Digital Inclusion - The Vision, the Challenges and the Way Forward

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***Abstract*—This paper considers the vision and aspiration of digital inclusion, and then examines the current reality. It looks beyond the rhetoric to provide an analysis of the status quo, a consideration of some facilitators and challenges to progress and some suggestions for moving forward with renewed energy and commitment. The far-reaching benefits of digital inclusion and the crucial role it plays in enabling full participation in our digital society are considered. At the heart of the vision of universal digital inclusion is the deceptively simple goal to ensure that everyone is able to access and experience the wide-ranging benefits and transformational opportunities and impacts it offers. The reality is a long way from the vision: inequality of access still exists despite many national campaigns and initiatives to reduce it. The benefits and beneficiaries of a digital society are not just the individual but all stakeholders in the wider society** [1]**. Research evidence has shown that the critical success factors for successful digital participation are (i) appropriate design and (ii) readily available and on-going ICT (Information and Communication Technology) support in the community. Challenges and proven solutions are presented. The proposition of community hubs in local venues to provide user-centred ICT support and learning for older and disabled people is presented. While the challenges to achieve digital inclusion are very considerable, the knowledge of how to achieve it and the technologies which enable it already exist. Harnessing of political will is necessary to make digital inclusion a reality rather than a vision. With the cooperation and commitment of all stakeholders actualisation of the vision of a digitally inclusive society, while challenging, can be achieved and will yield opportunities and rewards that eclipse the cost of implementation.**

Keywords-Digital society; digital inclusion; accessibility; participation.

I. DIGITAL INCLUSION: FRAMING THE VISION

The raison d'être of this paper is to provide an evidence-based roadmap to achieve the vision of digital inclusion embedded in the 'Declaration of Principles' presented at the World Summit on the Information Society, Geneva, 10-12 December 2003. This vision of digital inclusion is that everyone in the world will have equal access to the knowledge and information they require to enable them to live their lives to their full potential. The inspirational and aspirational [2] declaration states the following:

"We, **the representatives of the peoples of the world** …declare our common desire and commitment to build a people-centred, inclusive and development-oriented Information Society, where everyone can create, access, utilise and share information and knowledge, enabling individuals, community and peoples to achieve their full potential in promoting their sustainable development and improving their quality of life…."

While the Declaration sets crucially important and ambitious goals for our Information Society, relating to equality of opportunity in the digital world, clearly the goals will not be realised without equally ambitious development and implementation strategies to achieve an inclusive digital society which has been defined as one in which all members of a community are **able** to **access**, **use**, and **understand** digital technologies [3]. Building on the Declaration of Principles which underpins the vision of universal digital inclusion, the aspirations and principles of such a society would be characterised by global access to ICT (Information and Communications Technology) to make a significant contribution to improving health, wellbeing and quality of life for all [4][5].

This paper provides a clear basis for plans and strategies to progress towards the vision of an inclusive digital society.

A. Approach and methodology

This paper first considers the vision and aspiration of digital inclusion and its major and fast-growing importance, informed by published reports and case study examples of the transformative power of digital technologies. Section II gives an analysis of the status quo regarding the current reality of digital inclusion based upon an extensive array of published studies and supplemented by empirical data collected on the RCUK (Research Council UK) funded NDA (New Dynamics of Ageing) Programme, through the Sus-IT (Sustaining IT use by older people to promote

autonomy and independence) project. From this detailed examination, some of the key challenges to digital inclusion are identified and examined in Section III. Section IV then presents evidence-based recommendations on how to meet these challenges in order to close the gap between the vision and the reality. Finally, in Section V, new solutions are brought together with established good practice in an integrated strategy for achieving digital inclusion. This offers a holistic sociotechnical approach, and includes recommendations for design, for meeting ICT support needs in the community and for addressing ethical concerns.

The methodology applied included literature reviews, empirical research studies using a wide array of mixed research methods which includes surveys, interviews, focus groups and case studies. In addition to reporting well-established barriers to inclusion, the paper provides the basis for significant innovation by providing new insight into a key and fundamentally important critical success factor for effective and sustained digital participation, namely the provision of community-based ICT support.

In summary, the paper looks beyond the rhetoric on digital inclusion to provide an analysis of the status quo, a consideration of some important facilitators and inhibitors to progress and some carefully considered evidence-based suggestions for moving forward with renewed energy and commitment.

B. Why is Digital Inclusion Important?

Digital literacy is fast becoming a fundamental requirement for full participation in society. In our emerging e-society, ICTs are an important aspect of daily life. Primarily through the medium of the Internet, an ever-expanding range of information, goods, services, entertainment/leisure, educational and social networking opportunities are available. Digital technologies make possible transformations which enhance quality of life for individuals, increase life chances, prolong independence and autonomy and improve social connectedness [6][7]. Such transformations offer great potential to improve society and boost the economy [5][8].

Digital inclusion is essential for the realisation of many health benefits of technology. These are already being leveraged in the management of chronic conditions in ways that require a level of digital literacy. For example, for management of diabetes requiring insulin injections, people with this condition can already use insulin pumps, which slowly inject insulin into the body. While the pumps are mechanical, they utilise device management software [9]. Although there are other ways of managing insulin-dependent diabetes, for an individual to have the fullest range of choices, digital literacy is becoming a requirement. Personal assistants and reminder systems may also play a role in helping people maintain their independence. Indeed, many of the technologies under development that will enable people to live independently for longer have digital literacy implications for the person living independently, or for their family or their care assistants. In combination these technological capabilities offer the potential to lessen demands on other (both formal and informal) support systems for older people; improving the quality of life of older and disabled people while also reducing costs of care. By enabling rehabilitation, remote assessment, diagnosis and treatment delivery, the need for residential care could be delayed, or for some, avoided by supporting policies of early intervention.

Digital inclusion is also a prerequisite for capitalising on the social opportunities afforded by connectivity which can help to reduce social isolation and loneliness. Increasing digital participation allows people to stay connected with friends and family, their local community and the wider world in a variety of ways. For people who are geographically removed from their family or friends, services such as Skype are not merely cost-effective and convenient; they can become a component in maintaining social connectivity and cohesion in a way that telephones cannot. An example showing the power of the Internet to reduce social isolation is the experience reported by 80 year old Lucy: "With my computer I was there in the house with them when he opened his Christmas presents, my grandson came and kissed the computer screen. It stops you feeling alone" [4].

The role of digital inclusion in enabling social contact is highly significant and important in helping to maintain good mental health by reducing the depression, stress and anxiety associated with social isolation and loneliness. Numerous published articles by governments, academics, practitioners and others seek to show that being part of the digital world can improve life in a number of ways, means and forms [2][3][10]. The emphasis of such publications is often on the financial savings for the state and for individuals. While monetary gains are important, it is the transformations for individuals that are vastly more far-reaching and fundamentally important for our digital society and economy. This transformational capability of digital technologies is perhaps best illustrated by case studies which serve to convey the scale and scope of the power and significance of digital connection. For example, one case study reported on the website of Digital Unite describes the experiences of a woman who had lost her sight six years previously and now had to rely on her husband to read the post, write letters and other tasks that required reading such as checking recipes. When she discovered the magnification tool on her computer as well as text to speech software, her life was transformed. Through having access to the software and hardware of sophisticated assistive technologies (ATs), which could magnify the screen, read aloud both website content and scanned letters, she was able to regain her independence [11]. Many examples (e.g., from Leicestershire CareOnLine) show transformations of comparable magnitude and significance [12]. Their importance for the individuals concerned and for their carers and wider family cannot be over-stated.

It will be evident that the importance of digital inclusion extends way beyond an individual's social group. Digital technologies enable greater civic engagement, participation and influence in wider society. For example, through online voting, access to information about what is going on in your community – even for those who are housebound and opportunities for people (who may otherwise be heard) to have a voice on the issues that affect them. This not only connects them to their local community but also increases their visibility to those who are already digitally connected. Enabling social networks thus create digital opportunities for having fun and increasing and maintaining social contacts. Similarly, social media is fast becoming a means of disseminating local news. In the UK, for example, The West Bridgford Wire Facebook page [13], Loughborough Echo Facebook page [14], police alerts and appeals (e.g., Nottinghamshire Police Facebook page [15]) give information and warnings that affect people on a local level. It is also the case that social media can be an alternative and very visible means of influencing corporate behavior by publicising poor service, mistakes made and the consequences experienced (e.g., the viral Facebook post of a Virgin media bill posted by a man whose dead father-in-law had been charged a £10 late charge to his account, despite the company having been notified of his death) [16]. The account was subsequently closed. The post has been shared on Facebook a total of 97,677 times. This suggests that public Facebook/Twitter exposure is now mightier than the pen.

It will be evident from the extensive ramifications of digital connection considered here that the advantages of being part of the digital world are vast and increasing all the time – as are the 'dis-benefits' of being digitally excluded. The authors have sought to show that beyond the increased ease of use, enhanced communication, reduced costs and so on enabled by the internet and use of ICTs in everyday life, it is their transformational capability that makes the quest for universal digital inclusion truly important and significant.

II. DIGITAL INCLUSION: THE REALITY

A. Global Internet Usage

Statistics show that access to the Internet is currently unevenly distributed amongst the global population, and older people in most countries are less likely to be Internet users than younger people [17][18]. ITU World Telecommunications predicted that in 2010 approximately 70% of the world's population (6.9 billion) were not using the Internet [19]. In 2014, the figure for non-users had dropped to 60% [19]. World-wide, large numbers of older adults are reported to be non-users of technology [20]. In 2011, approximately 45% of the world's Internet users were below the age of 25 [19]. Statistics from 2013 show that while 99% of people in the UK aged between 16 and 34 were Internet users, this drops to 88% for people aged between 55-64, 71% of people aged between 65-74 and a very low 37% for people aged over 74 years [21].

B. The Digital Divide

The gap between those who do and who do not enjoy the benefits of access to the Internet has been termed the 'digital divide'. The term "digital divide" was adopted by the Clinton/Gore administration in the US in the late 1990s. Many studies have sought to explore the factors that underlie this phenomenon. These have shown that the digital divide is not a simple binary division between the 'haves' and 'have-nots' [10] but that digital divides arise from three main sources of inequality which occur both between nations and within them. These are differences in (i) *connectivity* (i.e., access to appropriate infrastructure, hardware, software, and services including fast and reliable Internet access), (ii) *capability* (i.e., appropriate education, tailoring for ability/disability, digital literacy and skills) and (iii) *content* (i.e., the availability of accessible, meaningful, relevant material which, combined with the 'pull' of compelling functionality provides powerful motivation to become digitally 'engaged' [5].

The digital divide persists despite the attention it has attracted in society from academics, politicians, social activists and many others for almost two decades. The causes and factors associated with the phenomenon have been considered extensively and it appears that multiple factors are involved and these are considered in the section below. The large digital divide between older and younger people is explained partly because older people may not have the financial means to pay for equipment and services, partly because they may not have acquired the necessary skills either through education or in the workplace and partly because they may not have any motivation or interest to use these new technologies. Chronological age however, is clearly not a factor in itself, since many older people do use, and enjoy using, computers and the Internet [22]. It has been suggested that this so-called 'grey digital divide' [23] will eventually close, as people who are established computer users move into retirement, or as a consequence of the many initiatives and programmes designed specifically to encourage and teach older people to use computers and the Internet, or perhaps as a consequence of improvements in the ease of use and accessibility of the technology. However, there are counter arguments: in 1998 President Clinton's commencement speech at the Massachusetts Institute of Technology asserted that: "...the digital divide has begun to narrow, but it will not disappear of its own accord. History teaches us that even as new technologies create growth and new opportunity, they can also heighten economic inequalities and sharpen social divisions" [24]. Further, recent research suggests that a fourth digital divide exists, namely that caused by digital disengagement [25].

The salient point is that, irrespective of age or any other defining characteristic, the reality for those who are, or who become, digitally disengaged, is a range of adverse social

and economic consequences associated with reduced access to on-line government and commercial services, to health information and social support as well as to researching and purchasing goods using such services as price comparison and review websites.

C. Factors Associated with the Digital Divide

In addition to the digital divide which exists between the old and the young, there are other digital divides based upon education [26], gender [27], social class [28], ethnicity [6] and disability [29].

Access to technology and the acquisition of the basic skills to use it were initially seen as the key to bridging the digital divide. However, as access to computers has increased across all industrialised societies, it has become clear that the digital divide is not just about access and the acquisition of basic skills and knowledge, but also about the ability and the confidence of individuals to utilise digital technologies effectively. Numerous studies have identified barriers to uptake of the Internet, and this has led to the proposition that non-users of the Internet can be transformed into users (the 'digitally engaged') by an additive model which addresses each of the three barriers – connectivity, content and capability). Consequently, governments and other bodies in many countries are investing significant resources into providing technical infrastructure, awareness and training initiatives, and the development of digital content and digitally-delivered services, with the aim of increasing access to the Internet and promoting digital engagement. Despite many widely publicised initiatives and programmes, the number of people not using the Internet has reduced only slightly, and the overall figure remains fairly stable (73% in 2009 and 72% in 2015 of people sampled by the Office for National Statistics (ONS) reported using the Internet daily (or almost every day for 2015) [30][31].

D. Beneficiaries

The beneficiaries of a digitally inclusive society are numerous and include key stakeholders in the following categories: government – national and local, service providers, retailers of on-line services and products, designers and developers of ICT products and services, AT providers, voluntary organisations and social movements, individuals and society.

1) National and Local Government

National governments benefit from widespread digital inclusion as a result of an increasing proportion of the populations being competent and confident to access centralised government services online. By reducing the burden on traditional services in this way, national and local governments are direct beneficiaries of a digitally-engaged populace with access to the health and wellbeing benefits enabled by technology. The ability for all members of society, especially older people, who are the heaviest users of many services, to utilise these online, would allow for cost-savings arising from greater individual self-care, care delivery and societal participation. Local government could expect see a lessening on the burden on some local services as a result of the benefits of digital inclusion that enable independent living, greater well-being and the reduction of social isolation.

2) Service Providers

In the case of the public sector, the increased levels of confidence and capability of older people in digital participation should increase the uptake of on-line services (e.g., Universal Credit in the UK) and this will be of great value to local government bodies attempting to 'achieve more with less'. Whether delivered by a nationalised or privatised service or a mix of the two, service providers stand to benefit from the increased inclusion enabled through use of accessible technologies. As an ageing society, chronic diseases and their management is increasingly important and needs to be cost-effective to maintain pace with the growing proportion of people living into old age. Health care is likely to see mobile technology becoming increasingly used as a management tool for such conditions [32]. In terms of proportion of spending, globally, the treatment of chronic diseases currently counts for 60% of healthcare spending [32]. Healthcare providers have an opportunity to reduce their costs and ameliorate the effects of the growing ratio of older people to members of the workforce in society by ensuring that they make use of the wealth of information available about how to make their current and emerging products more inclusive. It will become increasingly important that new technologies are accessible to the non-technologist, whether that is the community nurse, or the carer or the person with the health condition.

3) Retailers of On-line Products and Services

A major market exists in the 50+ age group which offers significant, largely untapped, commercial opportunities to many retailers and other commercial companies. Understanding and being able to 'segment' the older market appropriately to achieve better tailoring of products and services offers competitive advantage to business. For businesses such as banks and retailers that provide online services, participation in community schemes to provide ICT help and support would provide a venue for retailers and service providers to demonstrate their online services (without applying sales pressure), provide information and support, build capacity in the older population, encourage customer loyalty and develop customer engagement in an environment that is comfortable to their potential customers [33]. The benefit of customer engagement could also extend to online stores which allow people with mobility or transport issues, to comparison shop and buy online with greater ease. By participating in community venues, retailers have the opportunity to work in partnership with customers, allowing them to identify products that best meet the needs of their customers, highlight where changes would enhance the user experience as well as provide them with testing

opportunities for new products and services with a demographic of people with whom they might not otherwise engage. This reciprocal relationship would not only confer benefits to both parties, but would create the environment for good products to become great products that are inclusive as well as appealing to the mainstream.

4) Designers and Developers of ICT Products and Services

Meeting the design needs identified represents a commercial opportunity for ICT designers as well as offering an exciting intellectual challenge. Instead of designing for a typical user, (i.e., someone like the designer; young and, typically, male) designing for inclusion will take into account the variability of user characteristics, as well as the changes to individual capabilities over both the short and long term [34]. Such inclusive techniques not only benefit novice users, as well as people with disabilities, but also experienced users [35]. Indeed, the argument has been made that barriers that affect novice users such as indecipherable error messages, unexpected crashes, confusing menus, and site disorganisation, also present problems to experienced users [35]. By designing for inclusion, more people can use the service and the whole user-base benefits from a better product.

5) Assistive Technology Providers

Many ATs for people with recognised disabilities can help everyone in demanding or extreme usage situations. Innovative application of accessibility principles offers the promise of increased profitability. Successful examples of ATs that have wider appeal include such applications as text to speech; shorthand for text messaging; image stabilisation and closed captions in video games. Such accessibility technologies open up new market opportunities in every sphere of life, including healthcare, homecare, commerce, education and recreation.

6) Voluntary Organisations and Social Movements

The internet has also provided a much needed voice for people to take part in social movements and voluntary campaigns. Web-based activism organisations such as Avaaz [36], 38 Degrees [37], SumOfUs [38] have not only given people a voice with online petitions, but have also provided a platform for individuals to stage their own petitions. 38 Degrees also allows for grass-roots interactions through regular polling of members about the direction of campaigns as well as polling members on preferred campaigning strategies. In order for these organisations to allow all people to exercise their democratic rights, digitally inclusive strategies to give each citizen a voice in online activism are imperative.

7) Individuals

Individuals will benefit from inclusion in numerous ways elaborated in earlier parts of the paper. In addition to the generic advantages of digital inclusion described above, there are specialised developments which will be of particular benefit to older and disabled users. For example, creating adaptable interfaces could be particularly important for older users who want to use what everyone else is using rather an AT, either because of the steep learning curve involved in learning to use some ATs, or because of a personal preference to use what everyone else is using [39]. The experience of built-in personal customisation is of benefit to all. Similarly, adaptivity features that aid in automatic customisations can reduce or eliminate the learning involved in making such changes, thereby removing a number of access barriers. By ensuring stable, intuitive, usable and adaptive design, individuals will benefit in terms of not only accessing goods and services but also engaging in personal pursuits and living independently.

8) Society

The breadth of individual economic, health and wellbeing and social benefits combined with the reach of benefits across the private and public sectors also benefits society as a whole. Moreover, the interaction between all of these advantages creates a synergy such that the total benefit to society is potentially far greater than the sum of the individual benefits. A genuinely digitally inclusive society offers transformations which range, for example, from the empowerment that results from an individual who learns a specific skill on YouTube being able to solve a particular problem/meet a need, to becoming economically active through online courses and social support, to being enabled to participate fully in civil society.

III. Some Key Challenges to Digital Inclusion

The challenges to achieving digital inclusion are extensive and include: getting online; staying online; design barriers; inadequacy of support; a culture of disinterest; and emerging ethical considerations. Each of these is described below.

A. Getting Online

There are significant challenges involved in getting online – especially those faced by many older and disabled people. In one study which examined the barriers to learning to use ICTs, the older people who participated reported that the process of learning to use a computer required significant effort, time and patience and demanded considerable help and support [40]. Novice users described feeling ‘not in control’ and sometimes feeling overwhelmed by the complexity of learning to use a computer [40]. For example the processes required to turn a computer off, or to connect to the Wi-Fi network, or to upload software to connect a printer to the computer were not felt to be intuitive and were found to be ‘too confusing’ and complicated. The struggle of learning to use a computer was exacerbated by sudden, unexpected and unwanted ‘pop-ups’ which were described as, ‘confusing’, ‘annoying’ and ‘distracting’ [40]. Fear of using a computer was also a barrier, not only for novice users but for established users who feared doing something wrong or ‘breaking’ the device. For instance, learners were left uncertain regarding what

remedial action to take in response to error messages and in some cases the distressing experience deterred them from continuing their efforts to gain digital literacy skills [40]**.** Additionally, getting online was found to be a challenging process since learning to use ICTs is not a one-off exercise but an on-going process necessary in order to cope with the complexity and rapidly changing nature of technology. For instance, updates to operating systems meant that learners had to re-learn how to do tasks they had previously comfortably done at ease [40]. The cost of training/learning support sessions/classes is a further challenge to getting online, especially for novice users who often require sustained support over a period of time to consolidate their learning, accommodate the implications of their disabilities and memory issues and to develop confidence in operating in a digital world which is often unfamiliar to them. Another challenge experienced by novice ICT users included making the transition from using devices in the training environment to those they had in their own homes [40]. Their comments included: "the buttons are in different places" and "I can't find things that were obvious before". The lack of appropriate and readily available ICT learning support (discussed further below in D) was also found to be a major challenge associated with getting online [40][41].

B. Staying Online

Once the initial learning challenges have been overcome sufficiently to permit the novice user to participate in the digital world, further challenges arise in the face of capability and other changes. It is well established that older adults are vulnerable to capability changes associated with cognitive and physical changes in later life. Changes in psychological and cognitive aspects will impact on the capability to remember sequential processes and on confidence levels in using ICTs. Changes in physical aspects, such as changes in vision make it difficult to see what is on the screen, and dexterity issues will create problems for controlling the mouse. Social changes, such as family members moving away, also impact on the support available to older ICT users. Further, older adults encounter some or a range of the following barriers in learning to use and sustain use of ICTs: confidence and fear of using ICTs; problems with understanding technical jargon and dealing with pop-ups and spam; problems with updates, drivers, and software; dealing with the rate of change of technology and coping with poorly designed software and hardware [41].

In recognition of the issues facing older ICT users, which may lead to people giving up use of computers and other digital technologies, the 2004 UK Digital Inclusion Panel Report [5] stated that "there is a real risk that in the medium to long term, significantly more citizens will migrate from being digitally engaged to being unengaged than the other way round, as their capabilities change." It is a common myth that 'once people are online, they stay online'. There is evidence to show that some people who have used the Internet at some point, and for some period of time, have subsequently stopped doing so [5][17][29]. This phenomenon is a potential, but largely unrecognised, 'fourth digital divide' [25], i.e., it cannot be explained by a simple interpretation of lack of access, lack of skills or lack of interest or motivation, because the people in this category have formerly been users. One in ten people are reported to have given up on using computers and it has been found that the older generation are more likely to be the ones that 'give up' [26].

C. Design Barriers

The design of ICTs continues to pose many problems for older and disabled people – particularly relating to the speed of change and unnecessary complexity of software and products. Despite the existence of inclusive design concepts and general usability guidelines and heuristics for ICT developed since the 1980s [42], design barriers still present barriers to digital inclusion. Although there has been extensive work on accessibility, it is still the case that users who most need operating system-based accessibility tools are often unaware of their existence [43], arguably this is a design failing rather than a failure of the AT. Typically accessibility features enable the user to adjust for decline in eyesight and dexterity enabling them to change font characteristics, contrast settings, text colour and size, mouse speed etc. Additionally, even when ATs such as screen readers are selected and purchased by a user, such technology must then be checked for compatibility with the computer as well as for any unintended side-effects [43]. For example, magnification software will create the need for increased use of the mouse or touchscreen, and the need for more scrolling is likely to pose problems for a user with motor difficulties [44]. Compatibility issues can have implications for usability, for example, not all AT software will work with all operating systems, and sometimes the user will be expected to install updates and patches in order to make such software run. For people with basic digital literacy, it's the ICT equivalent of asking them to service their car, i.e., beyond the capabilities of many people.

There is also a lack of ATs that help people with minor to moderate decline in working memory. This lack is a significant barrier to the ageing population [45]. Technical jargon and generic manuals are also barriers to the successful use of ICTs in the ageing population [45]. The paper also identified a number of additional barriers that are exacerbated by age, which include:

a. keyboard characteristics (e.g., "too cramped" to accommodate motor function decline caused by osteo-arthritis and other age-related conditions)
b. software updates (difficulty understanding license agreements and their implications)
c. "invisibility" of accessibility features [45].

It is clear that no one solution will solve all problems. For some older people, direct interaction devices such as tablets and smartphones may indeed provide an easier means of interaction than a laptop, however, others may

have problems using such direct interfaces due to parallax and the crudity of the finger as an input device [46]. Additionally, while direct interaction may work for some, the practicalities of access will need to be addressed to ensure that this technology is available to all who wish it. For example, while smartphone and tablet use is increasing among the over 65s in the UK, accessing the internet away from home via portable devices, i.e., use of laptops or tablets is still only 22% and an even lower 16% for smartphones [31]. When compared to 54% and 87% of 35-44 year olds who use laptops/tablets and smartphones respectively to access the internet away from home [31], it is clear that this disparity of use and the reasons for such disparity need to be addressed as a part of the solution. Smart TVs with voice control and other input modalities may also serve a useful role in keeping some older people online. However, this may not be appropriate for all users for any number of access reasons including the fact that speaking can be very tiring for some older people; and personal choice and budget are relevant deterrents for others. Smart TV ownership in the UK is 29% as of January 2015 [47], making it a potential tool in the digital inclusion toolbox, but not a panacea, even in consumer-driven developed nations.

In 2001, Shneiderman argued that designing for diversity not only benefits all people by promoting quality but also that usability and design are key to success [35]. Crucially, Shneiderman points out that designers, ***"rarely see the pain they inflict on novice and even expert users"*** [35]. Unfortunately, 14 years later, this is often still the case.

D. Inadequacy of Support

Findings from a survey of older ICT users conducted as part of the Sus-IT project, make clear the importance of ICT support with 56% of older people saying they regarded support as the most important factor in sustaining their digital participation. Respondents reported heavy reliance on support from family members or friends both to learn and to solve problems. Approximately one quarter of respondents said that human support and encouragement was the most important thing to help them use technology successfully [45]. Yet results from another study on the Sus-IT project showed that the opportunities for ICT learning and on-going support are extremely inadequate [41].

The poor ICT support for older users in the community contrasts sharply with that available in the work place. For ICT users in the workforce, the majority of workplaces will have a dedicated member of staff tasked with ICT support i.e., setting up and maintaining the infrastructure, selecting which technology platform is used, installing updates etc. The ICTs are installed and maintained for all those in the workplace although most are likely to be the able bodied, and reasonably technologically au-fait members of society. What exists beyond the workplace for the many without such institutional support is very different. In contrast to the situation in many workplaces, many ICT users who are at home, unemployed, retired, living with disabilities, living on a reduced income, living with a reduced social circle and possibly living with reduced health find themselves having to cope with all these demands themselves.

Organisations such as charities for older people and public libraries do offer limited help, but typically this is piecemeal and variable, and as such, is perceived by older users as inadequate and unsatisfactory [41]**.** While instruction in digital skills was offered typically through structured classes, many older participants expressed their discomfort with formal classes and some articulated their negative associations with their school days [40]. The majority of ICT courses and campaigns offered in the UK to promote IT use focus on the acquisition of basic skills to go online rather than on promoting confident participation in the digital world and on sustained usage. The consequence of this narrow provision is that once initial training is over, older people can feel alone, anxious and frustrated when experiencing problems with on-going ICT use [40]. Ongoing support for many outside of work currently means having to rely on whatever support they can find from friends and family or in the community and, typically, experiencing the frustration associated with using these forms of support is the norm for those outside of work.

The poor quality of available support is also a challenge to sustaining digital inclusion. It is a common complaint that when support is offered from children, they are too fast or resolve the issue for the user without explanation [40]. Further, studies have identified teaching styles that tend to undermine learners' attempts to learn in formal settings. Some tutors fail to project their voice adequately [48] while some proceed too quickly. The speed at which people learn and process information tends to decline with age [49]; consequently, mixed age classes may fail to meet the needs of all. A fast pace of learning may leave some learners behind while a slow pace may cause more able learners to lose interest [50]. Furthermore, the use of jargon often confounds ICT novices [48].

Another gap in adequate support is dealing with anxiety caused by the threat of cyber-crime and bullying. While is is possible to counter some of the threats of viruses and cyber-crime through technical solutions such as firewalls and anti-virus software, the need to address the real fear that can arise as a result of the possibility of cyber-bullying and cyber-crime (e.g., phishing, viruses etc.) requires actual human support to ensure confident use of ICTs.

E. Culture of Disinterest

The culture in many commercial companies that develop ICT software and products fosters the belief that ATs do not create a significant return on investment [43] that the related lack of interest in the hidden nature and, in some cases, paucity of accessibility features often remains unchanged and unchallenged. It has been observed that developers experience difficulty convincing both clients and their management of the importance of accessibility [51]. While

many web developers view accessibility as important and consider it at the early stages of projects, there are a considerable number of people in project management roles who do not see ageing as an accessibility issue [52]. This lack of interest and awareness of age-related capability change impacting on the use of technology does not create a climate conducive to the development and visibility of accessibility features to assist those with declining working memory, dexterity, contrast vision and other age-related changes. The prevailing culture in many countries is often one in which compliance with established standards on accessibility is resisted. For example, a study of the webmaster attitudes to the implementation of Section 508, (Amendment to the Rehabilitation Act 1973 in the United States that mandates that government electronic content be accessible) on American e-government sites found that most sites did not conform to Section 508 [53]. If websites that have a legislated requirement to conform to published standards fail to meet this requirement, it is clear that simple legislation is not a cure-all for accessibility and inclusion and that a culture change is needed. Since research has shown managerial attitude to Section 508 compliance to be very important in determining whether attempts to make sites accessible were actually made [53], this finding is concerning and attitude change at all levels is urgently needed. It is clearly very difficult to persuade organisations of the importance of accessibility tools if there is widespread disregard of existing standards. The challenge of getting ICT professionals, particularly at management levels, to embrace digital inclusion (and usable and discoverable accessibility features) is a continuing barrier, despite the passion and commitment of many designers and developers to the development of inclusive products and services.

F. Emerging Ethical Dilemmas

There are very many ethical issues associated with different aspects of digital inclusion, e.g., as posited by Eccles et al. [54], and it is clearly beyond the scope of this paper to deal with these comprehensively. The focus of this section is on the exponential growth of automated collection of data about users, and its potential use and abuse as another threat to digital inclusion. Of particular concern are the ethical issues associated with the modern web and emerging smart technologies such as digital assistants and smart televisions. These technologies rely on information about the user to make suggestions and process interactions which pose risks to the privacy of their users. Information about the user is an important part of the functionality of the web. Browser-based tracking enabled by the use of cookies can be benign, for example, allowing a user to logon to a website for e-commerce, social media or similar purposes. However, third-party tracking cookies, which can be used to track people and to monitor their web behaviour in to order to tailor in-page advertising to them and to draw a picture of their browsing habits, are also prevalent, but not crucial to the workings of a webpage. For an individual struggling with only rudimentary capabilities in digital literacy, it is very difficult to distinguish between the benign and the invasive. While it is now a requirement in the EU for websites to give people the option to reject the saving of cookies on their browser in a clear and concise manner, lack of user understanding of cookies may prevent informed consent. When the consultation in the UK regarding changes to the law was held, it was found that 37% of people consulted did not know how to manage cookies [55]. This number is likely to be substantially higher in the general population due to the disproportionate number of "Internet-savvy" users taking part in the consultation [55].

The data collection that takes place at the level of the operating system also raises related ethical questions regarding privacy. Do people understand the privacy implications of certain operating system features? For example, the express installation settings for Windows 10 (i.e., when a user chooses to use the default settings for installation that only require clicking the "next" button rather than choosing to go through each setting before they are installed), allows for the collection of personal data including location, calendar and contact list details in order to tailor advertising and other features by default. For those with just basic digital literacy (and 21% of people in the UK do not have even basic online skills [56]) it is clearly not appropriate to assume understanding about what information their IT devices are collecting, why such information is needed, who sees this information and how they can control it. Important ethical questions about automated data collection are clearly a major challenge to digital inclusion. Possible safeguards must be considered, e.g., should default installations expressly state which data is collected and under what circumstances this happens? Should there be a master opt-out for all data collection?

Data collection is required for personalisation features for adaptive technologies. For example, Cortana, Microsoft's personal assistant software, (which can set and manage your calendar and even remind you of errands based on your location), relies on data collection to work. Taking into account the assistive capabilities of personal assistant technologies such as Microsoft’s Cortana and Apple's Siri as well as the emerging capabilities of some smart televisions, which can allow you to control your television using your voice for people with disabilities, it is vital that both the assistive capabilities of such technology as well as the privacy implications of using such technology are known and transparent. As the situation currently stands, people who use these services for the accessibility capabilities they provide are faced with a very serious dilemma about how they manage their own data. Assuming that people using these products for their assistive features are aware of the privacy implications of collection of their data, such people may not have a choice in foregoing the technology for the sake of greater management of their privacy. This lack of choice between access and privacy for people who need the

assistive capabilities of a product is a considerable barrier to overcome.

Excessive complexity and confusing wording, as well as the volume of text in terms and conditions and end user license agreements (EULAs) pose major challenges for very many users – not only the old and disabled. In light of the complexity presented by such agreements, the prospective user is presented with another considerable dilemma, namely to use technology and risk their data being used in unknown ways, or to abandon use of the technology and maintain their privacy. Many older people opt for the latter [26]. One such example of the complexity of privacy policies is that of the Samsung smart television. Following the launch of Samsung's smart television with voice command features and the publication of Samsung's smart television's privacy policy for televisions with this feature, questions arose highlighting the concern about the implications of privacy for users of the voice recognition feature. Questions surrounded the privacy policy of the Samsung smart television was first highlighted by the Daily Beast [57], an online magazine, in 2015. The policy, as originally published, implies that users are being monitored by their televisions, "*Please be aware that if your spoken words include personal or other sensitive information, that information will be among the data captured and transmitted to a third party through your use of Voice Recognition.*" [58]. Wording like this fosters fear of 'Big Brother' in your television threatening your privacy and can leave people with a number of questions about just how safe it is to use their technology. For example, is it safe to have a conversation in front of your television? Who has access to this information? Can this information be hacked? Although in response to the press attention and concern of privacy experts, the Samsung privacy statement has since been reworded to better explain the process of converting the speech to text as well as how to disable this functionality [58], questions still remain. How comprehensible is the privacy policy to the average end user? Who actually reads the terms of service?

From the brief analysis of some of the issues presented in this section, it will be evident that the challenges to digital inclusion are immense. Ways of addressing these are considered in Section IV.

IV. HOW TO MEET THE CHALLENGES?

To meet the many significant challenges identified in the previous section associated with getting and staying online, design barriers, inadequate support, the prevailing culture of disinterest in inclusion and accessibility and emerging ethical dilemmas will demand a raft of integrated solutions. There is no 'silver bullet' to meet the complex array of challenges and many contributions will be needed, including, for example, from businesses; government (both national and local); the third sector; policy-makers; educationalists and research and design communities.

The solutions which evolve will need to be implemented by policy makers, manufacturers, retailers, service providers, designers, education providers and others. Relevant stakeholders will need to be identified, empowered and engaged to work together to influence policy makers, manufacturers and service providers to convince them of the vast significance and value of achieving the vision of digital inclusion. Crucial to success is the necessity for relevant stakeholders to work together to increase access and develop widespread capability in the population and also to make understood the benefits to individuals.

To narrow the many digital divides identified in Section II will require not only the necessary telecommunications infrastructure to enable connection, but also the equipment to utilise the technological capabilities and the human capability to capitalise on both of these components. Evidence from Sus-IT indicates that two key determinants of sustained digital engagement of older people – and therefore of their digital inclusion in the long term – are (i) the appropriateness of design and (ii) the adequacy of ICT support available to them.

A. How to meet the design challenges

To meet the design challenges identified in Section III requires processes which enable older people to participate in shaping the design of products; increased investment in 'elder friendly design'; and greater awareness and education in accessibility. Experience on the Sus-IT project offers lessons/good practice in engaging older people in shaping design decisions showing that co-design 'sandpits' can be used successfully to involve older people in the research and design of digital products rather than as passive research 'subjects'. The outcome of these sandpits included custom computers for older people, products to support memory and identity in later life, products to combat isolation and iPad apps designed specifically for older people [59]. Further good practice relevant to tailoring design to the needs of users experiencing capability change and often unaware of the accessibility features available, or with cognitive difficulties with adjusting font size, the development and testing was carried out of an adaptive software framework which explored how to how to connect existing operating system accessibility solutions to the people who needed them, at the time they needed them [60]. The framework developed monitored moment by moment interactions of the user with their ICT, balancing the pros and cons of any changes and suggesting improvements such as zooming text size and changing mouse speed in a manner that would aid their interactions as a way of meeting design challenges and potentially prevent disengagement with their ICT.

To promote greater awareness and education in accessibility a number of proven methods are available. For example, embedding accessibility education throughout the undergraduate level [61], encouraging students to evaluate their own projects using ATs [62] and exposure to issues pertaining to diversity and inclusion [61] all raise awareness

of the diverse needs of Internet users. Similarly, engagement with students and designers through interactive video such as the UTOPIA Project (Usable Technology for Older People: Inclusive and Appropriate) [63] proved successful in changing the attitudes towards older people's use of technologies of both undergraduates, and Human Computer Interaction (HCI) professionals [64]. Another established method for promoting awareness and changing attitudes is the use of interactive theatre: in an evaluation study of a pilot, over 85% of respondents agreed with the importance of highlighting accessibility issues and the use of the theatre format [65]. By ensuring that the diversity of needs is known to, and understood by, students and professionals, content designers and developers are encouraged to follow user-centred design principles in an inclusive and participative approach to the design of their products, systems and services which then becomes embedded in the culture. Interactive theatre also allows older people to contribute to the shaping of design.

Goals for designing to achieve universal inclusion were first presented by Shneiderman in 2000. These are:

- increased availability of low cost ICT with better quality of service
- the reduction of system complexity and user frustration
- ensuring older technology and slower networks can participate fully
- ensuring that services for low-income and poorly educated users are understandable and usable, while allowing expert users to use more novel strategies
- ensuring accessibility for people needing support for visual, auditory, physical and other disabilities
- enabling designs to work in multi-lingual and device diverse environments [35].

These points are as germane today as they were in 2000 in the reduction or elimination of design barriers.

With regards to ethical issues, there needs to be a clear and possibly legislated procedure on getting informed consent from people with regard to when their data could be collected, how it is to be used, who sees such data and how long it is stored across smart technologies. There is a very strong argument for the service provider to ensure that privacy data is understood and clearly stated at the time of first use of the software, with step by step configuration of each setting with explicit information on the consequences of agreeing or disagreeing to the collection of personal details. This also holds true for operating systems. Rather than configuring privacy at the time of installation, where the gathering of data is not linked to the operating system itself but to bundled software, such settings should be off by default and configured upon the first launch of the software in question.

There will clearly not be one generic solution to overcoming design barriers. Device availability, device capability, cost, interaction modality and personal choice will all play a role in solving interaction problems experienced by diverse individuals. Regardless of the device used, what is key is that the person using the device is able to carry out the tasks they wish to perform.

B. How to meet the challenge of inadequate support

The evidence described in Section III that document the challenges, makes clear that support has to address the needs of getting online, staying online and dealing with a vast array of problems that arise on an on-going basis. The research findings cited have shown that getting online is only one of the challenges. Once the initial excitement of connection has passed, older users' new found-confidence can be eroded very rapidly by the early challenges of coping with technology at home. We have seen that if older people are to become confident participants and contributors in the digital world, they need ongoing, friendly and reliable support that meets their needs. The challenge of inadequate support for ICT users has been identified and explained. The pressing requirement is to fill the ICT support void beyond the workplace. There are two components involved in this: (i) enabling non-users to become users and, (ii) supporting existing users in sustaining their learning and use of fast-changing technologies.

Informed by participative research with over a thousand older people across the UK, a co-design process developed a user-specification of the users' support needs. This had the following characteristics:

- readily available, trusted and sustained
- delivered in familiar, welcoming and local venues
- embedded in social activities / personal interests
- free of time pressure and assessments
- inclusive of problem solving / troubleshooting
- offering impartial advice and 'try before you buy'.

Informed by this user-led specification, a co-design process followed, with older people and other stakeholders to deliberate and develop solutions to the challenges of inadequate support [33]. Consensus emerged that a socially embedded model of provision was required. From an extensive consultation and validation process, a detailed proposition for provision of ICT support in the community evolved. In this model (aspects of which already exist in limited ways), socially-embedded community-hubs provide flexible and adaptable learning to match people's range of needs, learning speeds and styles. They use existing community venues and are locally run, providing ad-hoc trouble-shooting assistance as problems arise. The social nature of the hubs allows people to share tips and support each other, all within a relaxed, social atmosphere allowing for intergenerational exchange and access to professional expertise. The value of venues/hubs is in their capability to:

- Support and sustain on-going ICT use
- Empower and inspire people in use of ICTs
- Promote adventurous use of ICTs

- Make online participation enjoyable, rewarding and 'angst –free'.

There was also consensus that in order to be effective in the long-term, ICT hubs should:

- be widely available across the UK
- available on an on-going and consistent basis
- user-driven and locally run and make use of local venues
- have access to appropriate training resources and professional expertise
- be sustainable by securing multiple revenue streams – which will differ according to local circumstances and assets.

The proposition has a strong evidence base. It has been developed through a programme of roundtable discussions with multiple stakeholders, culminating in an intensive multi-stakeholder consultation.

The advantages that community-based ICT support hubs will provide users can also be expected to benefit the beneficiaries identified in Section II. For instance, the public sector could expect to achieve greater uptake of online government services, e.g., Universal Credit in the UK. For companies, hubs will give them access to older people who will be enthusiastic testers of new products and services as well as providing a venue to conduct research on user needs. Similarly online retailers can enjoy increased customer engagement and loyalty as well as the opportunity to demonstrate and allow people to try new products in an environment where people will not feel pressured.

Additionally, five single-sector roundtables were convened with the following stakeholder groups:

1. Businesses developing or delivering accessible solutions
2. Designers and developers of ICT products
3. Retailers of ICT products or assistive technologies for older people
4. Government departments, the Public sector and Local Government
5. Older Peoples' Groups, e.g. 50 + forums, Age UK and U3A.

The roundtables refined the proposals for community-based ICT support and these were subsequently the focus of a consultation entitled 'Falling off the bandwagon' at St. George's House (SGH). The proposition was considered and validated further over the 24 hour consultation with experts representing a variety of stakeholders at SGH, Windsor Castle, where the feasibility of implementing the proposition as proposed was extensively deliberated, including how it might be funded and managed [66].

The extensive process to find and develop a solution to address effectively the challenge of inadequate support culminated in the publication entitled 'Promoting Digital Participation. The proposition: Community hubs, Meeting older people's technology support needs; developing social communities and reducing isolation' under a creative commons license [67] requiring only acknowledgement of the source to use the material freely.

This proposition is now informing digital literacy plans of some local councils in the UK and the major joint initiative of Barclays and BT to introduce pop-up community hubs in public libraries and other local venues.

Therefore, community hubs in highly varied forms tailored to local circumstances and needs can be seen to offer a powerful generic way of addressing the challenge of inadequate support. The wide-ranging outcomes include:

- friendly informal help for beginners and advanced technology clinics for troubleshooting problems, e.g., computers, cameras, online shopping, smartphones, bill paying
- readily available, trusted advice in simple language
- opportunities to try before you buy, e.g., smartphones, tables, laptops etc.
- help with choosing software that meets individual needs
- hobby-based support, e.g., family tree, digital photography
- opportunities to swap knowledge and tips
- reducing social isolation and loneliness through social gatherings.

V. Discussion and Conclusion

In this paper we have presented the vision of universal connectivity and inclusion. The authors regard digital inclusion as fundamental to a flourishing democracy and to the full participation of people in society. At the individual level, digital inclusion is crucial to sustaining and enhancing independence and autonomy. However, the transformative potential of such inclusion transcends the individual and has wide-reaching benefits for the whole of society and the economy. To achieve the vision will require coordinated policies, strategies and practices led or endorsed by national governments and coordinated and implemented by local government, service providers, businesses and third sector organisations. Encapsulating the essence of the 2003 Declaration of Principles allows the vision of an inclusive society and economy to be articulated as "the enhancement of the quality of life for all, extending autonomy and independence through the use of digital technologies. This vision would be characterised by:

- Empowered people experiencing the benefits of digital inclusion
- Widespread participation in society and the economy
- Readily available support in the community for engaging with and managing all aspects of the "digital world".

To create the digitally inclusive society encapsulated in the vision described above requires structural, political, and

social change on a vast scale - which perhaps helps to explain the slow progress to date.

The process of achieving such change needs itself to be inclusive of all stakeholders across society. This means that to succeed, the co-creation of an inclusive society is required. This will require collaboration on a grand scale to address the challenges through innovating, creating and evolving a digitally inclusive society that harnesses the power of ICT for the benefit of all. The knowledge to meet the challenges already exists.

The barriers to achievement of a digitally inclusive society are well understood and, while commitment and effort to overcome them will be required, solutions are available and the return on investment in implementing these will be extensive. With leadership and commitment, sustained digital connectivity for everyone is achievable. In particular, leadership is needed to promulgate the vision and to encourage the development of strategic alliances and partnerships within a framework of appropriate policies and strategies, involving all relevant stakeholders – especially older people and disadvantaged groups in society. Engagement at grass-roots is urgently needed to complement the 'top-down' digital inclusion campaigns currently in operation in some countries.

Ethical implications with regard to data collection must be clearly stated and visible to software users, in order for uptake of digital technologies to have the potential to reach all members of society.

Meeting the wide range of challenges of digital inclusion requires development and implementation of a strategy with the following components:

- A shared and compelling vision of what digital inclusion offers to the economy, to society and to individuals and communities
- Policies and strategies for implementing steps towards the vision
- Strategic alliances, partnerships and collaborations
- Leadership

Public events and workshops offer a compelling way of promoting awareness and excitement of digital inclusion and the resultant digitally inclusive society. Implementing the following steps may stimulate awareness and mobilise widespread support for digital inclusion:

- Showcase a ***realisable vision of an inclusive digital society*** and economy to inspire investment by ***all*** stakeholders in building ICT capability and confidence of all.
- Demonstrate 'proof of concept' by ***modelling best practice*** in government policies and strategies, i.e., 'Do as we do' to promote digital inclusion.
- ***Quality of Life strategies*** in the community: creative holistic strategies for achieving technology-enabled autonomy and independence of all.
- Establish ***intergenerational problem-solving forums*** to engage diverse sections of the community to scope problems, exchange ideas and co-create solutions.
- Enable the above by ***use of innovative techniques and methods*** (e.g., drama/interactive theatre, 'sandpits', story-telling etc).

There will inevitably be different perspectives and priorities among individuals, communities, businesses and government regarding what a digitally inclusive society looks like. However, the transformational outcomes envisioned by the Declaration of Principles help to inspire a shared vision and perspectives and encourage commitment to follow the roadmap to achieving this. The sharing of perspectives between all stakeholders, especially those in positions of authority such as national and local government and those in business developing and selling ICTs are crucial to success in creating and sustaining a digitally inclusive society. Inter- and intra- stakeholder co-operation, ongoing negotiation for the mutual benefit of varied stakeholders and respecting the voices of less influential/authoritative stakeholders is also key to this journey.

To provide a roadmap towards the vision of an inclusive digital society, the following steps are essential:

- Promote widespread awareness of the benefits – individual, societal and economic – of digital inclusion
- Engage and gain the 'buy-in' of key stakeholders to the vision of digital inclusion
- Encourage and reward adoption of inclusive design principles and promote them as the industry 'norm' for designers, developers and manufacturers of ICT systems, services and products
- Create expectations of and demand for inclusive design/digital inclusion amongst buyers and users of ICT
- Promote awareness that current ICT learning and support provision in the community is variable in quality and availability and not tailored to the requirements of users
- Recognise that sustaining people online is an even greater challenge than getting them online in the short term – and invest in community provision indicated above.
- Create a framework for ubiquitous provision of ICT support in the community, e.g., in public libraries
- Document and co-ordinate the various local initiatives that exist, e.g., some general medical practitioners (GPs) are now "social prescribing" (e.g., recommending patients make an appointment at a local library to obtain digital skills training).
- Utilise local resources to meet local needs
- Harness the political will to push this vision

- Recognise and celebrate what we can all achieve given the right access to ICTs.
- Promote the adoption of socio-technical systems as the industry norm

These steps offer a roadmap to a digitally inclusive society.

To summarise:

- We have the vision of universal connectivity and inclusion
- The potential economic and social rewards are vast
- The challenges are immense – *but we have the know-how to meet them*
- The opportunities for innovation and change in business and in society are even greater than the challenges
- With leadership and commitment we can tackle social inclusion through digital inclusion.

In conclusion, the path to achieving the Vision of Digital Inclusion is well-developed and waiting to be travelled. The rewards are significant and achieving the vision of digital inclusion presents opportunities for innovation and change in business and society that are even greater than the challenges.

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