

A selection committee consisting of the research team and industry experts (i.e., engineers, physical therapists, and sports scientists) reviewed over 450 concepts that resulted from the initial brainstorming. After an initial screen, the committee excluded 80% of the concept ideas due to an inherent lack of logic, effectiveness, and feasibility. For further refinement of the initial concepts, the committee integrated new ideas and adjusted concepts that resulted from discussions on how to present concepts to the target users. The research team also conducted a second round of concept refinement with the industry experts. During this round, the researchers categorized all refined and new concepts on an "Affinity Diagram." During this process, the research team classified the concept ideas into five groups: (1) Service-Centric, (2) Calisthenics, Isometric, and Plyometric (no equipment), (3) Simple Products (e.g., rubber bands), (4) Modified gym equipment, and (5) Water-Based Exercises. After completing the Affinity Diagram, the research team presented the new and adjusted concepts to the industry experts. Then, during a round table discussion with the industry experts, the research team introduced the concepts one at a time. Finally, the committee ranked the remaining concepts based on a down-selection process to pick the top-three concepts for further development. During this process, the committee members collectively picked the top-three concepts (by assigning colored sticky dots to their top choices), based on the criteria of safety and efficacy, ability to implement, perceived desirability of the user group based on the information obtained from the field research, and the scalability of the concept to easily reproduced the research in other communities all over Thailand.

4.3 User Feedback on Product & Service Offerings (Concept Testing)

The concept testing of this study aims to understand three main components: first, each concept's effectiveness in terms of the target user's willingness to use the product or product/service and the concept's effectiveness in providing health benefits. Two, engage the users in discussions to identify the strengths and weaknesses of each concept. Third, align the concept with the level of attitudinal influence, e.g., how much will they like it and be willing to do it routinely.

4.3.1 Concept Testing Process

Three product-service concepts were selected by the research team and industry experts based on the previously mentioned criteria. The user feedback for the product concepts was measured on its own and then subsequently paired with an incentive program. The intention was to compare if a stand-alone product concept is enough to motivate inactive elderly to exercise and get active elderly to use this product.

The research team compared the conceived product concepts with existing, familiar, high-end exercise products to measure the attitudinal responses between product sets. The intention was to assess the viability of the selected product concept to products at the other end of the spectrum, i.e., inexpensive, simple products versus expensive, sophisticated products. Another aim was to assess the differences in the responses if the selected product concepts are paired with some service-based incentive program. The idea behind this is to understand the attitudes towards the incentive program. It is important to note that the primary goal was to research what is most appealing to seniors from a motivational aspect over a product attribute aspect.

Understanding this makes it easier to design and engineer products that meet the needs of the target users.

The researchers created scale mock-ups of both the product concepts and the products paired with the intended service. Storyboard illustrations supported the mock-ups to explain in detail the concepts and the incentives. Additionally, the researcher showed images of existing fitness products to the target users that were more expensive and complex to analyze their responses to products and perceptions of product values.

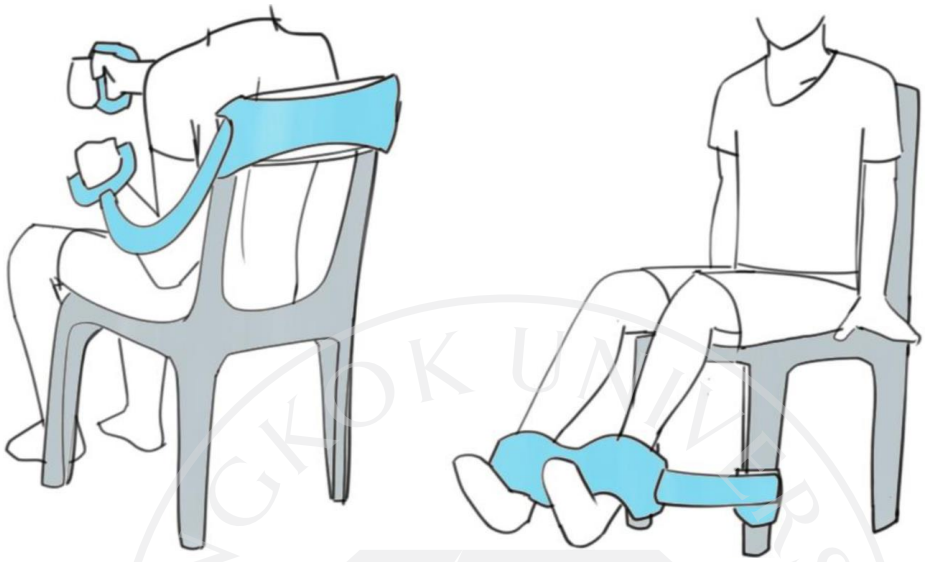
4.3.2 Participants (Target Users)

Participants in this round of user research were 66 jury-eligible users in various states of health. It included both Inactive Elderly and Active Elderly ranging in ages from 55 to 80. There were 53 women and 13 men. Participants were informed that they would be presented with three exercise product concepts and then asked to answer some questions about their perception of these concepts. This initial feedback would be followed up with three different services paired with the product concept ideas, followed by another short series of questions. Lastly, three existing fitness products are presented to evaluate the perceptions of the target users towards these products. Every participant was asked to explain what they understood about each concept to ensure they had the correct understanding.

4.3.3 Product Concept 1: Rubber Resistance Band

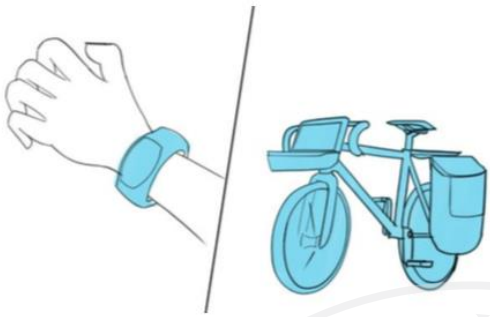
Concept 1 (product concept): rubber resistance bands intended to be used alone and paired with an ordinary household chair so that users can perform a wide variety of exercises (Figure 4.3).

Figure 4.3: Product Concept 1 Rubber Resistance Band without Service



Concept 1 (product concept with service)–a volunteer (staff member) transports by bicycle the exercise products to a group of elderly in designated communities. This volunteer has 10 +/- fitness tracker products (e.g., Fitbit), and the users wear them. The volunteer leads the group in an exercise routine, and then the users' health data is logged electronically. Media coverage of these activities could be in the form of social media for daily/weekly tracking paired with semi-regular television program coverage on a show similar to "The View," where viewers get to follow the volunteers and seniors on their journey to improved fitness (Figure 4.4)

Figure 4.4: Product Concept 1 Rubber Resistance Band with Service

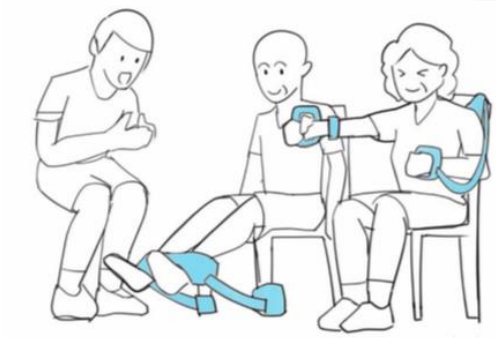


Volunteer gets a bicycle and Fitbit type products for users plus resistance bands for users

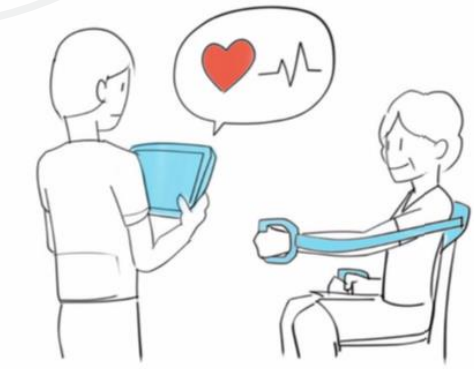
Volunteers are assigned communities to support

Volunteers fasten resistance band system to chairs to ensure it is safe and done properly

Volunteers deploy Fitbit type products onto the users for use at each session (Fitbits are shared with users in the different communities)



Volunteers lead users in the group exercise routines

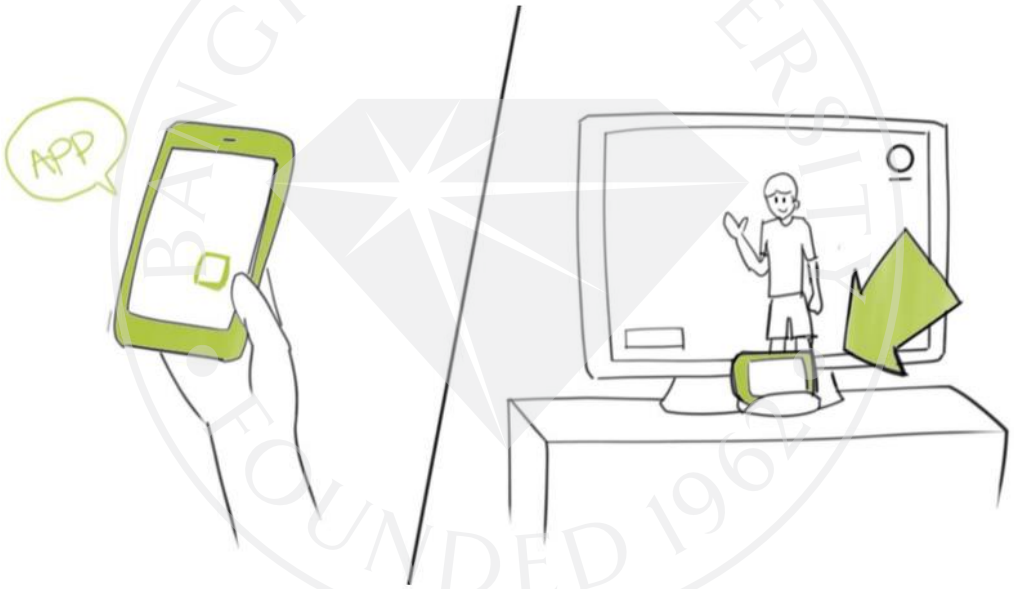


Volunteers log and track user data

4.3.4 Product Concept 2: Mobile Phone Application

Concept 2 (product concept): Users pair a mobile phone app with a television program. Users register via the app and sign in before the show starts. Then place the phone with the camera switched on in front of the TV. The elderly can follow an instructor on TV while the camera assesses how the person performs (Figure 4.5).

Figure 4.5: Product Concept 2 Mobile Phone Application without Service



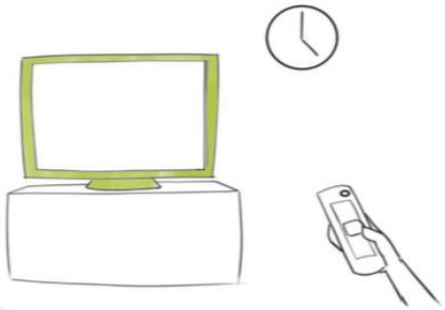
It is important to note that there is no actual exercise product for this concept. Users would be instructed by the host of the TV program that they could use household items as exercise props, i.e., water bottles for weights.

Concept 2 (product concept with service): Volunteers manage the technology component of this concept. They help users acquire the app, set up an account and

pair it with the TV. Users collect membership rewards points with each completed exercise, and they can use these points to get free products or services (Figure 4.6)

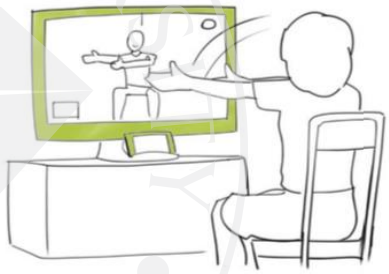
Figure 4.6: Product Concept 2: Mobile Phone Application with Service

Volunteer manages app installation and user registration



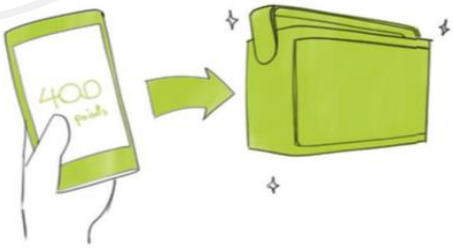
Volunteers provides the users with instructions on how to use the phone with the TV

Volunteers demonstrate the first set up for users



Users video themselves for membership points validation via their phones while following along with the TV show's exercise instructions

Volunteers see the point rewards associated with each different exercise



The points are collected in the app and then the points can be used to collect merchandise for the users

4.3.4 Product Concept 3: University Fitness Center

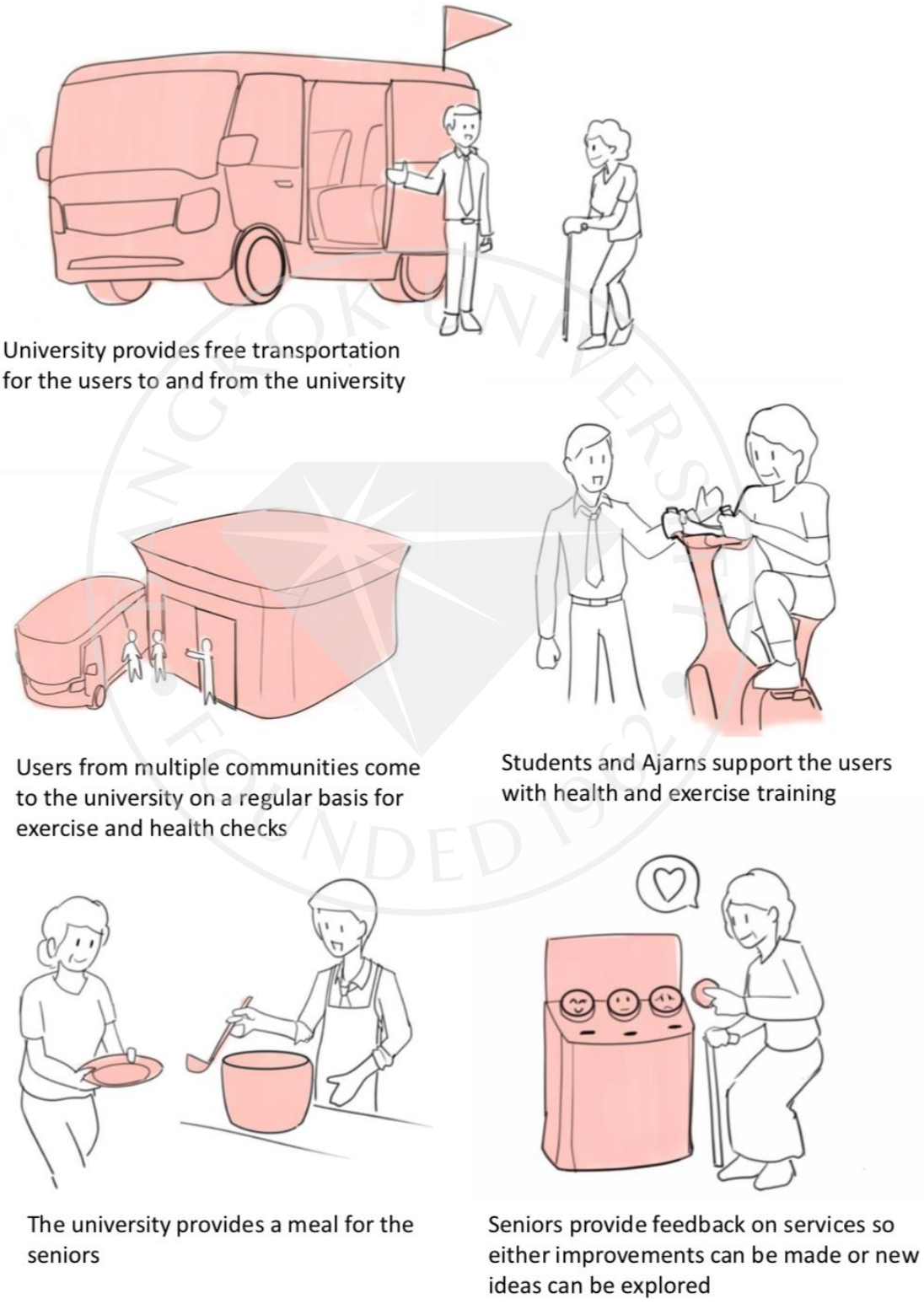
Users can go to the university closest to them for exercise at regularly scheduled times just for seniors (Figure 4.7)

Figure 4.7: Product Concept 3 University Fitness Center without Service

University becomes a full-service center for seniors providing transportation to and from the university, followed by health checks. The university provides students from various backgrounds the real-world training they need related to their major in college, e.g., medical students, nursing students, physical therapy, sports medicine. Additionally, students from engineering and design schools could participate in order to research the users and design more suitable products for this user group. Students from hospitality and culinary schools could manage user amenities and meals, learning how to prepare foods specifically for seniors with

special dietary needs. Commercial sponsorship would play a key role also partnering with the universities, i.e., a company like Betagro could supply hygienic meats and prepared foods to the program while educating students and users on the importance of food quality.

Figure 4.8: Product Concept 3: University Fitness Center with Service



4.4 Findings from Participants Observation

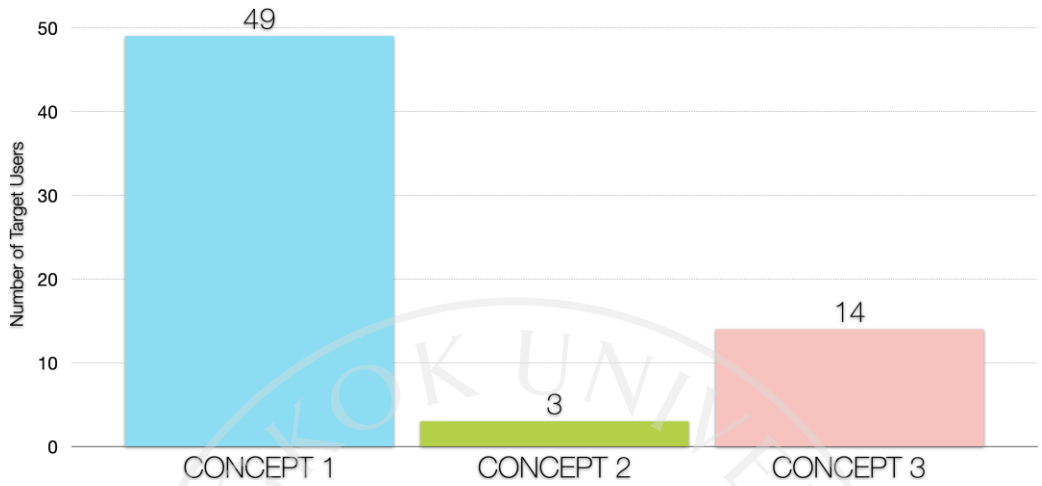
The results show that it is more challenging to design a fitness product for the elderly segment of the population. This drawback is primarily due to their physical condition and how it varies from one person to the next. For example, the average health of a population segment from 15 to 45 years of age would vary less regarding what they can do when exercising than the elderly segment. To better explain differences in participants, we can classify them as Young Old (55-65), Mid Old (66-75), Old Age (76-85), and Super Aged (86+).

Typically with age comes a natural decline in health, and the range of this decline can vary significantly from person to person. The most common problems reported were related to balance, heart and lung conditions, and strength. As people age, there is a natural regression of cognitive function, which may affect the senior's ability to maintain their balance while exercising, putting them at risk of injury. Diseases like diabetes can, in some cases, cause numbness in the seniors' legs and feet, which will affect their balance. There are several different heart conditions, which will either limit or prohibit exercise for this user group. Seniors with chronic obstructive pulmonary disorder (COPD) and other lung diseases and ailments that come with age can also limit or prohibit exercise. The range of strength in this user group is a much broader spectrum than a younger segment of the population. While some seniors could be equally as strong as the younger population segment, some will be very weak and frail yet still benefit from some strength training. Many of the interviewed target users have a history of injuries and suffer from "bad back, bad knees, bad feet, bad hips, bad shoulders, etc.," and arthritis due to some of the previous injuries mentioned by users.

The research also revealed that women were more accessible for interviews than men. This fact prompted a further inquiry into the matter as to why this might be. A review of a series of news sources and research papers found that Thai women typically live longer than Thai men. Although Thai women live longer than Thai men, they spend more of their senior years with illness and disabilities. When comparing genders, proportionally, Thai men have a longer healthy portion of life and less time with disabilities than women (Prasartkul, 2013).

The participants were reluctant to technology and technology-based products like the interfaces on the recumbent bicycle and the seated elliptical trainer, alongside the smartphone-based app of Concept 2 (Figure 4.5-4.6). The majority of low-income seniors interviewed did not have smartphones; however, most of them did have TVs. As the younger generations of today become the aging population in the future, one could induce that having technology-based fitness products, later on, will be a more viable option than it is today. Figure 4.9 represents the overall "first choice" responses of the target participants. The "Young Old" group (55-65) tended to like the concepts that included travel, sponsors, and the ability to increase an exercise routine. On the other extreme, the "Old Age" (76-85) group tended to lean more towards either community or home-based products and responded well to having volunteers. All age groups liked the idea of health checks and asked if these health checks could replace some of their current routine doctor visits.

Figure 4.9: Overall “First Choice” of Target Users for the Presented Concepts.



Some of the feedback, comments, and critical insights gathered from the user concept research revealed that communities with community leaders still use a paper-based system. The community leaders must travel from home to home and manually document the condition of the elderly in their communities. Another discovery is that a small but substantial portion of the elderly interviewed cannot read and write. Typically the Active Elderly have difficulty motivating the Inactive Elderly to participate regularly in exercise activities. There were many complaints about the lack of funds, lack of attention, and even the lack of information and feedback from doctor volunteers who visit the community semi-regularly to monitor heart rates and blood pressure checkups. It is important to note that the elderly did not care for incentives like free food or rewards points for products. However, most responded well to the idea of having TV programming as a means of support as well as a means of gaining notoriety and status.

CHAPTER 5

DISCUSSION & CONCLUSION

Design thinking has gained recognition as a human-centered, problem-solving process that can radically improve product innovations (Howard & Melles, 2011; Melles et al., 2012). Using a well-developed and customized design thinking process can be a competitive advantage to an organization (Fraser, 2007; Martin, 2009; Martin, 2010). This research has demonstrated how the design thinking process can be adapted to develop research strategies to understand consumer's needs and subsequently facilitates the innovation aspect of new product development. As an interdisciplinary practice, design thinking integrates the knowledge and experiences across functional departments of an organization and then combines them with the understanding of the needs and wants of the target consumers (Brenner & Uebernickel, 2016). The design thinking approach has facilitated the research process and enhanced the quality of insights gained from the research project presented here.

First iteration of the process. The following sections presented and discussed the main findings of the project.

5.1 Design Thinking

Research Phase 1 (Understand and Define): The results from the research showed that the vast majority of respondents do not have diet or exercise regimens in their life. Moreover, personal health knowledge among the interviewed elderly is relatively low because the sample consists mainly (n=68, 58.6%) of low-income and under-educated people to mirror the wealth distribution of Thailand. This population

segment lives off traditional and "tribal knowledge," which are stories that are developed and disseminated in their local social circles.

Research Phase 2 (Define and Create): Most elderly have a negative attitude towards diet and exercise, making it challenging for them to adopt a healthy lifestyle and exercise equipment into their lives. Based on this, the research team believed that an exercise product alone is insufficient to inspire a lifestyle change. As a result, the team decided to test different product concepts of exercise equipment (stand-alone) and compare them bundled with an incentivizing service.

Research Phase 3 (Prototype and User Testing): Designing a product that will be safe, effective, and appealing to all three income segments is a significant challenge for the development of a sustainable business model. Based on the insights gained from the interviews, the product design needs to be simple (i.e., intuitive and easy to use, quick to set up and break down) for the elderly to adopt such product or product-service package. Moreover, a product or product-service package that the elderly can use alone or with their social groups might further motivate a change in their exercise behavior.

A critical insight of this research is that the cultural aspects of the elderly population in Thailand should not be overlooked or underestimated. In Thai culture, *family* comes first, which is a very admirable cultural quality. Connecting personal gains from exercising to the wellbeing of the entire family might further motivate the elderly towards a lifestyle change. Social status is a crucial component to be conscious of when the majority of the consumers are from the low- and middle-income segment. A product or product-service concept that addresses the need for status will offer incentives and appeal. Lastly and maybe the most critical component

of Thai culture is "being considerate" (**ความเกรงใจ**). Thai people are kind and sensitive, and telling someone "no," let other people down, make someone feel bad, or lose face is often avoided. Due to this behavior, respondents often agree with the interviewer but may not commit to their answers.

5.2 Products and Platforms

The responses and feedback from people in the target communities revealed several success factors supporting a new product introduction.

5.2.1 Safety and efficacy, the product must be safe for this broad spectrum of users and provide the benefits of improved health. The challenge will be in meeting the needs of this physically diverse user group.

5.2.2 Simple and not intimidating, not mechanically complex, not technologically complex, or requiring users to pay for additional mobile phone services or internet access.

5.2.3 Ownership, whether owned by the user or the community, the total cost of the product and the cost of ownership should be modest. It should be easy to maintain, and it should be easy access to low-cost replacement parts.

5.2.4 A product that users can use in their homes and then easily transport to group events would meet the needs of the majority of this user group.

The product does not have to be the users' only form of exercise. It could be a product more focused on strength training paired with a calisthenics routine that requires no product for the cardio component of the fitness regimen. Research shows that water exercises in a swimming pool are among the best forms of exercise for seniors of all ages (Broman, Quintana, Lindberg, Jansson & Kaijser, 2006; Weinstein,

1986). These kinds of exercises have a low impact on joints and bones because the water buoyancy offsets the bodyweight. The water can provide resistance for strength training, and there are a large variety of pool exercises that provide aerobic benefits. The challenges of providing water exercises are cost, logistics, maintenance, and sanitary health.

5.3 Motivations and Incentives

Based on the research results, it is better to deploy products paired with a service in individual communities. Systems that require users to travel seem to be less desirable to the target users. The findings also revealed that the target users find systems with rewards points for free product giveaways less appealing. Regular or semi-regular follow-up and visits from an official source will keep the community engaged and motivated. Moreover, training one person from the local community to lead group exercises or assist the elderly to exercise at home, to maintain interest in a lifestyle change. In addition, the target users indicated a variety of factors that might motivate them to exercise:

5.3.1 Support from someone who has professional knowledge related to exercise and health can provide individuals with information regarding their progress or lack thereof—someone who can support individuals with their measurable results.

5.3.2 Offer status in the sense of community role models. The people researched found TV and social media to be an exciting option because they incentivized people to perform well to one day be on TV as role models. They also found it to be a practical way to share knowledge and information and the entertainment value of the television program concept.

5.3.3 Provide better support to the communities. Volunteers, trainers, doctors, etc., must be invested in the individuals in these communities, share knowledge and provide a small amount of one-on-one care.

5.3.4 Giving community-based support to the socially active elderly the flexibility to exercise in a group or receiving support at home is also considered a form of incentive.

The results support that a good motivation and incentives system needs to be flexible and plan for regularly scheduled changes to help maintain the interest of longtime users while also appealing to new users. Most participants would like feedback and become stakeholders in the measurable results the project aims to achieve. While free products or free food was rated lower in appeal to the target user group, many of them mentioned they do not work out because of their current financial circumstances. One of the proposed product concepts would be to gamify an exercise product paired with a product like a slot machine where users would have chances to win money every time they exercised.

5.4 Recommendations

5.4.1 Limitations of the Research

The researcher acknowledges certain flaws and shortcomings of the project due to its nature. The research project focuses on locations and sites in and around greater Bangkok. Funds and time restrictions prevent the researcher from collecting a larger cross-section for the entire Thai population. However, participants for the data collection are purposefully selected to reflect the demographics of the national averages.

Moreover, the project's Prototyping stage needs to be very simple and cost-effective because of limited funding. A result of this constrain is that only concept testing is possible, but no actual product testing.

The use of observations and interviews may lead to a Hawthorne effect, where respondents are aware of the observation adjust their behavior. This problem is especially significant in Thailand, where "face-saving" is an essential part of social behavior. The research design employs a mix of observation, interviews, and focus groups for its data collection to manage this adverse effect.

The qualitative nature of the field research method applied for the project makes it difficult to investigate causality, and the researcher cannot verify nor generalize the findings. Nevertheless, generalizability is not the project's aim since its purpose is to explore the knowledge, attitudes, and motivations of the elderly towards exercising.

5.4.2 Future Research and Next Steps

To develop a full-scale prototype to be tested with the target user group. The test locations should be a combination of communities already visited and new communities and participants who have a fresh perspective without being influenced by previous rounds of concept testing.

Reach out and establish relationships with universities and businesses to gauge the level of interest and the potential of support from these communities. Furthermore, estimating what types of products or services could be made available as a pilot project to scale it to a national level.

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