



The Development of Innovative Smart Solutions for Independent and Active Aging

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Abstract: The global population of retirees over 65 years of age is increasing, year by year. There is evidence that shows that this age group of pensioners prefer to ‘grow old’ at home even if this means being alone. The state welfare services that care for the elderly are in short supply. It is expected that smart technologies will not only reform the welfare services but in addition provide support for the elderly in their homes and support their independent living. Finding solutions to these two problems should become a priority in the developing countries. Here, there are weaker health and care ecosystems especially because formal home-care services remain underdeveloped and difficult to access, At the same time the number of informal carers is decreasing. The present study aims at supporting the understanding of ‘How can innovation contribute in supporting health and care ecosystems in developing countries?’ For this purpose, the study employed two perspectives: one provided by the experts and one by the summarizing the powerful evidence of the older adults’ technology adoption studies with regard to aging independently. The study interviewed 13 experts from across Europe from the NET4Age networking which comprises experts in Health and Care and conducted desk research on the adoption of the new technologies by older adults and their next of kin. The study identifies the types of innovations which need to be adopted by the developing health and care ecosystems and the new technologies which should be available in the markets of the developing countries.

Key words: social sciences, health and care ecosystems, technology adoption, older adults, SWOT analysis

1 Introduction

In Europe the number of the population of retirees over 60 has reached 20% of the population. The post war baby boomer is now in her/his 70s. In the context of the Health and Care ecosystems which have significant shortcomings in terms of effectiveness, professionalism and readiness, we have asked: How

can innovation support ageing well and independently in developing countries?

Globally, the focus on innovation increased as it promises to bring economic growth and social inclusiveness. For the last decade, research and white papers in innovation and technology diffusion began to flourish and, currently, there is a significant amount of

work which emphasizes the facilitating and limiting factors of innovative ecosystems on the one hand, and the older adults' and their families' adoption and effective usage of new technologies, on the other hand. Moreover, there is an urgent need of studies which focus on health and care innovativeness and technology absorption in developing countries. To the present, their needs and requirements have not commanded much interest. However, today there is globally a growing interest in studying innovation in health and care ecosystems due to sky-rocketing increasing needs and requirements of the new coming retirement of the Baby Boomer generation and their families.

Moreover, the innovation can be seen within a catching up strategy, which refers to developing a health and care ecosystem based on the Western model, while learning about its limitations and having access to the last updated technology. The strategy of 'choosing the own way' implies a qualitative understanding of the current situation and specificities while taking steps further considering the culture and current infrastructure. Hence, a strategy requires vision and values.

2 Theoretical backgrounds

The Health and Care developing ecosystems are merely existing in collectivist cultures or lay between a collectivist and an individualist culture. These cultures exhibit to a large extend group cohesiveness, which is often expressed through the extended family where members offer help and loyalty, strengthening the family-oriented paradigm. In order to measure the strength of the informal care, one can look at the degree of familialism paradigm through Hofstede Insights [1]. The ecosystems' framework of analysis is applied to countries comparatively much larger and advanced than countries still under development. There, ecosystems success stories are to be found, such as the aging well in Switzerland, Denmark or Finland. The most common explanation is that the small size of their domestic markets led to early economic openness to technology: small ecosystems can be more easily reforms as the periphery would not lag behind while the discrepancies are fading.

On the same par, according to evidence, the density of innovators and public communities' organizations in a given area enable higher rates of health and care development at a regional level, which make innovation sustainable, rather than reforming a whole country ecosystem. Hence, action is taken at small regional ecosystem levels, and thus, innovation and sustainability grow quickly without unbalancing the whole country ecosystem in case of failure or limited adoption [2].

Latest research studies show that the health and care ecosystems from the developing countries have the following commonalities: 1) Limited or no access to information and healthcare services, 2) Poor care and self-care at home, 3) Poor communication between patient and doctors, 4) Unequal access to technology benefits. All these lead to the following consequences: a) No diagnosis/ Self-diagnosis/ Disease aggravation, b) Critical treatment can be skipped and the older adult can be at high risk, c) Frequent users of ambulance services (high pressure on the system), higher rate of hospital emergency admissions, medical complications and re-hospitalization, d) Poor medical adherence: overmedication or undermedication, Non-compliance with doctor's instructions, doctors cannot have an overview and precise understanding of the symptoms which leads to poor anamnesis, e) Poor prevention and control measures in care at home [3, 4; 5].

If it takes political will to build an innovative health and care ecosystem, it definitely requires expertise and the careful consideration of the needs and technological familiarity in order to strengthen and give sustainability to the ecosystem through innovation. That would lead to the transformation and readiness of the health and care ecosystems in the developing countries.

3 Methodology

The study was based on a survey and desk research. The survey was conducted within NET4Age networking over the course of February 2022. The survey collected the opinions of the researchers across NET4Age European networking on 'How can innovation support ageing well and independently in

developing countries?’ A convenience sample of 13 researchers across Europe participated in the survey and answered to 3 key questions asked. Their perspective has been completed which solicited barriers and facilitators to technology adoption from the older adults and their next of kin informal caregivers.

We employed a survey methodology because this approach affords the comparative analysis among the research inputs providing insight into the types of innovation, and different stages of their vision towards technology absorption. The researchers survey had a convenient sample of members. The sample size is moderate. No personal data has been collected so no informed consent was provided to the study participants. The survey has comprised 2 open questions which revolved around the central theme: ‘How can innovation support ageing well and independently in developing countries?’

Here, we have considered if radical innovation should be employed, meaning that the system has to be restructured, or technological reforms should be taken, incremental innovation, for advancing the system performance. However, frugal innovation is another alternative, where points of focus are established in a top-down approach.

The following two questions have been asked:

1. Based on your knowledge and practice, what innovations can work even within a health-care system which has significant shortcomings in terms of effectiveness, professionalism, readiness etc.? (if you have no answer: What is your opinion of this situation?)

2. There are countries where the State cannot afford to meet the health care needs of its elderly poor and their carers. In these countries what innovations should be adopted by the elderly and their carers themselves which would increase their state of health, and/or their ability to be independent and/or their quality of life?

If this study aimed at contributing to a better understanding of what kind of innovation is needed from the experts’ perspective, on the same par, the study looked for what is, from the end-users’ perspective, the ‘perceived usefulness’ of the new technologies for the older adults and their caregivers,

be they their families of the formal care service providers.

4 Discussion

4.1 Innovation in the health and care ecosystem from developing countries.

However, we look at how to encourage the growth of the health and care country ecosystems through recommendations for strengthening the adoption of the innovation and believe that the discrepancies between and within the ecosystems should be addressed through policies with a strong emphasis on culture, and not solely by promoting technological innovation. The cases of under-developing countries pose a challenge to the ecosystem frameworks, due to their disparities in development: there are sharp contrasts in technological innovation and culture as well. The policies are commonly biased, favouring technology adoption in underdeveloped national ecosystems and neglecting cultural differences and status-qua and contextual requirements which consider the differences in development.

Our participants categorized innovation in two groups: technological and non-technological innovation and some of them insisted on the importance of the last, given the underdevelopment of the health and care ecosystems and their prone to failure when it comes about absorbing radical innovation. Moreover, we found significant differences in the meta-analysis of the actual usage of the new technologies by the older adults given the differences between the health and care ecosystems. These findings emphasized that, on the one hand, innovation for health and care ecosystems in the developing countries has different missions and ways of absorption comparative to the innovation from economically advanced countries, and on the other hand, the technologies needed for ageing well also different, given the different needs of the informal care support. All this constitute powerful evidence of the value of creating and designing the vision of change in accordance to the contextual requirements, rather than planning a catching-up strategy of technology absorption which constitute sources of political, economic and technological non-readiness and hence, new sources of failures.

In order to reform the health and care national systems, some of the experts emphasised that social innovation without technology is needed. “New access and concepts for systematically health-care work and services, upgrading organisation and coordination even to develop new profiles or jobs - social effectiveness facilitator, special coordinators” (Survey, 2022). Integrated care is another point of focus of the experts interviewed so, using new technologies for health promotion and especially for integrated care. “Integrated care which helps both patients, family care givers and all the professionals. Bureaucracies can become more effective and leave a trail of responsibility if considered carefully” (Survey, 2022). Informal care needs special attention, and it refers to using IoT for health monitoring and evaluation – supporting informal care-givers/ next of kin.

Data shows that older adults’ technology acceptance and usage is still slow and lags behind expectations. At the core of technology rejection or limited use of technology are: 1) indifference or the lack of relevance of the new technologies, 2) age-related impairments, 3) deficient knowledge, (while cost is not a key factor anymore). Informal carers’ technology optimal usage lags behind expectations because:

The new technologies are lacking relevance to the informal carers while targeting older adults who are already cared for. Data is provided without interpretation (hence, monitoring became irrelevant); A vision for integrated care is needed, where stakeholders are involved, though at primary level: community and non-governmental or social business organizations and not at an ambitious level (local communities, businesses, technology developers).

4.2 Innovation in the informal care context

There are complex limiting factors at play into the adoption of a top-down approach with respect to absorption of technology, which mismatch between technologies and older adults’ and their families’ needs. A user-centred design approach should be employed in order to identify older adults’ perspectives regarding the new smart technologies and gauge interest in participating in the co-design process. Identified barriers to technology use included low technology literacy, including lack of familiarity with

terminology, and physical challenges, which can make adoption difficult. Facilitators included an eagerness to learn, interest in co-design, and a desire to understand and control their data. Most participants identified as privacy pragmatics and fundamentalists, indicating that privacy is important to older adults. At the same time, they also reported a willingness to contribute to the design of technologies that would facilitate aging independently. There is a need to increase technology literacy of older adults along with aging literacy of technologists.

Latest studies [6,7] bring evidence that an innovative combination of acoustic sensing, artificial intelligence (AI), and the Internet-of-Things (IoT), is a cost-effective way for alerting care providers when an older adult in their charge requires help. Home mobility monitoring systems in visiting nursing practice proved to be a supportive tool for monitoring daily activities in community-dwelling older adults [8]. Actually, since a decade ago it is researched the monitoring of the sound environment where outliers (abnormal situations) are identified in order to decide for emitting an alarm wither to the formal or to the informal care providers (Strauss et al., 2008). The focus of the development of the new environmental technologies is on reducing cost and increasing reliability.

Some research shows that costs of the new smart technologies should not be high as long as we draw from the technologies which have been already adopted. For example, Istrate et al (2008) has shown that an embedded PC, equipped with a classical sound card and a microphone, is capable of real-time detection and analysis of sounds to detect abnormal situations. Hence, the system was found to be reliable for detecting and classifying sounds at signal to noise ratios of 10 decibels (dB) or more, with an error rate of 5% or less. However, it was less efficient at sound and speech recognition [9].

Most of the remote monitoring systems are non-intrusive as privacy is a very important point of concern for the older adults and for their caregivers as well. According to [10], the advance of artificial intelligence provides unique opportunities to provide health monitoring and assistance for older adults facing difficulties to live independently in their homes.

That includes the correlation of the following technologies who aim to do activity recognition, activity discovery, activity prediction, and prompting system.

Changes in the intensity of the daily activities correspond to exacerbations of mental illnesses including depression and dementia as measured by standard health assessments (Geriatric Depression Scale, Mini-Mental State Exam, and the SF-12 Health Survey). The densities can be used to alert clinicians to changes in mental health status the theoretical section, there are two perspectives which can be employed when envisioning the reform and strengthening of the health and care ecosystem in developing countries in order to meet the new societal challenges as well as benefit on the last advanced research: 'catching up' and 'doing their own way' allowing for early interventions assisting residents to age in place.

Social isolation is the highest risk factor for functional and cognitive decline and, more it is the greatest fear of the older adults and their families. Goonawardene et al [11] show how a non-intrusive sensor-based monitoring system comprising of motion-sensors and a door contact sensor can be utilized to detect elderly who are at risk of social isolation. They have found that the overall social isolation level of the elderly and the time spent in the living room is positively associated with the emotional loneliness level. Further, elderly who perceived themselves as socially lonely tend to take more naps during the daytime.

Based on the survey' results, we distinct between type of innovations and the sectors where they are most needed. Generally, according to the expertise, no radical innovation should be undertaken in the formal care sector, while, in order to strengthen the informal care sector, radical innovation is needed and can be incrementally adopted.

If the first perspective employs the incremental adoption of the innovation in order to induce gradual change into the ecosystem, the second perspective shows its strengths and weaknesses, as well as threats and opportunities, in a different approach. Hence, the survey results are shown in the SWOT analysis presented below. Hence, we should further understand that 1) in the developing countries, frugal innovation

should be considered and not disruptive innovation; 2) Social innovation without technology should be considered in order to develop new job profiles and gaps in the community services provided, 3) Due to the weak formal care ecosystem, health promotion should be considered; 4) Developing Integrated care should be a priority, instead of strengthening formal care at the expense of informal care sector, 5) The new technologies should target and look to strengthen the informal care sector.

From the experts' perspective, the types of innovation needed within the Health and Care Ecosystems in the developing countries, from the experts' perspective (Survey, 2022) are as following:

Formal care: Social innovation without technology is needed

Integrated care: Using new technologies for health promotion and especially for integrated care

Informal care: Using IoT for health monitoring and evaluation – supporting informal caregivers/ next of kin.

A SWOT Analysis of the Health and Care Ecosystem in the developing countries, from the experts' perspective (Survey, 2022).

Strengths: informal care/ family-oriented paradigm

Weaknesses: overall weak technology adoption by formal care providers and older adults

Threats: overburdening of formal and informal care

Opportunities: innovation without technology and frugal innovation for supporting the informal carers.

It is relevant to mention here that the threat identified based on the SWOT analysis can be overcome by the smart new technologies, while developed based on the end-users' requirements.

We have shown that the degree of development of the health and care ecosystems plays a key role, and so does the psychological factors when deciding the relevance of the new technologies to the older adults.

Research limitations/implications: This paper undertake the discussion around technology acceptance by the older adults, but most of the research evidence is drawn from the European cultural context.

Practical implications: In this paper we argue that the technology developers should take into consideration the facilitating and limiting factors of the technology

acceptance, and that beside the end-user implications in the co-creation process, facilitators should be included into the teams for assuring the information flow among the end-users and the business and the technical teams.

Originality/value. The present communication adds a new dimension by considering the acceptance and adoption of new technologies based on the degree of development of the health- and care-ecosystems within which the new technologies are developed.

Acknowledgements: This work was performed in the frame of the iCAN (AAL/2019/182) and AAL4All (AAL-2021-8-164-CP) funded by the AAL Programme and co-funded by the European Commission and the national Funding Authorities of the partner countries.

Comparative to other monitoring systems, those based on sensors have a higher rate of acceptability. In the future, we need to determine a more simplified view of self-management.

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