

Designing for Digital Exclusion in Essential Services

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Abstract: The rapid transfer of the key government services such as healthcare, finance, government administration, and education to the online platforms has completely changed the process of services delivery process on the international level. As this digital transformation has brought significant benefits in terms of operational efficiency and scalability, it also contributes to socio-technical inequalities in that it suppresses the population which lacks access to it, skills, or infrastructure themselves. In this paper, a critical analysis will be performed on the conceptualization of how the indispensability of digital services can be achieved to reduce exclusion, and at the same time tap into the capabilities of modern technologies. Based on a qualitative, conceptual paradigm, using human-computer interaction (HCI) scholarship, the study analyzes the policy, and previous empirical studies of antecedents assess the groups most vulnerable to digital exclusion and evaluate current, regulatory, and design-based interventions. The analysis shows that even strategies which are more concerned with compliance, or remediation, do not suffice as such tactics are still not adequate to consider the very socio-technical nature of exclusion. The paper, therefore, suggests a combined set of evidence-based design guidelines, i.e. accessibility-by-default, participatory design, multichannel access, progressive disclosure, and built-in digital literacy support, adapted to the conditions of high stakes services. It argues that the inclusive digital design should be a socio-technical requirement unlikely to occur instead of a contingency. The integration of inclusiveness in the design of the lifecycle enables critical services to actualize technological progress as well as promote social equity.

Keywords: Digital Exclusion; Inclusive Design; Human Computer Interaction (HCI); Essential Digital Services; Accessibility-By-Default; Socio-Technical Systems; Participatory Design; Digital Inequality; E-Government; Digital Transformation.

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I. INTRODUCTION

The digital revolution has taken center stage as a core strategy of providing much needed public and private services. Governments are becoming more dependent on e-government portals, lifestyle facilities are implementing telemedicine systems, financial institutions are advertising online and mobile banking and educational institutions are relying on learning management systems. On organizational level, digital services will offer low cost in operations, efficiency, and reach. They are convenient, fast and flexible as perceived by the user. These advantages however are not shared equally and to most people, digitalization has provided new frontiers instead of clearing existing ones.

Digital exclusion appears when the population or certain demographic groups cannot gain access to or effectively use digital technologies and online services.

When applied to the situation of key services, the consequences of the elitist exclusion may be devastating, comprising limited access to healthcare, economic marginalization, underprivilege in education, and reduced civic participation.

It is shown by the Human-Computer Interaction studies that exclusion is hardly ever due to one determinant; quite the contrary, it is manifested through the interplay of abilities of the users, the socioeconomic factors, technological infrastructures, and design choices inherent in the digital systems.

The research inquiry that is the subject of this paper relates to how designers of vital online services can avoid excluding vulnerable populations and take advantage of modern technological possibilities at the same time. The study consists of four separate stages. First, it discusses which groups are most vulnerable to digital exclusion and considers

some of the underlying determinants that contribute to this vulnerability. After that it provides a critical analysis of existing interventions adopted by both organizations and governmental bodies. In the third phase, it expresses five design principles that are clearly grounded in the research on human-computer interaction and supported by empirical evidence. The final stage conducts a reflective analysis on the wider implications that inclusive design has for the essential services, and on upcoming initiatives of digital transformation.

II. POPULATIONS AT RISK OF DIGITAL EXCLUSION

➤ *Older Adults*

Within academic literature, older adults are always found as one of the demographic groups with an increased susceptibility to digital exclusion. The changes in the visual and auditory perception, motor skills and thinking processes associated with age are also contributing factors to the difficulty of navigating the growing complex user interfaces. In addition, a high percentage of elderly people went without the exposure to digital technologies in formal education or initial work experiences, which in turn is accompanied by a reduced degree of digital literacy and weakened self-efficacy in contact with online systems. Czaja and colleagues (2019) note that older adults tend more trust online services associated with the apprehensions, fears of irreversible mistakes, and security issues impacting the willingness to utilize the necessary services, as evidenced by their significant role in influencing their decision to use them. The shift to online-only or so-called digital-first banking is a timely empirical example. The closing of physical bank branches in many jurisdictions in a massive manner has disproportionately affected the elderly who rely on physical government help. Fundamentally ineffective verification procedures, small typeface, and highly populated data formats contribute as well to the lack of inclusion, proving the point at which design choice meets age-related vulnerabilities.

➤ *People with Disabilities*

Persons with physical, sensory, and cerebral disabilities subject to systemic barriers each time the digital structures do not put into consideration accessibility issues. Vision and hearing are impaired, motor and neurodivergent disorders are modifying the way users see, navigate and interact with interfaces. Despite its clear-cut guidelines notably the Web Content Accessibility Guidelines (WCAG) suggested standards, the level of applying these standards varies effectively across various sectors.

Lazar et al. (2017) provide empirical evidence that the accessibility constraints are often treated as a compliance issue at a late stage, and not part of the design process. Thus, assistive technology can be poorly supported, keyboard navigation can be underdeveloped, and alternative textual explanation or captions can be used. In health care portals, the non-accessibility of appointment-booking interfaces (or even diagnostic results) can serve as a direct impact on the

wellbeing of users, which highlights the ethical nature of the practice of exclusionary design.

➤ *Low-Income and Rural Populations*

One of the main causes of digital exclusion is socio-economic status. People with less economic status might feel limited in their ability to access quality internet connectivity, modern digital equipment, or safe personal zones needed to interact with digital services.

These rural communities have often been faced with numerous infrastructural challenges, particularly the limited range of broadband and high prices related to connectivity. The COVID-19 issue increased these inequalities on the global scale. With the shift towards digital platforms of educational services, healthcare services, and governmental services, people without a reliable connection or a qualitative device have been pushed to the periphery.

Van Dijk (2020) argues that digital exclusion in such places is not only a technological disadvantage but also a structural phenomenon, which is rooted in extensive patterns of socio-economic inequalities.

➤ *Migrants and Linguistic Minorities*

Minorities in terms of language, cultural differences, and ignorance of institutional practices often face exclusion created by linguistic minorities, refugees, and migrants. Some of the most needed services, meant mostly to cater to speakers of a dominant language, require a high level of literacy, bureaucratic sophistication and cultural orientation.

The challenge is depicted through e-government platforms. Complicated words, restricted choice of languages, and culturally inclined metaphors may deter interest and cause mistakes that have severe effects such as wrong benefit applications or deadlines. These complications highlight the need to designate the crucial services in a culturally and linguistically inclusive manner.

III. METHODOLOGY

The literature review was filtered according to relevance, frequency of citation, and the discussion of digital exclusion in the form of basic services.

This paper presents qualitative and conceptual research that is based on a synthesized literature on the interdisciplinary research system that includes human-computer interaction, digital inclusion, e-government, and the design of the public services. Alternatively, as opposed to gathering raw empirical evidence, the study incorporates theoretical constructs, empirical evidence, and policy briefs to question the issue of digital exclusion in critical services.

The methodology used is presented in three steps. First, the relevant literature was reviewed in order to define the vulnerable populations facing digital exclusion and socio-technical factors affecting access and usability. Second, the current intervention strategies, including the accessibility regulation, assisted digital models, and participatory design,

were critically assessed, and the advantages and the drawbacks were taken into consideration. Thirdly, the knowledge gained as a result of the synthesis was summarized into a collection of evidence-based design principles, distilled by matching them with the well-known theories of HCI and usability heuristics.

This approach is not novel to HCI or social informatics disciplines in which the synthesis is informed by theory to guide complex systems during design.

IV. CRITICAL EVALUATION OF EXISTING SOLUTIONS

Availability guidelines and legal systems have raised the level of awareness and responsibility; however, they often encourage formal implementations instead of meaningful inclusion. The temporary assistance that the assisted digital services provide risks dependencies or stigma, unless incorporated into the long-term design strategy. Participatory design is useful but requires long term effort to avoid tokenistic actions. Reduced, mobile first-designed interfaces increase usability, but they need to trade parsimony with functional depth.

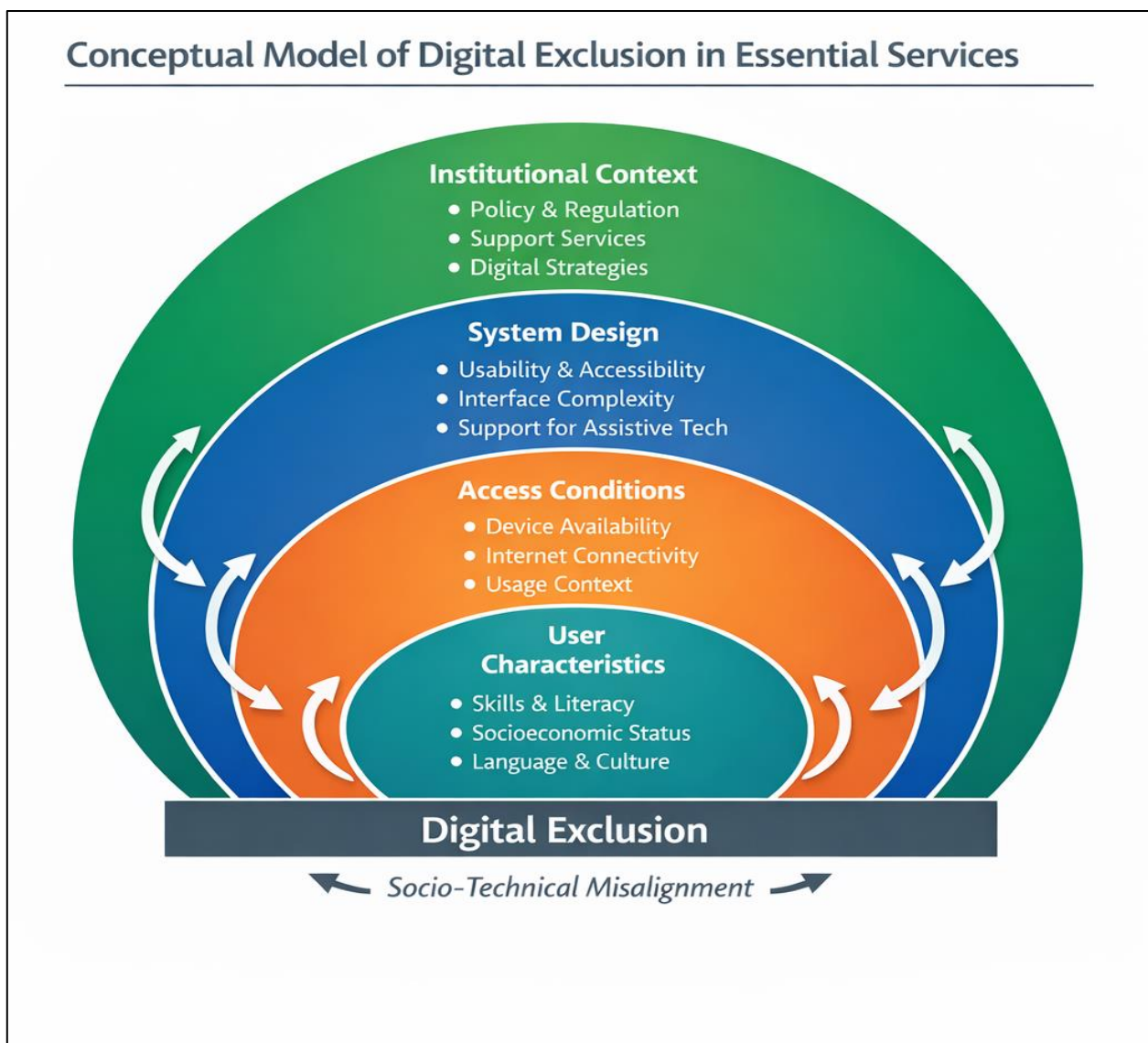


Fig 1. Conceptual Model of Digital Exclusion in Essential Services

The figure illustrates digital exclusion as an emergent socio-technical outcome resulting from interactions between user characteristics, access conditions, system design, and institutional context.

This model is derived from recurring themes identified across the literature reviewed. The given conceptual framework outlines the problems of digital exclusion as the emergent process due to the interplay of four different strata: (1) the characteristics of users, which include skills, competencies, language proficiency, and socio-economic status; (2) access conditions, i.e., device availability, access infrastructure, as well as the context; (3) design of the system, i.e., usability, accessibility, and the complexity of interactions; and (4) institutional context, i.e. policy frameworks, supporting systems, and regulating forces. The exclusion is realized when a lack of unification occurs between these layers, which complement the explanation that digital exclusion is a socio-technical problem and not a purely technologic one.

➤ *Accessibility Standards and Regulatory Approaches*

The most common reaction to digital exclusion is accessibility standards and legislation. There are statutory documents that establish minimum expectations of digital accessibility, including the Americans with Disabilities Act (ADA), the European Accessibility Act and the Web Content Accessibility Guidelines (WCAG). The empirical evidence shows that these structures have managed to improve awareness and create legal responsibility.

However, empirical research indicates that regulation-based programs often end up in mere compliance and not incorporation. Yesilada et al. (2019) argue that accessibility assessment with the help of checklists can overlook contextual and experience-based aspects to produce systems that, though technically correct, cannot meet the practical demands of most users. This identified deficiency highlights the necessity to go beyond compliance and embrace participatory and user-centered approach.

➤ *Assisted Digital and Hybrid Service Models*

Assisted digital models combine internet-based locations with supported models, such as call centers, community kiosks, and face-to-face support. The example of the Government Digital Service in the United Kingdom clearly recognizes that there is a section of users that requires additional support to navigate through digital services.

Although assisted digital methodologies overcome short-term exclusion, they come with serious shortcomings. The intensity of resources and the propensity to perceive them as temporary solutions as opposed to design components reduce their effectiveness. Moreover, reliance can create dependency and increase the stigma in cases where reliance is framed as one of helplessness and not support among users.

➤ *Participatory and Co-Design Practices*

Participatory design involves the users, especially the marginalized groups being involved in the design process in a direct manner. Within empirical research on HCI, researchers suggest that co-design practices reveal latent barriers, contextual constraint and user priorities that could otherwise go unnoticed by the designer (Spinuzzi, 2005).

Despite this strength, participatory design has several challenges. It requires a considerable amount of time, money, and dedication on the part of any given organization, and as a result participation conducted shallowly can degenerate into tokenism performances. Co-designing functional needs is a continuous process that assumes both genuine power and impact over design decisions as opposed to just symbolic consultation.

➤ *Simplification and Mobile-First Design*

Easy interfaces and mobile first experience have been adopted to prevent access inequality, especially in low-income situations where mobile phones outweigh desktops. If not, there would be increased clarity of navigation, decreased cognitive load, and truncated content, then there would be enhanced usability among a large segment of users. However, excessive focus on simplification can remove some necessary functionality or flexibility needed by various groups of users. Inclusive design, **thus, requires a balanced strategy:** the support of novice users without limiting the experienced ones.

V. RESEARCH CONTRIBUTION AND PROPOSED DESIGN PRINCIPLES

The paper is significant as it conceptualizes the idea of digital exclusion as a multilayered socio-technical scenario, generalizes the constraints of the existing intervention, and suggests a collective theory of inclusive design concepts. The principles that have been proposed include accessibility-by-default, participatory design, multichannel access, progressive disclosure, and built-in digital literacy support. Together, they promote the inclusive design as one of the strategic elements of fair digital transformation.

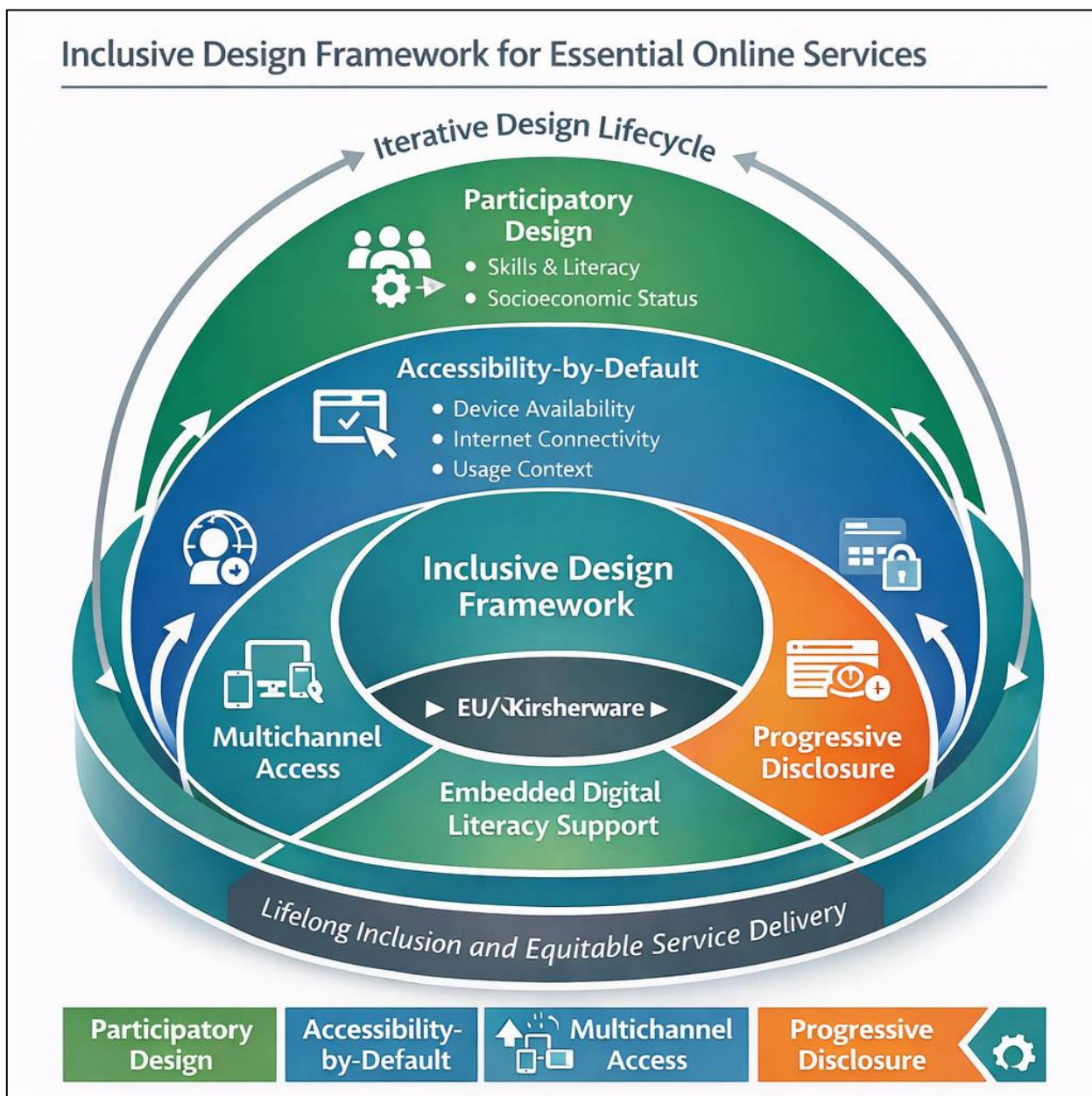


Fig 2. Inclusive Design Framework for Essential Online Services

The figure illustrates inclusive design as an iterative lifecycle in which accessibility-by-default and participatory design guide all development stages, while multichannel access, progressive disclosure, and embedded digital literacy support operate at the interaction level to sustain long-term inclusion and equitable service delivery.

This model is used to conceptualize inclusive design as an iterative lifecycle and not a linear process. The two principles are accessibility-by-default and participatory design, which would direct every development step. Multichannel access, simplified interaction, which is delivered through progressive disclosure, works at the interaction layer, and the aid of digital literacy works as an enabler, which maintains the long-term interaction and the inclusion.

➤ *Accessibility-by-Default*

The aspect of inclusion of accessibility needs to be included in the initial stages of design and development. This type of integration includes the use of assistive technologies, dynamic and adjustable layouts, and adherence to the accepted accessibility guidelines. These have been proven true in the form of empirical data that show that the early implementation of accessibility measures improves overall usability and at the same time reduces the long-term costs (Lazar et al., 2017).

➤ *Inclusive and Participatory Design*

Designing together with vulnerable users rather than designing to vulnerable users is important in that the varied needs and situation considerations are methodically integrated into the design choice. Participatory design enhances the level of trust, relevance and adoption, especially

in the most needed services where the level of engagement by the user is paramount.

➤ *Multichannel and Flexible Access*

Different access channels should be provided in inclusive services, including web, mobile, telephone, and face to face services. Multichannel strategies support various abilities, resources and tastes and hence reduce the exclusionary risks (Jaeger and Bertot, 2010).

➤ *Simplicity with Progressive Disclosure*

The reduction of cognitive load is the most important in interface design that is proposed using clear language, consistent layouts, and intuitive navigation. Progressive disclosure also helps to hide the complexity until needed, hence supporting the users with different levels of expertise. Such approach aligns with established rules of usability (Norman, 2013).

➤ *Integrated Digital Literacy Support*

The design must have contextual assistance, tutorials and clear feedback systems that guide users with little digital literacy. With the supportive design, the reliance on external help is reduced, which consequently supports the persistent inclusion (Van Dijk, 2020).

VI. CONCLUSION

Digitization of key services can provide a paradoxical situation: it can increase access and efficiency but can also exacerbate social exclusion, which is its dark side. This paper has shown that older adults, people with disabilities, low-income people, and rural people, and linguistic minorities are the most disproportionately impacted by digital exclusion due to the interlocking between social, economic, and design-related factors.

Existing solutions, including regulatory compliance to assisted digital models, are partial solutions but not sufficient in case they are applied alone. The inclusive digital services require the holistic, human-computer interaction-centric approach that incorporates accessibility, participation, flexibility, simplicity, and surroundings of the user into the mainstream of design activity.

Finally, inclusive design does not constitute only a technical or legal task but also an ethical commitment of designers of fundamental services. By embracing the concept of evidence-based design, organizations will be able to embrace modern technologies, and at the same time make digital transformation facilitating equality, instead of exclusion.

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