BANK4ELDER

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Report with general user needs

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Executive Summary

This report is the result of a review focused on demographic and functional characteristics of older persons and their needs, use and problems with Information and Communication Technologies (ICT), taking special attention to bank services and interfaces: online banking, web, Automatic Teller Machine (ATM), mobile phone and television. Moreover, the report contains a study of new emerging technologies and the relation between the next generation of older persons and the new technologies and the banking access. This report will allow knowing the global situation of older persons and ICT, focusing on bank services and interfaces.

The review has based on the technical-scientific literature and statistics of national and international organizations. Although, the focus is on the European older population, the next generation of older persons have also taken into account because they will be older population in a few years.

Ageing population is a reality in our society. Older people represents 17% of European population and this will continue increasing until 30% in 2060. The ageing can limit persons capabilities from physical (e.g. reduced movement ranks and muscular strength), cognitive (e.g. memory loss) and sensorial point of view (e.g. reduced vision); which can be reinforced by pathological processes (e.g. Alzheimer). However, the older population is a very heterogonous group with people without any functional limitation to people with severe disabilities. Therefore, it is important to adequate products, services and environments to their capabilities to ensure a comfort interaction of most of older persons.

The fit of product/service requirement to older persons capabilities, it is especially important for the Information and Communication Technologies (ICT) because ICT can support some activities of daily living (ADL) such as money managements. The ICT can help older people to counteract reduced capabilities, which are more prevalent with age, allowing, among others, to stay healthier or to remain active at work or in their community; leading to enhance their independent living and to improve their quality of life.

Moreover, most of older people lack of technologic skills and/or have low education levels. This factor, together with reduced functional capabilities, provokes serious difficulties during interaction with new technologies; because most of these interfaces do not take into account the needs and capabilities of older persons.

In relation to banking, most of older people access to bank services by going to the branch, because they feel safer than using other solutions as web or ATM or because they lack of ICT skills to interact with these interfaces. However, the percentage of older persons that use ICT or that access to bank services using web or ATM is increasing. 71% of European older persons use the mobile phone and 23% access to Internet. However, only a few percentage of older persons access to bank services using ATM or web.

Therefore, it is necessary to adapt bank services and interfaces to needs and capabilities of older persons to guarantee a comfortable access. For example, older people with reduced mobility can beneficiate from these new banking interfaces, allowing to be more independent and will not rely on third persons.

Abbreviations

ADL	Activities of Daily Living
ICT	Information and Communication Technologies
ATM	Automated Teller Machine

1   Introduction

The structure of population within European Region countries has changed during last decade, increasing the percentage of older people and resulting in an ageing population profile. The Ageing of Europe, also known as the greying of Europe, is a demographic phenomenon in Europe characterized by a decrease in fertility, a decrease in mortality rate, and a higher life expectancy among Europeans.

Population ageing is a complex phenomenon, provoking different social and economical consequences. Many Efforts have made to avoid problems related with population ageing but also to benefit from the new opportunities, which have revealed with this new situation, as the lengthened employable age of the population or the vast and wide knowledge source that represents older persons. Therefore, it is necessary provide older persons tools, products and services adapted to their needs and capabilities in order to maintaining them as active member of current society.

This is especial important in the ICT field and in it use to access to a wide set of services as bank services. However, most of older persons cannot benefit from these new banking accesses due to a lack of fitting to their needs and capabilities. Therefore, it is necessary to adapt bank services and interfaces to older persons to guarantee a comfortable access.

This deliverable corresponds to Task 2.1 "Detection of user needs" of the WP2 "Definition of user requirements and design specifications. The objective of this deliverable is to provide an overall overview of older persons needs in relation with new technologies and bank services.

This report is structured as follows: Section 2 describes the socio-demographic and functional characteristics of older population; Section 3 and 4 describes the use of ICT and bank services by older persons respectively; Section 5 describes the problems and needs of older person when interact with bank interfaces; and Section 6 and 7 briefly describe the future technologies and future generation of older persons.

2   Socio-demographics characteristics of European Older

The population in Europe is growing and becoming older, and the impact of the demographic ageing within the EU will be more patent along following decades. The population pyramid is inverting due to the low fertility levels and higher life expectancy. The percentage of older population will significantly increase during next years, when a greater proportion of the post-war baby-boom generation reach retirement and due to a significant and continuous increase in the life expectancy at birth.

Between 1960 and 2008, the proportion of older people (65 years and over) in the Europe has risen from 10% to 17%. According to Eurostat, this trend will continue until 2060 (see Figure 1), reaching 30% and increasing from 84.6 million in 2008 to 151.5 million in 2060. Moreover, women will be 40% more in this age range than men [1] [2].

Life expectancy at birth has increased 10 year over the last 50 years due to improved socioeconomic and environmental conditions and better medical treatment and care. Women live longer than men do, with a life expectancy of 82.4 years and 76.4 years respectively [2]. The problem is that the old-age dependency ratio, which indicates the relationship between the working-age population and elderly people, was 25.6 % in Europe [3].
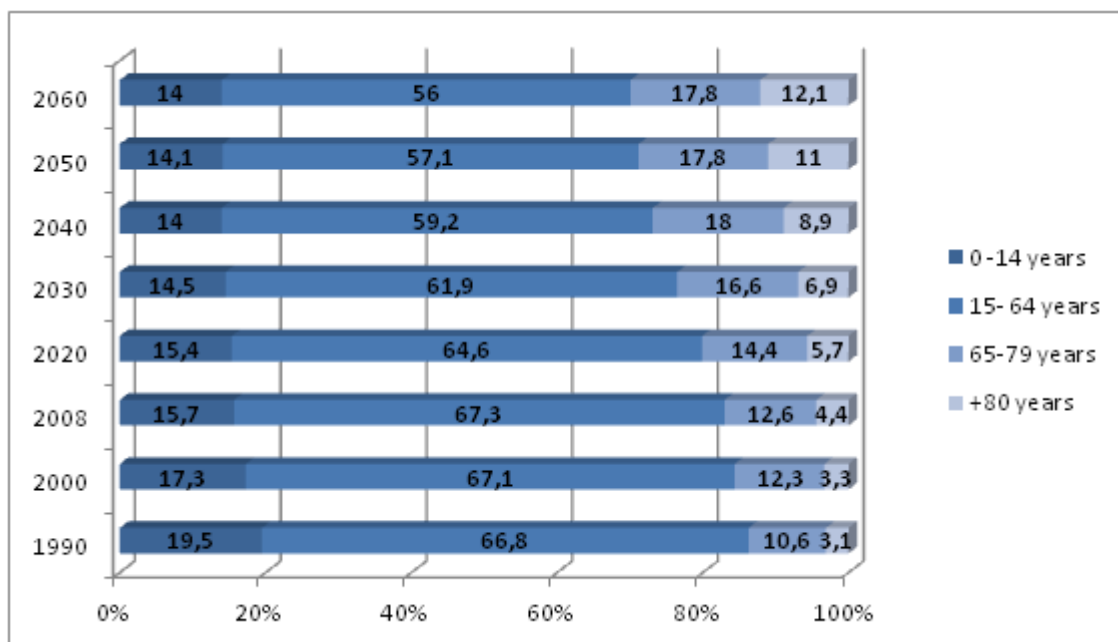
Figure 1. Population structure by major age groups. Source: [1].

A considerable number of older persons live alone in Europe, 33% of women aged 55 and over were living alone while the men in the same age group was 15% [2]. The difference is between men and women is due to the higher life expectancy of women [1].

In 2010, there were 62 million women (24.5% of all women) and 54 million men (22.3% of all men) in the EU27 who were at risk of poverty or social exclusion. This means that they were at least in one of the following three conditions: at-risk-of-poverty, severely materially deprived or living in households with very low work intensity.

The ageing problem that affects mainly the industrialised countries is linked with another important trend: approximately 54% of the population of developing countries will reside in urban areas in 2025. The rapid growth of urbanisation along with the massive immigration of large sections of the population towards the richer countries will result in an increasingly multicultural social context.

Although the older population is not a homogenous group in terms of education, incomes, functional capabilities and/or types of disabilities often associated with age; older population is a group with the greatest risk of being excluded from the benefits of the Information Society. A recent study of EUROSTAT,

found that more than 60% of persons over 50 in Europe feel that their needs are not adequately addressed by current ICT equipment and services [3].

Older European persons dedicate half of the day to personal care (this includes hours of sleep),six and a half hours are spent on social life and leisure, four hours on housework and three quarters of an hour on journeys from one place to another, and the rest of the time (14 min) is spent on non-professional help and voluntary work[4].

2.1   Physical, sensorial and cognitive capabilities

As people become older, their capabilities can change. These changes can include a decline in cognitive, physical and sensorial functions, but the existence of this decline, its level and its impact will depend on each individual. This is one the key reason for the heterogeneity of older population, especially from functional point of view.

There are two different kind of ageing: biological ageing and pathological ageing. In the biological ageing, the functional capabilities occur slower and more progressive and in the pathological ageing, these capabilities occur fast or even, sharply. We can find older persons without any functional limitations to older persons with severe disabilities, covering the full range. The Figure 2 shows these differences.
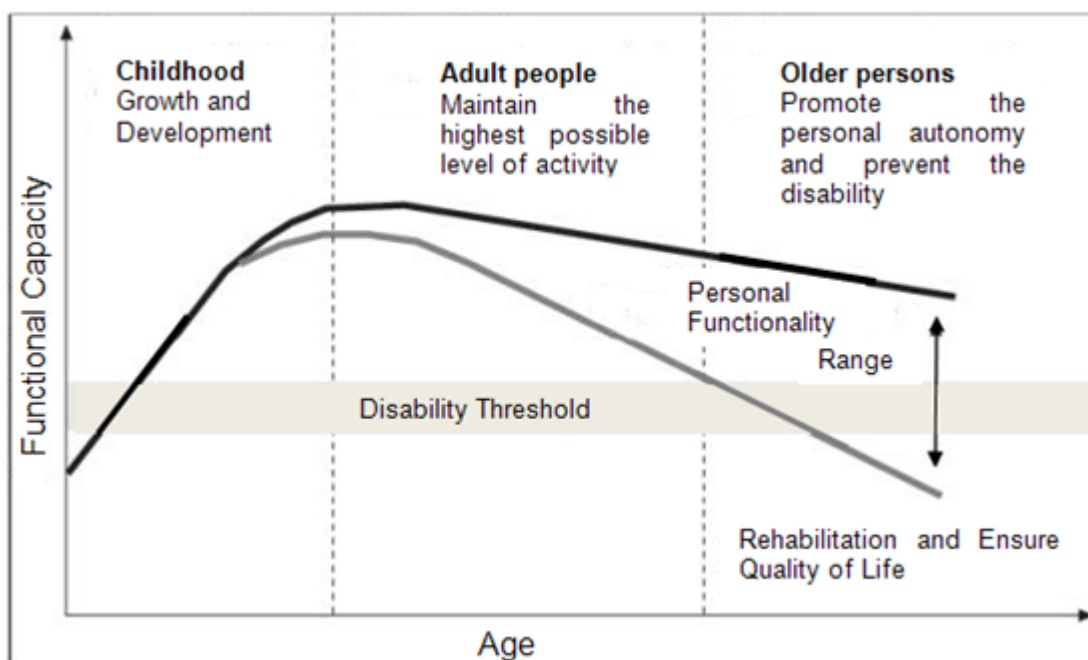
Figure 2. Functional capabilities of older persons. Image source: [5].

The functional capability increases during the childhood and the first years of adults, decreasing along the next years due to, among other, lifestyles, smoking, alcoholism, physical activity, diet and environmental factors. The main age changes that can affect to ICT interaction and bank services access are briefly described in the next subsections.

2.1.1   Physical capabilities

Most of corporal dimensions change with the age [6]. Most of corporal segments decrease but for example, abdominal deep increase; and the dispersion of these dimensions increases with the age. The main capabilities affected by the age are movement ranks, muscular strength, coordination, corporal reaches and balance.

The dimension of hand and fingers, and the **movement rank** of superior member, affect to the design of the interfaces. For example, the fingers size establishes the minimum size of buttons and the distance

among them, or the movement rank of the head establishes the location of the devices with output information.

In relation to interfaces interaction, the movement rank of index finger is possible one of the most important (Table 1). However, other parameters as wrist or head movements can also be important for example for gestural interaction[2].

The **muscular strength** also decreases with the age due to muscular atrophy and changes on the mechanical properties of bones and muscles [7], so weight and resistance of the devices should be taken into account. Moreover, it is related with wrist movements that can be difficult to perform by older persons.

Moreover, some pathology (e.g. Parkinson disease) affect to motor skills such as fine motor control due to involuntary movements, tremor or restless or flexed posture.

Table 1. Movement rank of index finger [8][8].

Age	Gender	Mean	P 5	P 95
55-59	M	51	38	65
	W	53	35	73
60-64	M	50	34	67
	W	55	39	74
65-69	M	52	36	67
	W	53	36	70
70-74	M	54	34	73
	W	53	40	68
75-79	M	49	35	64
	W	53	41	68
80+	M	54	41	64
	W	53	37	68

2.1.2   Sensorial capabilities

All senses: view, touch, hear, and taste, decrease with the age. Next, the main capabilities related with interface are detailed.

Most of information is visually provided [9], so this capability is especially important to interact with interfaces. The main changes in the **vision** capability are visual acuity, focus objects, contrast sensitivity, accommodation, dazzle, darkness adaption, colour vision and stereopsis [10]:

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[5][2] This data will provided with internal studies of the IBV if it is needed to define new ways of interaction for banking interfaces such as gestural control.

- Decreasing of visual acuity to 1.16 mm (0.23 mm for young people) [11][11]. Moreover, older persons need three times more light than persons of 20 years.

- Increasing of sensitivity to dazzle because of opacity of ocular lens [12]. Although, older persons need more light, this illumination increase can produce discomfort.

- Decreasing of the capability to focus far and near objects. This lost for near objects is called presbyopia [13].

- Decreasing of contrast sensitivity. If the contrast between background and characters is low, older persons can be unable to read it [11].

- Decreasing of darkness adaptation [14][12].

- Decreasing of colour perception. It provokes problems to differentiate blue and green, red and green, and blue and violet [10].

- Decreasing of stereopsis[3] [10].

In relation to **hearing loss**, the main problems are loss of sensitivity of pure tones, speech recognition (especially if it is distorted), localizing sounds, binaural listening and increasing of sensitivity to loudness.. The hearing loss vary with the frequency, affecting first to the high frequencies and finally to low frequencies [10].

In relation to touch, older persons suffer a decrease of tactile and pain sensitivity. Older persons have more problems for discriminate size, textures, roughness, line widths and shapes[8]:

- Cannot discriminate roughness below 0.05 mm and 10% of older persons have problems to discriminate roughness of 0.1mm [11].

- Need more time to discriminate shapes [8] and perform more errors [11][11].

- Easier to discriminate shapes with angles and they discriminate better between circle and squares than between triangles and arrows [11][4].

2.1.3   Cognitive capabilities

Neurons population decreases along all life, affecting to different capabilities as long- and short-term memory and attention.

On the one hand, the **attention** capability can be divided into four categories:

- Divided attention, which allows to simultaneously perform two tasks, is reduced with the age except simple tasks even in the least demanding situations [15] .

- Shift of attention, which allows to alternately follow two data source, seems to be related with long termed memory. Older persons are unable to maintain a data set in the memory while they are answering to another stimulus [15]; and have problems to get back the previous stimulus. For example, going to a room and forgetting the reason. However, there is few information about this capability.

- Maintained attention during long time seems not be reduced with the age although the total capability attention is reduced with the age [15].

- Selective attention is most basic attention function because the user must filter all irrelevant information of the environment and select the most important information to achieve an efficient behaviour. There exist multiple evidences that older people can easily get distracted [14] affecting negatively to memory and problem solution tasks.

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[3] Ability to discriminate depth or distance.
[4] For more detailed information see [11]

On the other hand, the memory decrease with the age [16] affecting to product-user interaction. The memory capability can be divided into:

- Sensorial memory provokes a brief record that start to disappear in one second except it change to short-term memory. This memory does not decrease with the age [8].

- Short-term memory can contain 5-9 data fragments during 10-30 seconds [17]. A test to measure this capability is the ability to memory a sequence of digits [8].

- Long-term memory maintains permanently the data without limited amount of data, but it does not mean that persons can be able to satisfactory access to this data. Older persons have more problems to access to events of their recent past and need more time to search this data[16]. The memory significantly decrease over 75 year, being able to remember only 5 digits [8]. It applies to remember a telephone number or to introduce the personal identification number (PIN), which is frequently forgot by older persons [8]. Previous examples affect to explicit memory. However, many times, it is necessary to get implicit information such as "Have I closed the door?".

However, the ageing process differs in each person due to genetic predisposition, environmental factor and individual behaviour. Moreover, recent studies have detected that cerebral plasticity continues with the age. Therefore, it is important to maintain active the brain through cognitive training, although seems that improvements with basic capabilities trainings are not translated into improvements on performing ADL [18].

3   Use of Information and Communication Technologies

The social environment is sometimes claimed to be underrated in this area, as most attention has been given to cognitive, physical and sensory aspects. However, it has become clear that the use of technology by older persons can be directly influenced by their social environment. Moreover, Information and Communication Technologies (ICT) can have a significant influence in the social life of senior citizens.

The most significant impact of ICT on the social life of older persons is related to computer-based communication, being the Internet the foremost example. In social sciences, there is an ongoing debate whether this type of communication can enhance they so called **social capital**. This social capital generally declines with age. Social capital refers to "the institutions, relationships, and norms that shape the quality and the quantity of a society's social interactions". It can be described in the following forms [19]:

- Network capital, or relations with friends, neighbours, relatives, and workmates that provide companionship, emotional aid, services, information, and a sense of belonging.

- Participatory capital, or involvement in organizations that afford opportunities for people to bond.

- Community commitment, or a responsible sense of belonging that mobilizes one's social capital effectively.

The previous forms of social capital increase when older persons use ICT. For example, the computers can present unique opportunities for older persons to socialize and establish social networks that can help to alleviate loneliness and alienation. For older people with reduced mobility or older people that life far away from their family environment, the computer-based communication (e.g. e-mail or videoconference) can provide needed "virtual" social support from these family members

ICT gives older people a chance to participate in a wider part of society, making it possible to connect with people that are either similar in experience and interest or diverse, thus increasing participatory capital and possibly community commitment.

Older persons have much to gain using these ways of communication, seeking new information and disseminating their own ideas to others or acquiring new social ties and discarding old ones at will. Moreover, Internet "surf" does not require physical displacement capability (which is key factor to increase social isolation among older people), allowing to maintain virtual social networks from their homes without being typecast by their physical appearance and without matter the time or place.

The use of ICT by can generate greater social connectivity among older people group. It is important to know that online participation of senior citizens is not only beneficial to these people, but also to the entire society. Older people have a vast amount of knowledge and experience in life that they can share leaning on ICT.

ICT can help older persons to improve their quality of life, stay healthier, live independent and counteract reduced capabilities, which are more prevalent with age. ICT can enable them to remain active at work or in their community.

Independent living is the ability for older people to manage their life styles in their preferred environment, maintaining a high degree of independence, enhancing their mobility and quality of life. This can be achieved by improving their access to age-friendly ICTs and personalising and integrating social and health care services. Ageing well is also about continued active and satisfying participation in social life and work, when ageing [4].

In addition, ICT can help to improve the working conditions for people working in the care sector and to make care work more attractive in the future. ICT Solutions can address many needs related to ADL [4]:

- Social communication: easy access to phone and video conversation, notably if enabled by broadband to stay in touch with family and friends, overcoming social isolation.

- Daily shopping, travel, social life, public services: easy access over the internet to order goods online, for example when reduced mobility makes physical shopping more difficult.

- Safety: making sure entrance doors and windows are locked/closed when leaving the house or sleeping; checking for water or gas leaks; and turning all but one light off when going to bed, etc

- Reminders: memory problems tend to be associated to ageing and thus support may be needed in taking medication and fulfilling household tasks

- User-friendly interfaces: for all sorts of equipment in the home and outside, taking into account that many older persons have impairments in vision, hearing, mobility or dexterity

- Telemedicine: opens up new opportunities for providing medical care to the home and there are many new developments in ICT-based home care, including ways of monitoring wellbeing and providing a secure home environment

- Personal health systems include wearable and portable systems for monitoring and diagnosis, therapy, repairing/substitution of functionality and supporting treatment plans for individuals with a chronic disease complemented by telemonitoring and telecare, thus avoiding hospitalisation.

- Support for people with cognitive problems and their carers to stay at home for longer and remain active for as long as possible, for example through cognitive training, reminders, GPS tracking etc.

- Support for more efficient workflows in care, by integrating health and social care through sharing information, monitoring and follow-up to interventions across different organisational and physical boundaries.

Emerging technologies, such as robotic, new materials and biosensors, can improve future developments in many of these areas. Moreover, the concept of Ambient Intelligence offers great potential, with the possibility for the whole environment (at home, moving, in the street, whilst driving or during transportation, in public buildings and so on) to have embedded intelligence that helps solving everyday life's needs.

On the other hand, the main entry barrier to the use of ICT by ageing population is not the fear of technology course, but the lack of perceived usefulness and motivation, since it is a generation that has lived his youth and adulthood in a pre-digital world and has gained little or no experience of using ICT. In 2011, 71% of individuals in the EU27 used the internet at least once in the last three months prior to the survey [20]. The percentage of regular internet users among younger persons aged 16-24 was 91% while it was only 40% for the age group 55-74 years. The percentage of the population with high formal education using the internet was more than twice as much as the share for the population with a low level of education. Differences between men and women were relatively small. Slightly more than two thirds of men (70%) and 65% of women used the internet regularly [21].

It is important to think that the next ageing generation of older people will be more familiarized with ICT and it is possible that exist less barriers to access ICT. The purchase of goods and services using internet is an increasing phenomenon. There are interesting differences between men and women when looking at the goods and services they buy over the internet. Among persons aged from 16 to 74 who ordered goods or services over the internet in the last year (e-shoppers), women bought more clothes (58%) and more (17%) food than men (45% and 13 respectively), men bought more electronic equipment (32%) than women (17%), while the was no difference for booking travels and holidays (52%) [1].

The ICT platforms use as alternative to the personal attention is more and more spread, especially in banking services and purchasing of products and services. Internet has opened a big space of possibilities for everybody and for older persons too. Internet offers advantages like buy from home, telecare, etc. However, there are big barriers that prevent the expansion of ICT in this group and own feeling of older people as "I do not know what it is", "it is costly, "I do not need it", etc. These barriers and feeling can restrict the possibility to access to products and services.

Policies and initiatives aimed at promoting ICT use for ageing should cover [22]:

- Facilitating access to information society tools and services for the elderly, removing barriers, making ICT tools easier for everyone to use, and encouraging people to make the best of them to enhance their independence in good health, to participate in work, and to be active in society.

- ICT can help to increase the efficiency and quality of social and health care delivery to a growing ageing society, and contribute to the financial sustainability of these services in the future

Many older persons can **experience problems** with:

- Buttons: Some are too small, rubbery, do not click when pressed and therefore provide no feedback whether the associated number had been dialled.

- Menus: Too many, most of them unnecessary, difficult to understand and recall.

- Devices: Too small to hold comfortably.

- Text size: Too small to read even with corrective lenses.

Promising learning possibilities for older computer users are online learning courses and environments in which young and old users are mixed. Moreover, computer use may raise the declining level of cognitive and motor ability of elderly people. For example, computer games positively affect information processing, reading, comprehending and memory. It can also result in a faster reaction time, and an increase in attention span and hand-eye coordination [10]. These improvements can help older persons in their ADL but training on basic capabilities does not guarantee improvements on ADL performing [18][18].
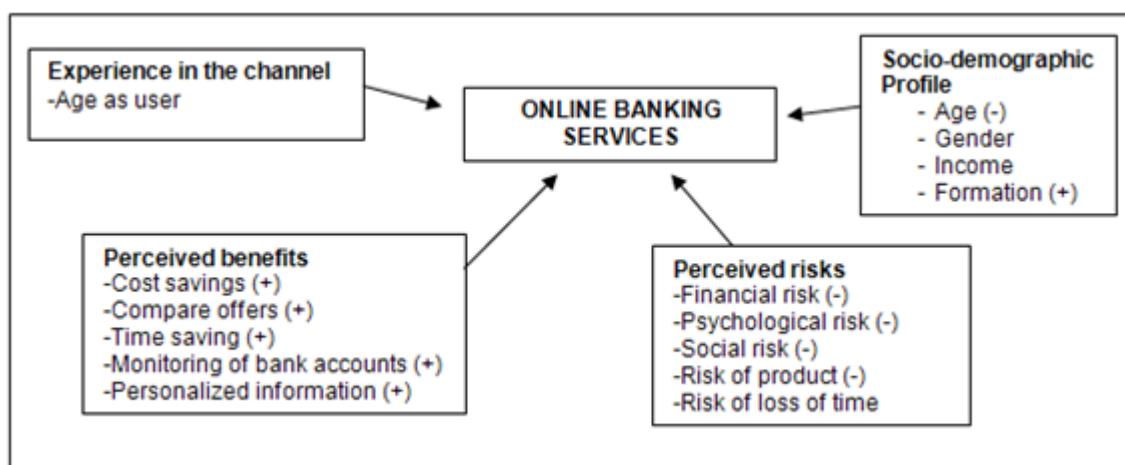
4   Banking services

Every people use banking services. There are people who do not like to have a bank account, but now it is impossible to live without one. We must have a bank account to pay the household bills like electricity, water, telephone and internet, etc.

The most common and widespread **banking services** are: apply for a credit card, buy traveller's checks, cash a check, check your account balance, deposit money, exchange money, fill out a withdraw slip, open a checking account, open a savings account, order checks, pay off a loan, pay your bills online, rent a safety deposit box, review your bank statement, take out a loan, talk with a bank teller, talk with the bank manager, transfer money, use a debit card and withdraw money.

Access to banking services can be done through window branches, automatic teller machines (ATM), web, mobile or television. Last decades, people only uses the bank branches but nowadays many people use other access ways as online banking. Some operations as "open an account" can only be done through the branch but most of bank operations can be done through the web.

Access to banking services has moved from the branches to ATM and e-banking. In 2008, 29 % of all persons (aged 16 to 74) in the EU-27 used e- banking and this percentage increase to 47% when attention was focused on Internet users. In all EU countries[5], the percentage of users of e-banking services has increased, covering from 12% and 16% in Portugal and Spain respectively, to 71% in Norway. In the same way, there were about 294.6 thousand of ATMs in the EU-27 [3].

The research "Purchase behaviour analysis in financial services online" [23] shows the benefits and risks of the online banking services and the user profile (Figure 3). People with Internet experience are more interesting in e-banking because they don that problems of use neither perceptions of lack of security. Therefore, the main profile of e-banking user is young people with high income and high level of formation.

Figure 3. Variables of the purchase of online financial services. Source: [23].

Another research establishes the key differences between people who user online banking services [23] , proposing three kinds of users according to the degree of ICT adoption:

- "Real innovative": People who feel attracted by the technological advances and lower costs of transaction. They are pioneers in the use of ICT and online banking.

- "Fans": People who rapidly adopted the technological advances. They do not show the concern due loss of personal contact when use an online banking service.

- "Carefree": People who think in the comfort offered by the service. They do not matter the loss of personal contact. Although they show a greater concern in terms of security and confidentiality of the information.

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[5] Except Bulgaria, Cyprus and Romania.

The key problem to reject to use e-banking is the lack of security perception to make some operations, for example, 21% of people say that they do not rely to realise virtual operations with their money [21].
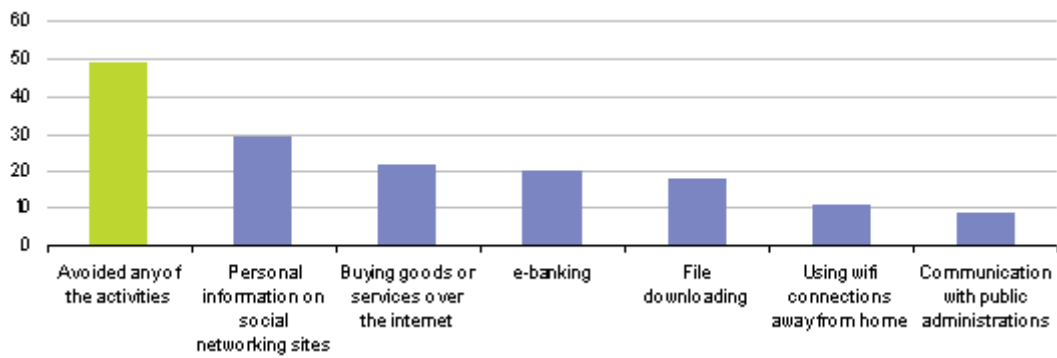
Figure 4. Activities avoided at least once in the 12 months prior to the survey by internet users due to security concerns, EU-27, 2010. Image source: [1].

5   Interfaces to access banking services

Access to banking services can be done by personal attention through window branch and using four interfaces: automatic teller machines (ATM), web, mobile phone and television. Currently, people use online banking but, some years ago, all operations were directly realized in branches. The increase of Internet users has promoted an increase on use of several interfaces as a smartphones or access to services such as e-banking. Moreover, the use of bankcards to access banking services increased to 74% from 2006 to 2007 [20][20]

Older persons can access to bank services using this new interfaces but it is necessary that mobile, web and ATM services respond to specific needs of some groups of older people as lack of previous experience or basic education levels or the reduction of their physical, cognitive and sensorial capabilities. This group is really heterogeneous, therefore interfaces requirements should cover most of their needs and characteristics but also being able to adapt to the specific characteristics of each one to ensure an easy and comfortable interface interaction. The main characteristics are related with fonts, sound, contrast, style, content, navigation mechanism, etc.

5.1   Automated Teller Machine

ATM allow to access to the following **banking services**: checking the account balance, depositing money (not in all ATM), reviewing the bank statement, transferring money, withdraw money providing updated account information, converting currency, stock market and securities information, opening retirement programs, buying cinema tickets and postage stamps, etc. Using debit card or bankcard to access these services.

The ATM use allow banks to save resources and reduce queues, and enable customers to perform banking transactions without need of human attention any day and at any hour (24 hour/365 days access). ATMs are allocated in bank offices, shopping centres, restaurants, airports, railway stations, bus stations, important buildings, etc.

The ATM software and hardware can vary depending on each bank are even inside each bank. On the one hand, the ATM hardware should take into account the anthropometry of older users to ensure an ergonomic and comfortable interaction. On the other hand, the ATM interface should take into account visual, auditory, touch, cognitive and physical capabilities (e.g. fine motor control) to define its requirements related to screen size, buttons size and contrast, navigation modes, etc. In both cases, the ATM must try to reach the universal design, considering people with different disabilities to make easier the access to the maximum percentage of population.

The main **problems** of older persons when interact with ATM are due to:

- Lack of fine motor control: It affects to with size of buttons, slots, etc.

- Reduce vision: It affects to h size and contrast of buttons and text.

- Hearing loss: It affects to output auditory information.

- Cognitive decline: It affects to number of options and hierarchy of menus, language complexity, unclear or missed feedback, etc.

5.2   e-Banking

Most of banks have a website with information about services and allow customers to access to several banking services: account access, make transaction, amend account/personal details, loans, saving accounts, mortgages, etc. The security control vary from one bank to another, using passwords, bankcard numbers, personal identification numbers, coordinates, etc.

The main advantages of e-banking are the 27 hours/7days access (as ATM), not need of queues and access from anywhere if Internet is available. However, it has some disadvantages related with own Internet

access (cost of Internet access, low connection speeds, temporally out-of service, lack of personal attention) and with the lack of access to some services as deposit banking cheques[6], deposit physical cash, withdraw cash, high money transfers, etc.

Most of problems of older persons with ATM interaction will apply also for web interfaces, reducing the importance of physical problems (except fine motor control) and increasing the importance of cognitive problems related to navigation, complexity menus, etc. There exist several standards, guidelines and scientific research to provide tools and requirements to designers and developers in order to allow an easy and comfortable web interaction of older persons. The main **problems** of older persons with web interaction are due to [24]:

- Lack of fine motor control: It affects to size of active elements as buttons, menus, links, etc.

- Reduce vision: It affects to size and contrast of buttons; size, contrast and type of text; use of determinate colours (e.g. blue); etc.

- Hearing loss: It affects to with output auditory information.

- Cognitive decline: It affects to number of options and hierarchy of menus, huge amount of extra or unnecessary information, navigation bars, language complexity, unclear or missed feedback, links use, use of animations, time to perform each operation, etc.

Moreover, the lack of knowledge and experience of older persons in ICT use enhance previous problems, especially the problems related to hierarchy, layout, interaction ways, etc. Therefore, it would be very helpful to provide a) on-line support, "step by step" tutorials, and use guidelines to help older users and b) train and educate older persons in the use of ICT.

5.3 Mobile phones

Currently, 80% of older persons have a mobile a phone, covering from 30% in Poland to 90% in Finland [25]. However, low percentage of older persons connects to Internet using their mobile phones.

The mobiles phones provide several useful **functionalitie**s for helping older in their ADLs and maintaining them more time at their homes with a higher quality of life [22]:

- Address book: This feature can replace heavy paper-based address book that older persons tend to carry around when they found themselves unable to remember many numbers.

- Alarm and reminders: Alarm and reminders can be very helpful to remind older persons to take their medication and not to miss their appointments with their doctors.

- A dedicated help/panic button that would not require older persons to remember a series of numbers to dial when emergency situations arise. However, it was remarked that there are cheaper and easier to use devices for safety purposes such as personal alarms and fall detectors.

- A series of control buttons for important functions rather than software-based menus which are often more difficult to see, especially in smaller-sized previous term phones next term.

- A hard sleeve to protect buttons from accidental pressing rather than keypad lock, as older people tend to forget the combination to lock/unlock the keypads. Additionally, the locking feature often requires a fast succession of key presses, which is difficult for some older persons with joint or vision problem.

- A dedicated button to activate a stronger and longer lasting backlight for older people with reduced vision and slower operation.

- A voice recorder and replay, which will be useful as a reminder. One example of its use is to record a shopping list at home, which the user can then play back in the shop.

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[6] Some banks have started to provide this service.

- Environmentally aware setting that would set the ring tone in silent in quiet places and set it back to loud when the ambient noise is higher.

- A caller ID complemented with the caller's picture. This helps remembering who the caller is, which is useful for older persons with memory problems.

The size of mobile phones is a barrier to make easier older persons interaction (e.g. limiting size of elements) but a correct design can jump this barrier. However, it is frequent that the development of mobile phones does not take into account older users needs and capabilities, hampering older persons to beneficiate from all these functionalities. Although during last years, some manufactures have designed devices adapted older user needs such as Auro Mobile, Emporia, Owasys, etc.

However, the new smartphone provide new feature that can help to solve this problems such as large touch screen interface, high personalization (e.g. increase text size or contrast, rearrange menus), multiple feedback (vibration, visual and auditory), specific applications to meet specific user needs, etc. Moreover, the disrupt of tablets in ICT market can definitively solve the problem of the size, although touch interaction presents some additional problems as the lack of tactile feedback, which is present on physical buttons.

5.4   Television

Although, the TV is the most used device by older persons, the provision of services through digital TV have not been adequately exploited. For example, the access to banking services using the TV has limited to isolated actions of some banks (see Deliverable 2.3 and D2.4). However, the use of TV can allow older persons to access many services without going outdoor and using a familiar interface for them [25]. Moreover, the screen size and loudspeakers can solve most of auditory and visual problems.

Currently, most of older persons only use TV for watching different channels or films and few ones use extra services as the teletext/videotext. Although the digital TV provides extra services, these TV remote controls are too complex with high number of buttons and difficult to understand. In fact, most of problems are due to commands and buttons and the excessive number of functions associated to each button, which are related to cognitive, physical (e.g. motor fine control) and visual problems.

The main advantages of TV banking are the 27 hours/7days access (as ATM), not need of queues and access from home without go outdoors. And the main disadvantages are the limited access to TV banking, costs of use the service, lack of personal attention and reduction of the services (withdraw money, deposit physical cash, etc.)

Current and future developments as the web access through TV or the use of alternative control (speech commands, tactile and gestural controls) can considerably improve access to TV banking, spreading the use of this banking way.

6   Emerging technologies

Emerging technologies are contemporary advances and innovation in various fields of technology. Various converging technologies have emerged in the technological convergence of different systems developing towards similar goals. Convergence can refer to previously separate technologies such as voice (and telephony features), data (and productivity applications) and video that now share resources and interact with each other, creating new efficiencies.

Emerging technologies are those technical innovations that represent progressive developments within a field for competitive advantage; converging technologies represent previously distinct fields, which are in some way moving towards stronger interconnection and similar goals. However, the opinion on the degree of impact, status, and economic viability of several emerging and converging technologies vary.

Over centuries, innovative methods and new technologies are developed and opened up. Some of these technologies are due to theoretical research, others commercial research and development. Technological growth includes incremental developments and disruptive technologies. An example of the former was the gradual roll-out of DVD as a development intended to follow on from the previous optical technology Compact Disc. By contrast, disruptive technologies are those where a new method replaces the previous technology and make it redundant, for example the replacement of horse drawn carriages by automobiles.

Emerging technologies in general denote significant technological developments that broach new territory in some significant way in their field. Examples of currently emerging technologies include information technology, nanotechnology, biotechnology, cognitive science, robotics, and artificial intelligence.

The main technologies/ ICT solutions that can substantially improved access of older persons to banking services are:

- New systems of security and user recognition:
    - o Smartcards.
    - o Contactless (e.g. Near Field Communication)
    - o Finger print, facial recognition or pupil analysis.
    - o Physiological response (e.g. Heart rate).
- New control interface[7]s:
    - o Speech commands.
    - o Use of simple TV remote control.
    - o Touch and multi-touch control.
    - o Gestural control.
    - o Head tracking.
    - o Eye tracking.
    - o Brain Neural Computer Interface (BNCI).
- Recognition of mood/activity based input technologies.
    - o Use of heart rate, skin conductivity, etc. as input of user state in order to adapt the software.
    - o Presence/Location/Proximity based technologies (e.g. Passive Infrared Sensor, Radio-Frequency Identification, Near Field Communication).

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[7] Most of previous technologies as described as input channels but it can be also used as output channels. For example, a Tablet that modifies the height of its screen as feedback response.

7   Next generation of ageing population

The next generation of ageing population (55- 65 years) are more familiarized with ICT, have more ICT experience and skills than current older persons do. Most of people between 40 and 50 years know and frequently use new technologies. The last report of Online Business School explains that people between 45 and 54 years old is the group that has grown more in Spain (9.07 %) [20].

However, the problems related with age as capabilities reduction will have to be also taken into account to design and develop future interfaces. Moreover, the apparition of breaking technologies could generate another time this digital gap.

To sum up, the e-inclusion in our society has considerably increased and it continues increasing (**¡Error! No se encuentra el origen de la referencia.**).

Table 2. Use of TICs and use of online services. Source: [4].

	Computer use			Internet use			Used internet for finding information on goods or services		
	2008	2009	2010	2008	2009	2010	2008	2009	2010
EU-27	66	68	71	62	65	69	50	51	56
Euro area (EA-16) (1)	66	68	72	63	65	70	52	55	59
Belgium	71	76	79	69	75	78	58	59	62
Bulgaria	40	44	45	35	42	43	22	17	26
Czech Republic	63	64	69	58	60	66	45	50	53
Denmark	86	87	89	84	86	88	73	74	78
Germany	80	81	83	75	77	80	66	69	72
Estonia	66	71	75	66	71	74	53	54	61
Ireland	67	68	70	63	65	67	46	54	57
Greece	44	47	48	38	42	44	31	33	36
Spain	61	63	67	57	60	64	46	47	54
France	71	72	79	68	69	79	57	60	65
Italy	46	49	53	42	46	51	30	33	35
Cyprus	47	53	57	39	48	52	32	39	47
Latvia	63	65	67	61	64	66	49	50	57
Lithuania	56	60	62	53	58	60	37	44	48
Luxembourg	83	88	90	81	86	90	69	75	78
Hungary	63	63	64	59	59	62	49	48	55
Malta	51	60	64	49	58	62	42	48	52
Netherlands	88	90	91	87	89	90	76	79	82
Austria	76	75	77	71	72	74	51	54	58
Poland	55	59	62	49	56	59	33	29	39
Portugal	46	51	55	42	46	51	34	40	44
Romania	35	42	41	29	33	36	17	12	26
Slovenia	60	65	70	56	62	68	48	49	57
Slovakia	72	74	78	66	70	76	49	50	62
Finland	84	84	88	83	82	86	73	73	74
Sweden	89	91	92	88	90	91	75	77	82
United Kingdom	80	84	86	76	82	83	64	64	63
Iceland	92	93	95	91	93	93	78	80	84
Norway	90	91	93	89	91	93	80	83	82
Croatia	46	50	56	42	47	54	33	33	43
FYR of Macedonia	50	55	56	42	50	52	22	26	30
Turkey	34	36	39	32	34	38	14	18	21

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