

# Personalised Ageing

Subjects: **Others**

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Given the growing number of older people, society as a whole should ideally provide a higher quality of life (QoL) for its ageing citizens through the concept of personalised ageing. Information and communication technologies (ICT) are subject to constant and rapid development, and can contribute to the goal of an improved QoL for older adults. In order to utilise future ICT solutions as a part of an age-friendly smart environment that helps achieve personalised ageing with an increased QoL, one must first determine whether the existing ICT solutions are satisfying the needs of older people. In order to accomplish that, this study contributes in three ways. First, it proposes a framework for the QoL of older adults, in order to provide a systematic review of the state-of-the-art literature and patents in this field. The second contribution is the finding that selected ICT solutions covered by articles and patents are intended for older adults and are validated by them. The third contribution of the study are the six recommendations that are derived from the review of the literature and the patents which would help move the agenda concerning the QoL of older people and personalised ageing with the use of ICT solutions forward.

ICT    older adults    patent    personalised ageing    quality of life    review    smart ageing

## 1. Introduction

This entry introduces and elaborates the terms of quality of life and smart ageing, and discusses ICT solutions as building blocks that sync into the concept of personalised ageing, i.e., achieving quality of life for older adults. It provides the description of the proposed framework for achieving an increased QoL for older adults, i.e., personalised ageing, from the perspective of ICT solutions. This proposed framework is used for the structured review of the literature and patents, and serves as a basis for the presentation of the results of both reviews.

## 2. Quality of Life

Quality of life is a broad concept that has many definitions and meanings depending on the context under consideration. It is referred to as<sup>[1]</sup>: “a perception of one’s position in life in the context of culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns”. The QoL is culturally built as a person’s search to satisfy the three universal requirements, i.e., 1) safety and security, 2) a sense of integrity and meaning of life, and 3) a sense of belonging to a social network. As will be discussed below, this means that culture contributes to three QoL dimensions (i.e., economic and physical safety; overall experience of life; and leisure and social interactions). It is also specified in terms of well-being<sup>[2]</sup>: “a state of well-being which is a composite of two components: 1) the ability to perform everyday activities which reflect physical, psychological, and social well-being, and 2) patient satisfaction with levels of functioning and the control of disease and/or treatment related symptoms”. Others use the term satisfaction with life<sup>[3]</sup>: “QoL is the degree of need and satisfaction within the physical, psychological, social, activity, material, and structural area”. One can conclude that QoL is something like the overall enjoyment of life and a multidimensional concept which emphasises the self-perceptions of an

individual's current state of mind, which is affected in a complex way by the person's physical health, psychological state, personal beliefs, social relationships, and their relationship to salient features of their environment<sup>[4]</sup>.

According to the European Framework 8 + 1<sup>[5]</sup>, QoL constitutes the following eight dimensions: (i) material living conditions; (ii) health; (iii) education; (iv) productive and valued activities; (v) governance and basic rights; (vi) leisure and social interactions; (vii) natural and living environment; (viii) economic and physical safety; and lastly (ix) overall experience of life. Material living conditions cover the income, consumption, and material conditions of a person. Productive and valued activities relate to economic activity, i.e., quality and quantity of employment, as well as other activities, i.e., inactivity and unpaid work. Health is measured in outcomes, healthy and unhealthy behaviours, and access to healthcare. Education covers competences and skills, lifelong learning, and opportunities for education. Leisure and social interactions include quantity and quality of leisure, as well as access to leisure, and the social dimension, i.e., relations with people and activities for people together with social support and cohesion. Economic security and physical safety address wealth (assets), debt, and income insecurity from the economic side, and crime and a perception of physical safety from the physical side. Governance and basic rights cover institutions and public services, discrimination and equal opportunities, and active citizenship. Natural and living environments include pollution, access to green and recreation spaces, as well as landscape and built environments. The ninth dimension, i.e., overall experience of life, covers life satisfaction, effects (negative—being nervous or being depressed or down, and positive—being happy), and meaning and purpose of life.

### 3. Smart Ageing

Smart ageing is a term that is often used interchangeably with healthy ageing<sup>[6]</sup> or active ageing<sup>[7]</sup>, but without an exact definition. One description explains it as a wide concept defined as technology and innovation usage in both the public and private sectors to produce products, services, solutions, and systems to improve the QoL of people who are 50 years old and over<sup>[8]</sup>. A similar definition is given by Varnai et al. in<sup>[9]</sup> and is as follows: smart ageing is using technology, innovation and design in both the public and private sectors to produce products, services, solutions, and systems to improve the quality of life for the older generation in three key areas: functional food, connected health, and assisted living. Moreover, Song et al. in<sup>[10]</sup> regards smart ageing as a concept for mitigating the effects of ageing and improving older peoples' life by managing various healthcare challenges with the utilisation of biomedical, computing, and communication technologies.

According to EuroHealthNet<sup>[6]</sup>, the key determinants of smart ageing are: (i) access to services; (ii) employment and volunteering; (iii) physical activity; (iv) social inclusion and participation; (v) new technologies; (vi) diet and nutrition; (vii) long-term care; (viii) environment and accessibility; and (ix) education and life-long learning. Namely, appropriate health and social services should be accessible to all older people. It is important that older people are not excluded by a new means of delivering services (like a shift from personal care to online services). Being employed or involved in voluntary activities is a great way of maintaining health and avoiding social exclusion. In adults aged 65 years and over, physical activity includes leisure time; physical activity; transportation; occupations; household chores; play; games; sports; or planned exercise, in the context of daily, family, and community activities<sup>[11]</sup>. Social inclusion and participation in various activities enables older people to grasp opportunities to be active and breaks down barriers they face in their everyday lives, such as cognitive impairment and depression<sup>[12]</sup>, a lack of stimulation and social interaction<sup>[13]</sup>, lethargy, boredom, depression, and loneliness<sup>[14]</sup>. New technologies are developing at a rapid pace and affect every segment of our lives. ICT can and will play a key part in helping older people to be more independent and to lead healthier lives. In this regard, many ICT solutions are proposed to prolong and support the independent and active living of older adults. Therefore, those solutions contribute to long-term care by providing possibilities to monitor the activities and health of older adults. ICT solutions for activities monitoring are deployed at

home to warn caregivers about any unusual behaviour in older adults or outside the home to control risky situations. On the other hand, ICT solutions for health monitoring combine ICT solutions for activity monitoring at home with the use of medical devices. However, those solutions have to address several challenges and barriers, i.e., (i) ease-of-use because many older adults are not comfortable with technologies; (ii) invisibility and disuse to isolate older adults; (iii) privacy and security to avoid older adults becoming vulnerable considering their health conditions; (iv) affordability of technology in terms of cost; and (v) supporting older people to stay in their homes or move in different environments independently. Ageing affects nutrition as well as lifestyle: adequate nutrition becomes increasingly difficult with increasing age, whereas physical activity usually decreases. Nutrition and lifestyle, however, are important determinants of health and outcome in older people, especially in those with multiple chronic conditions<sup>[15]</sup> [25]. Nutritional status, dietary habits, and food patterns vary widely across Europe<sup>[16]</sup>. Moreover, the quality and accessibility of the environment in which an older person lives can have a significant bearing on how active they are in society. Finally, there is a strong connection between learning and better health for older people. The concept of life-long learning does not mean only obtaining employment-related qualifications, it also means promoting learning throughout the life course, for the well-being and enjoyment of all.

## 4. The Framework—A Contribution of ICT Solutions

The elaboration on quality of life and smart ageing provide the necessary building blocks to introduce the framework of personalised ageing. Figure 1 represents our framework for achieving personalised ageing, i.e., the QoL of older adults. The proposed framework has a horizontal and a vertical component.

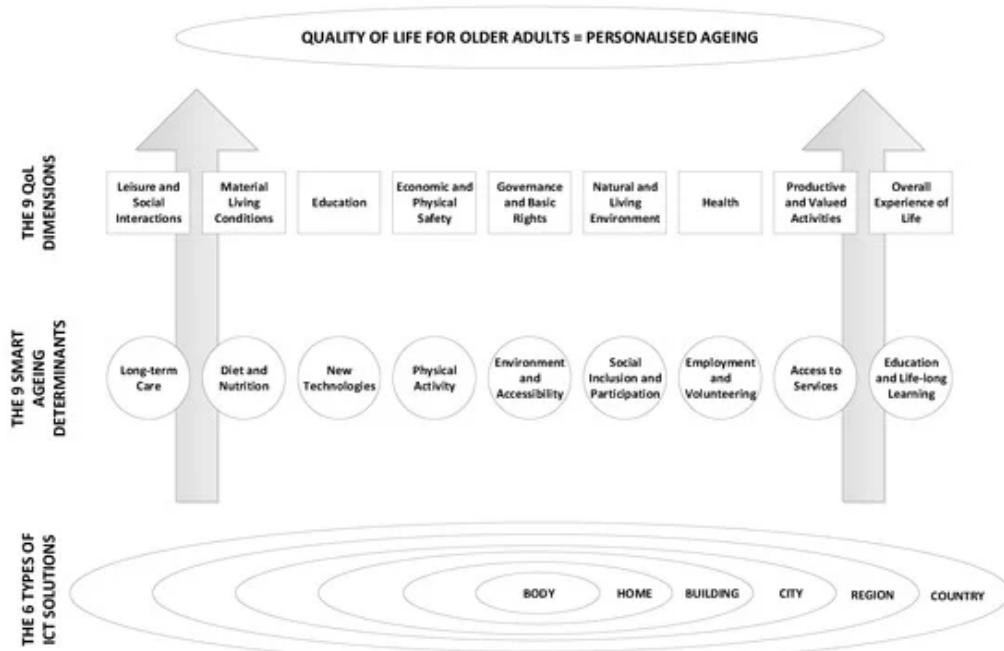


Figure 1. The framework for the Quality of Life (QoL) of older adults.

### 4.1. Horizontal Component

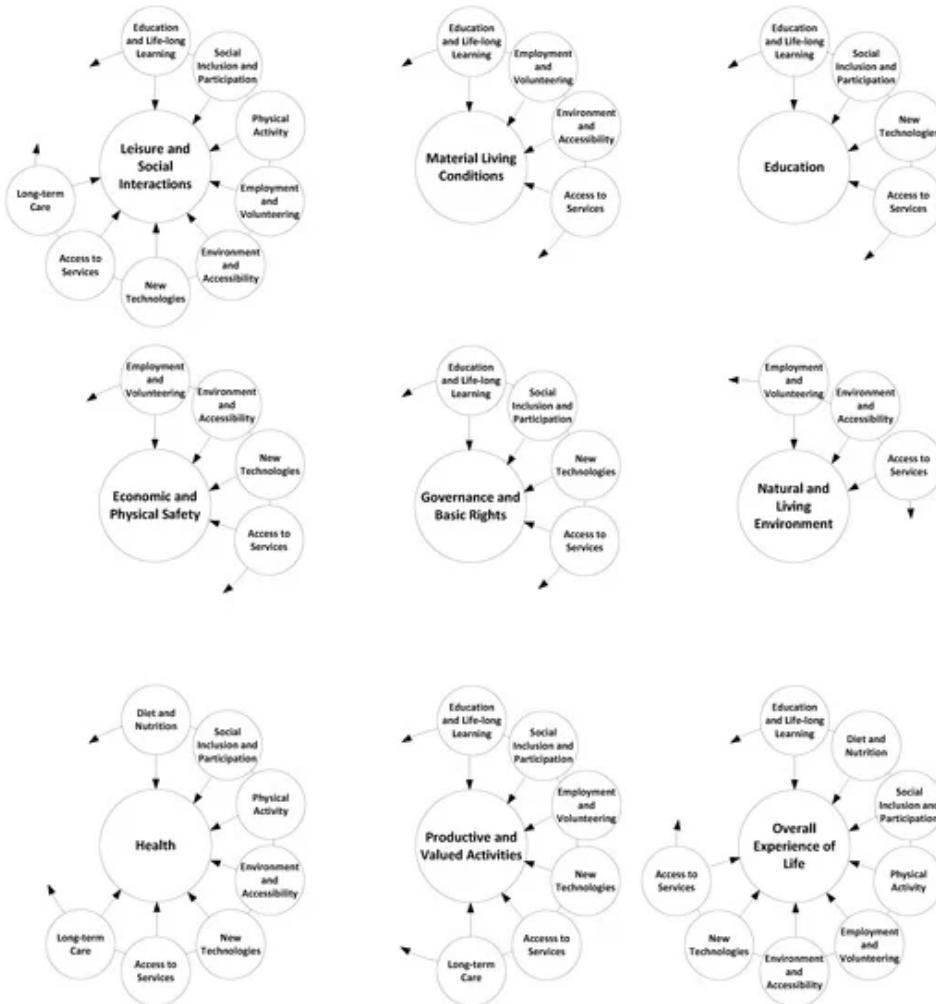
The horizontal component refers to and describes the environment in which the multiple ICT solutions will operate, further contributing to the smart ageing concept. As given in the framework, those can be the: (i) human body; (ii) home; (iii) building; (iv) city; (v) region; and (vi) country. Smart ICT body-worn solutions cover devices with installed tools, applications, or systems

that will be placed on the human body, i.e., watches, glasses, bracelets, chips, and pacemakers. Smart ICT home solutions cover items that surround the older persons in their homes or narrow living environments such as smart furniture, phones, computers, spatial, and temporal sensors. Both types of solutions should aid older adults in their more confident and independent behaviour in the domestic environment. Furthermore, these solutions could be totally personalised to older individuals. Smart ICT building solutions include the rule of operation, and devices that older persons encounter and use as soon as they close their home doors, but before they are out in the streets and concern things such as stairs, elevators, keys, etc. Smart ICT urban solutions refer to solutions (logic, applications, systems, devices) that are placed anywhere in the city (or a village) and increase the ease the life of older adults when they come across environments that include public transport and public surfaces, various spatial and temporal sensors, and so on. ICT building solutions and city/urban solutions are ones that are used by other cohorts in the population too, but they need to be adjustable to older adults considering the fact that they will soon make up a quarter of the entire world population. Moreover, these solutions should encourage and support older adults to take their deserved place in society instead of withdrawing from it. Smart ICT regional solutions cover applications and systems that provide better governance of certain regions taking into account their specificities, while smart ICT country solutions refer to those that affect the country as a whole, and are mostly regulatory and policy related. The latter two also affect the other age groups in society, but they should be conceptualised in an adjustable fashion in order to satisfy the needs of older adults.

## 4.2. Vertical Component

Taking the bottom-top approach, the description of the vertical component of the framework aimed at the QoL of older adults is as follows: The first step on our way to a better QoL are ICT solutions (Figure 1). That is, the existing ICT solutions and ones that are to be developed in the (near) future should be designed to contribute to key smart ageing determinants.

The next level is having smart ageing determinants mapped out into QoL dimensions. A proposition for the mapping is given in Figure 2. The main aim of this mapping is to have a link between these two concepts. The knowledge of these connections, i.e., which smart ageing determinant influences which QoL dimension, gives better targeting opportunities and effective attainment of the ultimate goal—QoL for older adults, i.e., personalised ageing. The main aim of this mapping is to find a link between these two concepts (i.e., smart ageing determinants and QoL dimensions). For example, an ICT tool that is designed to satisfy the smart ageing determinant education and life-long learning can positively affect and improve the QoL for older adults by contributing to its following dimensions. First, leisure and social



**Figure 2.** The proposed mapping of the smart determinants to QoL dimensions.

Interactions, because it allows older adults to entertain themselves and to get in touch with other learners. Second, material living conditions, because it allows older persons to increase their incomes by doing various paid jobs if they increase their knowledge in a specific domain. Third, education, because it allows them to have personal growth. Fourth, health, because it allows older adults to take better care of their physical and mental health if they constantly learn about the new medical improvements and health recommendations. Fifth, productive and valued activities, because it allows older adults to feel productive. Finally sixth, the overall experience of life, because it allows them to feel better if they enjoy learning.

On the other hand, QoL dimensions on material living conditions can be affected by the following smart ageing determinants: education and life-long learning; employment and volunteering; environment and accessibility; and access to services. For example, education and life-long learning allows older adults to gain knowledge they can monetise and improve their material status. Employment means that older adults can work and thereby improve their material living conditions. Environment and accessibility as well as access to services impact material living conditions as a QoL dimension in terms of providing opportunities to allow older adults to increase the level of their material living conditions.

It is also important to stress that in addition to the impact that these smart ageing determinants individually have on QoL dimensions, they can also have interdependent relations among each other. These interplays between them as well as constructs that they form which in the end can affect QoL dimensions should be additionally investigated in future research.

The final level is formed by the QoL constituents (in this framework called QoL dimensions (8 + 1)<sup>[5]</sup>) a contribution to the improvement of the overall QoL of older adults, which leads to personalised ageing. In case there are multiple ICT solutions designed to be personalised and satisfy multiple smart ageing determinants, which in combination contribute to multiple QoL dimensions, then those improved QoL dimensions jointly accomplish the goal of QoL while ageing or in personalised ageing.

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