



EVALUATING URBAN DEVELOPMENT GOALS IN THE 'SMART AND
WISE TURKU' PROJECT: AWARENESS, DIGITAL ACCESSIBILITY,
AND SOCIAL INCLUSION

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Abstract

Smart city concepts have been implemented rapidly to transform urban areas through improved sustainability, operational efficiency, and citizen engagement via technology. However, concerns over digital divides, low public awareness, and potential neglect of vulnerable populations are significant concerns. These issues must be addressed to ensure that smart city initiatives are socially inclusive and do not increase the equity gap. Existing literature provides insights into how smart cities advance environmental features and operational efficiencies. Factors such as digital accessibility and awareness relate to socioeconomic status, level of digital skills, and local governance. However, these studies are usually in larger metropolitan areas and often fail to reach the lower portion of the societal pyramid. Consequently, smaller urban regions like Turku are usually understudied. Therefore, this research study analyses the Smart and Wise Turku Project to determine how well it achieves the goals of digital accessibility, civic engagement, and social participation in different demographic categories. A quantitative, cross-sectional survey was conducted with 348 responses from Turku residents. Descriptive statistics, Pearson's correlation analysis, and multiple linear regression analysis were conducted to establish the major predictors of inclusion and participation. The analysis component includes: Inclusion and participation prospects based on pre-existing digital infrastructure, literacy levels, municipal support, and demographic parameters. Public awareness and municipal support emerged as the strongest drivers of digital access and social inclusion, while traditional demographic factors such as age, education, and nationality had little to no impact. Contrariwise, language spoken at home and employment status had a sizable impact on inclusion. Furthermore, despite the region's sophisticated digital services and platforms such as Decidim Turku, there remains a lack of awareness and readiness, especially among the unemployed and non-native speakers. Enhancing digital literacy, providing outreach in multiple languages, and implementing long-term strategies for citizen participation were identified as necessary actions.

Tiivistelmä

Älykaupunkikonsepteja on otettu nopeasti käyttöön kaupunkialueiden kehittämiseksi kestävyuden, toiminnallisen tehokkuuden ja kansalaisten osallistamisen parantamisen kautta teknologian avulla. Kuitenkin huolenaiheina ovat digikuilut, matala yleisötoisuus ja haavoittuvien väestöryhmien mahdollinen syrjäytyminen. Näihin haasteisiin on puututtava, jotta älykaupunkihankkeet olisivat sosiaalisesti osallistavia eivätkä kasvattaisi tasa-arvon kuilua. Nykyinen kirjallisuus tarjoaa näkemyksiä siitä, miten älykaupungit edistävät ympäristöystävällisyyttä ja toiminnallista tehokkuutta. Tekijät kuten digitaalinen saavutettavuus ja tietoisuus liittyvät sosioekonomiseen asemaan, digiosaamisen tasoon ja paikalliseen hallintoon. Kuitenkin nämä tutkimukset keskittyvät yleensä suurempiin metropolialueisiin ja laiminlyövät usein yhteiskunnan heikommassa asemassa olevat ryhmät. Tämän seurauksena pienemmät kaupunkialueet, kuten Turku, jäävät usein vähälle huomiolle.

Tämän vuoksi tämä tutkimus analysoi Smart and Wise Turku -hanketta arvioidakseen, kuinka hyvin se saavuttaa digitaalisen saavutettavuuden, kansalaisosallistamisen ja sosiaalisen osallistamisen tavoitteet eri väestöryhmissä. Tutkimuksessa toteutettiin määrällinen poikittaistutkimus, johon saatiin 348 vastausta turkulaisilta asukkailta. Aineiston analyysissä käytettiin kuvailevaa tilastotiedettä, Pearsonin korrelaatioanalyysiä ja monimuuttujaista lineaarista regressioanalyysiä keskeisten osallistumiseen ja osallisuuteen vaikuttavien tekijöiden selvittämiseksi.

Analyyosio kattaa osallisuus- ja osallistumismahdollisuudet olemassa olevan digitaalisen infrastruktuurin, lukutaitotason, kunnallisen tuen ja väestöllisten parametrien perusteella. Julkinen tietoisuus ja kunnallinen tuki nousivat vahvimiksi digitaalisen saavutettavuuden ja sosiaalisen osallisuuden ajureiksi, kun taas perinteiset demografiset tekijät, kuten ikä, koulutus ja kansalaisuus, vaikuttivat vain vähän tai eivät lainkaan. Sen sijaan kotona puhuttu kieli ja työllisyystilanne vaikuttivat merkittävästi osallisuuteen. Lisäksi, vaikka alueella on kehittyneitä digitaalisia palveluja ja alustoja, kuten Decidim Turku, tietoisuuden ja valmiuden puute on edelleen ongelma erityisesti työttömien ja ei-äidinkielisten keskuudessa. Digitaalisen lukutaidon parantaminen, monikielinen viestintä ja pitkäaikaisten kansalaisosallistamisstrategioiden toteuttaminen tunnistettiin välttämättömiksi toimenpiteiksi.

Keywords: Smart and Wise Turku Project, Urban Development Goals, Smart Cities, Digital Accessibility, Social Inclusion, Public Awareness, Digital Literacy

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1 Introduction

1.1 Background

In recent years, the ‘smart city’ concept has become widely used in urban development planning worldwide. Smart cities are typically characterised by the integration of digital technology, real-time information systems, and data analytics to enhance urban living (Caragliu & Del Bo, 2023; El Barachi et al., 2022; Fernández-Díaz et al., 2023; Moa & Linnea, 2020). These factors improve the quality of life and the efficiency of urban operations and services. Smart cities also ensure that the needs of present and future generations are met concerning environmental, social, and economic aspects (Caragliu & Del Bo, 2023; Hodson et al., 2023; Neirotti et al., 2014).

Many cities across the globe are facing significant challenges in transportation, sustainability, and governance due to increased urbanisation. This causes numerous cities to aspire or transition towards smart cities (Bastos et al., 2022; Kitchin, 2015; Klaus & Polsky, 2025). Cities from Singapore to Amsterdam have implemented IoT (Internet of Things) traffic sensors, environmental monitoring, smart grids for efficient energy management, e-governance services, and various other smart city technologies to enhance the quality of life for citizens and public administration (Kitchin, 2015; Klaus & Polsky, 2025).

Smart city projects have significant benefits such as service efficiency and environmental sustainability. Moreover, some of the positive impacts are enhanced public services, reduction in environmental impacts and optimisation of urban infrastructure to improve residents’ quality of life and economic productivity. However, smart city projects present challenges such as energy overconsumption, data privacy, and social exclusion issues (Hodson et al., 2023; Neirotti et al., 2014). According to Hollands (2015) and Hodson et al. (2023), smart city projects require careful management; otherwise, they can increase social problems such as digital divide, social exclusion of minorities, etc. These problems are seen throughout different socioeconomic groups due to varying digital literacy and limited accessibility to technology (Hodson et al., 2023; Hollands, 2015). Furthermore, Kitchin (2015) and Klaus and Polsky (2025) mentioned that some smart infrastructure projects have resulted in increased usage of energy, and in some cases, there have been serious data privacy concerns.

The Smart and Wise Turku project was initiated to transform the city of Turku into a smart city by focusing on data, sustainability, and social inclusivity of the city (SAWT, 2021). The project began in 2017 and concluded in 2021. Its scope included digitising public services through artificial intelligence (AI) and data analytics to improve the quality of life in the city. Social inclusion was one of the primary focuses of this project. The project aims to ensure that all citizens, especially vulnerable groups such as youth at risk of exclusion, receive equal access to city services. Beyond social inclusion, the project devised smart mobility solutions that improved transport efficiency and accessibility (SAWT, 2021). The public transportation system in Turku, known as Föli, now uses a contactless smart card reader, which makes commuting easier and helps Turku achieve its goal as a digital city. AI has also been adopted to improve parking management systems, making parking space usage more

efficient while decreasing traffic congestion in the city. These exciting innovations utilised real-time data, digital payments, and automation in public mobility services, allowing Turku to make significant strides in achieving its objectives as a smart city (SAWT, 2021).

Evaluating the effectiveness of the Smart and Wise Turku project in promoting digital accessibility, public awareness, and social inclusion is essential for assessing its contribution to broader urban development goals. These elements help make smart city initiatives welcoming and fair for everyone. This evaluation provides valuable insights into the barriers that might prevent residents from accessing smart services and identifies ways to enhance digital inclusivity. Furthermore, by evaluating project outcomes, we can steer future urban development towards a better alignment of technology with accessibility, sustainability, and social equity in smart city planning.

1.2 Problem Statement

Many see smart cities as a means to produce sustainability, inclusion, and urban efficiency. Recent studies reveal that smart cities face enormous socio-digital gaps, especially regarding digital accessibility and social inclusivity (Hartley, 2023; Hodson et al., 2023; Kolotouchkina et al., 2024). While these projects profess that they utilise technological advancements to enhance the living conditions of cities, it is still unclear if all societal groups are truly being served. The ‘Smart and Wise Turku’ project was to make Turku a world-leading smart city by 2021 using data and social sustainability. However, there is a lack of literature on how this program has improved digital accessibility and social inclusion across different demographics in Turku (Makkonen & Inkinen, 2024).

One major problem with smart city projects is that they tend to increase social inequities instead of solving them. Research has shown that digital advancements focus on users with higher levels of tech proficiency while ignoring those who do not possess digital skills or smart devices (Chen et al., 2022). This has been noted in cities like Toronto and Barcelona, where smart city projects were implemented but widened the access gap to digital services, with lower-income and senior citizens having difficulties using digital services (Lee et al., 2023). These concerns are also relevant for Turku’s smart city transformation because there are still concerns about the accessibility of such digital services to vulnerable groups such as the elderly, migrants, and persons with disabilities.

Moreover, the ‘Smart and Wise Turku’ project does not evaluate the level of public knowledge, interest, or engagement with smart city initiatives. Kolotouchkina et al. (2024) argue that digital silos will continue to exist because there is no adequate provision for digital literacy training or policies sensitive to the needs of the marginalized. In Turku, the new AI urban services, smart mobility, and e-governance features raise questions regarding their accessibility and usability by the entire population. If these technologies may worsen the existing digital divide, then surely these technologies were not designed with proper evaluation in mind.

Another critical gap exists between smart city policies and real-life user engagement. Studies have demonstrated that many smart city initiatives are carried out without background research into the citizens’ needs and expectations (Klaus & Pol-

sky, 2025; Makkonen & Inkinen, 2024; Moa & Linnea, 2020). There are technological solutions like Decidim smart, but many times they are usually poorly designed or ignored altogether (Chen et al., 2022).

In response to these challenges, this study seeks to evaluate the Smart and Wise Turku project with a specific focus on public awareness, digital accessibility, and social inclusiveness. It aims to assess the degree to which residents engage with smart services, identify barriers to equitable access, and offer informed recommendations for future urban development strategies.

1.3 Research Question

The ‘Smart and Wise Turku’ project was implemented to provide better digital public services, awareness, and social participation. The project brought in new digital technologies and services. However, the extent to which these digital implementations have been adopted and utilised by Turku residents remains unclear. Determining the awareness and usability of these technologies by the different socio-economic groups within the Turku population will highlight the progress of digital inclusion within the city. To explore these issues, this research focuses on the following research questions:

- **RQ1:** How does the ‘Smart and Wise Turku’ Project affect digital accessibility for different demographic groups within the city?
- **RQ2:** What is the level of public awareness about the ‘Smart and Wise Turku’ Project, and how does it influence engagement with the project’s digital initiatives?
- **RQ3:** In what ways does the ‘Smart and Wise Turku’ Project contribute to social inclusion, particularly through its digital initiatives?

This thesis seeks to answer these research questions by assessing the effectiveness of Turku’s smart city transformation in fostering inclusive digital engagement. The findings will assist in identifying barriers to digital participation, evaluating the inclusivity of technology adoption and providing strategic recommendations for designing socially responsive smart city frameworks. Ultimately, the research aims to contribute to the development of urban digital policies that ensure the benefits of digital transformation are equitably distributed across all residents, regardless of age, social background, or digital literacy.

2 The Evolution and Impact of Smart City Technologies

2.1 Definition and Components of Smart City Concepts

2.1.1 Defining Smart Cities

The smart city concept has evolved over the past few decades due to technological components such as digital technology, data analytics, and IoT. These technologies allow smart cities to maximise resources to improve public services and foster sustainability in economic, environmental, and social aspects (Gracias et al., 2023; Veloso et al., 2024). According to Bauer et al., smart cities are driven by digital technologies such as IoT, AI, big data analytics and ICT. These technologies are collectively able to gather and analyse large amounts of real-time data from various sources to monitor, manage and optimise urban services (Bauer et al., 2021).

Similarly, Neirotti et al. (2014) and Gracias et al. (2023) defined smart cities as urban systems that enhance efficiency, innovation, and inclusivity through the use of digital technologies. This definition shows that technology is a means to achieve the broader goal of smart cities, which is to create sustainable, efficient and inclusive environments. Furthermore, Makkonen and Inkinen (2024) pointed out that smart cities should be usable by all residents, including people with disabilities and people with limited digital literacy.

While Bauer et al. (2021), Neirotti et al. (2014), and Gracias et al. (2023) emphasise technological integration, Makkonen and Inkinen (2024) highlighted the importance of accessibility. This thesis, therefore, aligns with Makkonen and Inkinen (2024) definition as it evaluates how smart technologies serve diverse population groups.

2.1.2 Historical Perspective on the Evolution of Smart Cities

It is possible to divide the evolution of smart cities into three main phases: the Information and Communication Technology (ICT) focused phase, the IoT-driven phase and the AI-enabled phase. This was derived from recurring themes in smart city literature, reflecting how technology has shaped urban development. While the initial smart cities emphasised architecture and digital integration, recent approaches focus more on societal participation and equal digital service availability (Chen et al., 2022).

The ICT-Focused Phase (1990s-2000s): During this phase, smart cities used ICT to improve their public administration and service delivery. The primary goal of this phase was to achieve economic development as well as develop the technological infrastructure, with less attention to social inclusiveness or accessibility (Lee et al., 2023). Amsterdam and Barcelona were some of the first cities to integrate e-governance services in an attempt to increase openness and improve service provision (Neirotti et al., 2014). But, as with many early programs, the cities were more worried about making services cost-effective than helping vulnerable groups (Chen et al., 2022). While ICT facilitated the development of digital urban ecosys-

tems, most initial smart city initiatives were implemented by central governments and multinational firms that did not understand the local social context. Such undertakings often neglected the presence of economically marginalized groups and thus exacerbated the digital divide. This is noticeable in South Korea’s Songdo and the UAE’s Masdar City. Even though these cities are smart and technologically advanced, they have faced challenges with citizens feeling disengaged and lacking social and community activation (Calzada et al., 2023; Tavitian, 2022).

The IoT-Driven Phase (2000s–2010s): In the second phase, IoT came to prominence. IoT technologies enabled data collection in real time to better manage urban areas. IoT sensors help track air quality index, energy usage, and public transport system (Bauer et al., 2021). However, while these technological advancements resulted in enhanced service delivery, they also exacerbated the existing digital gap. Low-income people, the elderly, and people with disabilities face barriers to accessing IoT services because of infrastructure and digital literacy challenges (Chen et al., 2022). Cities like Portland and others have responded to this issue by rolling out digital equity initiatives like Smart city PDX and Free Geek to ensure everyone reaps such technologies’ benefits (Hodson et al., 2023). At this stage, the smart city concept evolved to emphasise the importance of active citizen participation in governance, moving beyond just technical automation. The 2010s introduced a new wave of smart cities, characterised by community planning, digital inclusion, and co-creation as essential pillars. Cities like Barcelona and Amsterdam led this movement by incorporating open data and participatory instruments. Most significantly, Amsterdam’s Initiative Data Commons granted people data rights, while in Barcelona’s Decidim, residents could determine policies to be debated and discuss them in forums (Calzada et al., 2023; Royall, 2021).

The AI-Enabled Phase (2010 to Present): Smart cities, with the advancement of AI, especially Machine Learning (ML), during this period, involve the use of automation and predictive analytics to increase urban efficiency. Traffic management, predictive policing, and automated city services are some areas where AI has been applied (Lee et al., 2023). On the other hand, recent studies show that some biases in AI algorithms are able to reinforce preexisting biases against minority groups (Chen et al., 2022; Hodson et al., 2023; Kolotouchkina et al., 2024). To mitigate these issues, cities like Seoul and Toronto have built ethical AI systems to ensure a thoughtful, inclusive, and ethically guided integration of AI into urban systems (Hodson et al., 2023). Cities are being designed with advanced technology alongside the ethical implications concerning its use. International accounts like the Cities’ Coalition for Digital Rights and UN-Habitat’s People-Centred Smart Cities Framework have advocated for the application of governance focused on inclusivity and digital rights protection. AI monitoring systems aimed at preventing discrimination and ensuring accountability have been adopted in Vienna, Barcelona, and Helsinki. In contrast, the Sidewalk Labs failed project in Toronto underscores the consequences of overlooking public trust, privacy, and the use of AI in urban design (Calzada et al., 2023; Veloso et al., 2024).

2.1.3 Key Technological Innovations in Smart Cities and their Role in Social Inclusion

The development of smart cities has led to the emergence of various technological innovations that aid in ensuring social inclusion through easier access to digitised information. These innovations aim to minimise socio-economic gaps, improve public participation, and provide equitable smart city services.

Universal Design and Digital Accessibility: Ensuring the accessibility of smart city technologies to every disabled, elderly, and low-income citizen is one of the greatest challenges in smart city development (Chen et al., 2022). Universal design concepts suggest the development of user-friendly digital interfaces for public services, multilingual support, and assistive technology in addition to speech recognition to cater to the differently abled. For example, the city of Helsinki has developed and implemented public service applications such as voice guidance to enable visually impaired residents to use various city services independently (Hodson et al., 2023). While Helsinki's use of voice guidance exemplifies good practice, its scalability and impact remain constrained by budgetary limitations and the speed of adoption across other sectors. Turku, with similar demographics and digital maturity, may face comparable barriers.

Citizen Engagement and Participatory Smart Cities: Traditional smart city projects had minimal input from the local people on how digital services should be designed and integrated. Current developments call for more attention to be given to bottom-up models of governance in which the residents themselves actively participate in and contribute to the smart city initiatives (Lee et al., 2023). One such known case is Amsterdam's smart city Engagement initiative, which allows residents to give feedback on urban projects via mobile applications and digital forums. Also, the Decidim platform in Barcelona allows people to participate in voting during the elections, among other services, providing residents with an active role in urban governance (Chen et al., 2022). These campaigns increase public knowledge and help build trust in digital governance and overall inclusiveness in smart cities.

Ethical AI and Fair Algorithmic Governance: In recent years, AI usage has been increasing, especially in urban areas. Hence, negative impacts such as bias, social injustice, and concerns about transparency and fairness are gaining prominence. Algorithmic bias comes with many risks, especially to marginalised groups. It could reinforce inequality in social structures if precise measures are not put in place (Chen et al., 2022). This is why some cities are adopting stricter ethical guidelines regarding AI. For example, the Fair AI Governance Framework used in Seoul deals with algorithmic transparency in public services. Also, Toronto employs AI Impact Assessments that incorporate bias evaluations in planning (Moa & Linnea, 2020). Trust, interoperability, and inclusivity must be built into smart cities such that, through proper urban regulation, services provided by AI systems are fair, transparent, and accountable.

2.1.4 Key Pillars of Inclusive Smart Cities

The transition to people-centered smart cities relies on four fundamental pillars: digital accessibility, participatory governance, social equity, and technological ethics (UNDP et al., 2024). These elements ensure that smart city projects prioritize inclusivity, address societal inequalities, and empower citizens in decision-making processes. Digital equity is particularly critical for smart cities. Initiatives such as free municipal Wi-Fi, affordable internet policies, and digital literacy programs are essential tools for rectifying the imbalance (UNDP et al., 2024). Stockholm and Seoul, for example, have been able to successfully roll out widely subsidized broadband to the economically disadvantaged (Royall, 2021).

There is a move towards co-governance models, meaning that citizens can participate in the urban decision-making process via online platforms, AI-assisted policy-making, and crowdsourcing of public policies (Tavitian, 2022). Madrid and Vienna have adopted citizen assemblies and participatory budgeting platforms that enable urban dwellers to make decisions affecting the planning of the city (Calzada et al., 2023). Smart city technologies must cater to people with different needs, including children, the disabled and the elderly. Laws on accessibility, universal design, and sensitive planning of gendered spaces are emerging as the defining features of contemporary smart cities (Tavitian, 2022). In Copenhagen, smart mobility measures are focused on pedestrians and the removal of barriers in public transport (Calzada et al., 2023).

The development and implementation of smart cities involving AI, big data, and predictive analytics also raises concerns of biased algorithms, breach of privacy, and surveillance (Almeida et al., 2024). To eliminate these issues, cities like Barcelona and Helsinki have already established AI ethics frameworks that guarantee transparency and responsibility for automated decision-making (Calzada et al., 2023). The shift from technology-focused strategies to a more people-oriented approach is crucial in the life cycle of smart cities. Initially, smart cities were only built with a focus on infrastructure, automation, and efficiency. Now, the focus is on inclusivity, governance participation, and even social equity. The ideal model of smart urban development is envisioned as technologically resilient, inclusive, and sustainably empowered. However, technology must not be a medium of exclusion. Cities that have adopted people-centric policies will propel the smart city movement towards a more socially fair and just urban environment.

2.2 Impact Assessment of Smart City Projects

Smart city initiatives in urban areas focus on enhancing digital accessibility, citizen education, and social incorporation. However, as much as technology offers an advantage in a city's planning and development, the availability of digital resources and skills continues to pose challenges. It has been shown, however, that a lack of attention to the so-called "smart" infrastructure in areas of concentrated disadvantage (deprivation) – often referred to as the digital divide helps those who are already digitally savvy more than those who are not (Kolotouchkina et al., 2024). For example, in Portland, the Smart City PDX initiative focused on black and disabled people's inequalities towards access and empowerment as a holistic equity-focused

strategy (Horrigan, 2019). Also, the SmartCityPHL road mapping in Philadelphia is one example wherein the city aims to empower underserved populations to design their programs driven by advanced digital literacy (Callahan & Siefer, 2021).

However, some smart city projects still face gaps concerning digital awareness. In the Amsterdam Smart City Initiative example, several IoT-based solutions were incorporated, but many residents were unaware of how to obtain and efficiently use the technologies (Leclercq & Rijshouwer, 2022). There is a need to promote awareness campaigns and educational initiatives as much as deploying smart technologies.

2.2.1 Digital Awareness: The Overlooked Pillar of Smart City Engagement

Digital awareness refers to an understanding a person has regarding digital technologies and proprietary tools related to the skills and knowledge for their responsible use. Furthermore, it entails the awareness of offered services within a particular system (Caragliu & Del Bo, 2023) or smart city systems (Buyannemekh et al., 2024). This stress on technical inclusiveness becomes meaningless without citizens being aware of such services. Thus, awareness becomes a necessary condition for both accessibility and social inclusion.

Consequently, a lack of information is especially problematic for governance that relies on participation from citizens. In Cueta and Turku, for example, citizens are encouraged to participate in programmatic governance. They are free to propose changes on the Decidim platform, but first, those people need to know that the platforms exist (Chen et al., 2022; Ferrer, 2017). Without tailored communication plans and broad-ranging campaigns, these platforms stand to cater only to tech-literate populations, thereby widening existing gaps in participation and deepening society's digital divide. Also, a lack of digital awareness directly correlates with a lack of digital literacy, which is yet another important factor for citizen participation in smart cities. The citizens need to first acknowledge the availability of the services and then know how to operate and utilize the services (Buyannemekh et al., 2024). This lack of awareness disproportionately impacts more vulnerable groups like migrants, elderly people, and the unemployed who face social isolation and a lack of confidence in digital resources (Shin et al., 2021).

2.2.2 Digital Accessibility: Bridging the Gap or Exacerbating Inequality?

Digital accessibility guarantees that every individual, regardless of any disabilities they might possess, can interact with, navigate, comprehend, and engage with digital content such as platforms and technologies. This is achieved through the appropriate design and development of the content (Kilic & Karakuş, 2021). Ensuring a digitally accessible environment remains a fundamental concern for smart city projects. Shin et al. (2021) highlights that exceptionally skilled citizens enjoy the more advanced smart city innovations, especially using 5G technology. However, low-income citizens, the elderly, and people with disabilities are left behind. For example, Seoul's public service infrastructure for the smart city is equipped with AI and integration of smart transportation. While these characteristics enhance the efficiency of the

area and the services offered, they increase the complexity of service interaction for non-digitally literate users (Chihuangji, 2023).

2.2.3 Social Inclusion: Are Smart Cities Truly Inclusive?

Social inclusion primarily aims to improve the identity-based disadvantages that some groups and individuals face regarding participation. This process focuses on enhancing the abilities, dignity, impact, and overall opportunities of persons or groups that are socially marginalized (Ivers, 2020). Along with ensuring access to the internet, digital smart city projects must provide evidence of their contribution towards social inclusivity. It is prudent to evaluate whether such projects enable all residents to participate or if they deepen the existing social divides. San Jose city's Smart City Vision initiated in 2016 is an example of integrating social equity alongside the built smart city infrastructure. The city allocates a portion of the income earned from 5G pole attachment fees to a Digital Inclusion Fund that supports internet access and information technology literacy projects for economically disadvantaged people in the community (Chihuangji, 2023). Also, Rotterdam participates in smart city programs through the people-based governance model, which allows citizens to use community-driven digital resources to interact with the city's smart policies and strategies (Leclercq & Rijshouwer, 2022).

Conversely, the failing Sidewalk Labs project in Toronto highlights concerns about the poor management of inequalities in a smart city project. This project was eventually terminated because of critical issues relating to the privacy of data, lack of appropriate public engagement, and the systematic neglect of marginalized social groups in decision-making (Kolotouchkina et al., 2024).

2.2.4 Implications for the Future of Socially Inclusive Smart Cities

The future of socially inclusive smart cities will depend solely on how digital technologies are embedded into the urban structure. Consequently, cities must focus on expanding programs that teach citizens how to use digital services irrespective of their social class. Research shows that smart cities that concentrate on literacy programs are able to engage the public and grant wider access to service needs (Bvuma, 2024; Isabella & Agustian, 2023). Additionally, enforcing ethical AI policies is equally important in reducing algorithmic discrimination that is biased towards socially marginalised groups. Consequently, cities like Toronto and Amsterdam have started implementing AI governance policies that increase transparency for more equitable urban services (Sanchez et al., 2023). Furthermore, affordability of smart infrastructure is supported through expansive subsidised internet and public Wi-Fi services, as well as IoT devices and applications to ensure the inclusion of poorer sections of society (Makkonen & Inkinen, 2024).

Cities should create policies that enable the participation of various stakeholders, which will improve inclusivity. Many smart city initiatives fail as they do not consider the so-called 'bottom-up' approaches (Royall, 2021). It is the responsibility of the city to create spaces for public engagement for smart city initiatives to work, especially for people who are subject to digital exclusion. In this context, the participatory smart city of Barcelona serves as an example of where digitised governance

for community engagement is achieved (O'Dell, 2021).

A significant body of research exists regarding technological innovations in smart cities; however, in comparison, the evaluation of social inclusion and the impact of the digital divide of these technologies, especially in smaller European cities, remains a gap (Bokhari & Seunghwan, 2024; Royall, 2021; Yigitcanlar et al., 2024; Zhao-Yerden et al., 2021). Most research focused on metropolitan agglomerations. Therefore, literature about smart technologies in mid-sized cities and their inclusivity for various socio-demographic groups is lacking. This gap is essential because mid-size cities have smart solution integration challenges and opportunities concerning demographic inclusivity and equitable access (Royall, 2021).

3 Digital Equity and Social Inclusion in Smart City

3.1 Principles and Practices of Digital Inclusion in Smart Cities

3.1.1 Principles of Digital Inclusion in Smart Cities

One vital component in formulating a smart city’s blueprint is digital inclusion. Even though smart cities use technology to improve governance, mobility, and public services, the digital gap continues to be challenging and often exacerbated by the existing social disparities (Caragliu & Del Bo, 2023). Therefore, it is essential to understand these principles and how they are applied in practice.

Accessibility and Universal Digital Connectivity: Digital inclusion guarantees that every citizen has access to digital services and infrastructure. Besides information and communication technology, digital access includes broadband connectivity, smart city applications, open data and even online government services. Studies highlight that cities with well-established digital infrastructures like Barcelona and Amsterdam have significantly improved digital participation (Caragliu & Del Bo, 2023; Ferrer, 2017; Lee et al., 2023). Nonetheless, gaps persist in digital accessibility within lower-income populations and underserved areas. A study covering 181 European metropolitan areas stated that smart city interventions tend to be economically efficient, but at the same time, they mitigate the existing disparity in access to the internet due to a lack of policy intervention in income-stratified positions (Caragliu & Del Bo, 2023). To close these gaps, local governments must formulate policies that tackle the infrastructure gap at the periphery by providing broadband services and subsidizing digital services to low-income users.

Digital Literacy and Citizen Empowerment: Smart city projects require residents to have complete access to digital tools and sufficient digital literacy. For instance, the public library has become one of the most critical institutions to teach digital literacy, by providing free internet access, skill development workshops and civic engagement opportunities (Zhang et al., 2021). Some libraries in Chattanooga and Chicago have spearheaded resident-focused digital literacy campaigns, ensuring that the seniors and other low-income constituents can access and use the digital portion of government services easily (Buyannemekh et al., 2024). Also, the Smart City PDX Initiative in Portland shows the importance of democratic approaches to digital literacy. The city has partnered with community-based organizations to offer training programs that enable residents to utilize smart city applications, use government services online, and participate in e-governance, thereby actively working to bridge the digital divide (Lee et al., 2023). These programs highlight the fact that there is a greater context beyond mere utilization of technology, especially in the context of urban governance.

Participatory Governance and Community Engagement: Digital inclusion also incorporates a focus on ensuring that smart city technologies are equitably accessible to all persons and especially to vulnerable groups. Often, as in the case

of many smart city initiatives, these projects have been implemented through a top-down lens where public agencies and private IT firms design and deploy digital services with little or no engagement with the target population. Contrariwise, evidence shows that smart city policies are more successful when based on participatory governance models (Colding et al., 2024). Take, for instance, the case of Barcelona, where the Decidim platform has reportedly allowed the city’s citizens to participate in the design of smart city projects through digital voting and open forums (Ferrer, 2017). Similarly, Portland has embraced a “people first” Smart City PDX initiative that aims towards community engagement as a precondition to digital inclusivity and data privacy (Lee et al., 2023). Those models prove that smart cities cannot and will not operate without including governance structures that regard digital inclusion.

3.1.2 Barriers to Digital Inclusion in Smart Cities

Barriers to digital inclusion in smart cities can be classified into three groups: socioeconomic inequalities, infrastructural limitations, and inadequate digital literacy programs.

Socioeconomic and Digital Divide: Digital participation in smart cities is fundamentally determined by economic status. According to Caragliu and Del Bo (2023), cities with high levels of urban smartness experience a high degree of digital inequality, meaning that advanced smart technologies are enjoyed to a more significant extent in richer urban neighbourhoods than in poorer ones. Moreover, it has been noted that digital exclusion disproportionately impacts certain demographic groups, particularly seniors, disabled persons, and those with limited language proficiency, who may struggle to operate complex digital devices (Colding et al., 2024). To eliminate these inequities, user-friendly platforms need to be developed along with adequate internet services and multilingual services.

Infrastructural Challenges in Digital Accessibility: Even though research indicates that Amsterdam, Seoul, and other cities are implementing open and integrated urban mobility and governance E-platforms, issues still exist in making this technology available to all socio-economic levels (Lee et al., 2023). Additionally, they note that many rural and peri-urban regions have low adoption levels of smart city features because of the existing broadband gap. To remedy this situation, the cities should invest in high-speed internet, 5G, and digital access points in these neglected areas.

Ethical Concerns and Data Governance: Ethical aspects of digital inclusion, such as privacy and surveillance, form another crucial dimension. Information and data collection are central components of smart cities. Ferrer (2017) argues that Barcelona has solved this issue by establishing strict ethical AI policies that would guarantee that smart city data is open to and used by residents. However, the absence of comprehensive anti-digital exploitation policies is an integral problem many cities face. The Smart City PDX initiative in Portland has attempted to address these concerns by embedding digital ethics into urban governance. This approach includes data anonymization policies, citizen control over personal data, and trans-

parency measures that allow residents to understand how smart city technologies impact their lives (Lee et al., 2023). These efforts emphasize that digital inclusion must go beyond access and literacy, encompassing rights-based approaches to data governance and privacy protection.

3.1.3 Strategies for Enhancing Digital Inclusion in Smart Cities

These strategies are designed to ensure that all citizens, regardless of their demographics, can participate in smart city initiatives. It is essential to tackle the connectivity challenge for economically disadvantaged groups. Zhao-Yerden et al. (2021) recommend expanding free public Wi-Fi networks at libraries and transit hubs. Moreover, cities should fund community-driven digital literacy initiatives through public libraries and community centers to help seniors and low-income residents acquire basic digital skills (Buyannemekh et al., 2024). Colding et al. (2024) stated that providing multilingual digital services, including voice and other assistive technologies, can aid in overcoming barriers for disabled people or those with limited proficiency in the language. There is also a need for decent and transparent data governance frameworks which protect the data privacy of citizens while allowing them to use smart city tools (Ferrer, 2017) actively.

Digital inclusion is a cornerstone of equitable smart city development, ensuring all residents can access, engage with, and benefit from digital urban services. While challenges such as socioeconomic inequality, infrastructural gaps, and ethical concerns remain, best practices from cities like Barcelona, Portland, and Seoul demonstrate that inclusive digital policies can enhance civic participation and urban innovation. As smart cities evolve, a commitment to digital equity will be essential in fostering sustainable, just, and technologically empowered urban communities.

Even with exhaustive principles, practices, and strategies aimed at improving digital inclusion, there still seems to be a gap in empirical studies evaluating the effectiveness of these strategies within mid-sized European smart cities. Most research attempts to analyse larger cities, including, but not limited to, Barcelona, Amsterdam, or even Seoul, while mid-sized cities such as Turku seem to be neglected (Caragliu & Del Bo, 2023; Colding et al., 2024).

3.2 Barriers to Digital Accessibility and Awareness in Smart Cities

3.2.1 Socio-Economic Inequalities and Digital Divide

The digital gap and lack of awareness remain crucial in ensuring that all stakeholders reap the rewards of a smart city. The most predominant obstacle for digital accessibility in smart cities is the digital divide which results from unequal access to technology and lack of digital literacy. The digital divide is not only limited to infrastructure but also includes economic, social, and even psychological factors which hinder the fair distribution of smart city services. Ziosi et al. (2024) divides the digital divide into structural, cognitive, and motivational dimensions, all of which stem from exclusionary practices. Structural inequalities result from a lack of finance and infrastructure. In contrast, cognitive inequalities stem from insufficient

digital skills and motivational factors that pertain to the willingness of the populace to use digital services (Ziosi et al., 2024).

Economic disparities refer to the difference between the rich and the poor through accumulated wealth and income. This disparity further aggravates the issues concerning the digital divide, mainly due to the lack of accessibility to these services in low-income urban areas. For example, financially constrained households do not have access to high-speed internet or smart devices such as personal computers, nor do they have the means to participate in digital literacy programs, thus excluding them from any smart city initiatives. Additionally, various areas in smart cities have also prioritized infrastructure development in high-income smart cities, which has left people from low-income communities under-connected and enormously underserved. Research shows that global adoption remains highly restricted due to economic poverty, particularly in low-income regions (Fernández-Díaz et al., 2023; Mora et al., 2017; Ziosi et al., 2024).

Apart from the citizens' financial restrictions, economic limitations at the municipal level as well play a main role in digital divide. As noted by Mutambik (2024), economic conditions like financial stability and operating capital are some of the most notable hindrances when it comes to effectively applying smart city technologies. The majority of cities are too bound by the need to invest in other critical social issues other than building digital infrastructure which leads to situation when people from different ethnic urban districts have unequal access to smart city services (Mutambik, 2024).

3.2.2 Digital Literacy and Public Awareness Gaps

The success of smart cities is contingent not only upon the advancement of technology, but also on how residents can access and utilize available digital services. Digital literacy is still considered a major obstacle when it comes to older individuals, low socioeconomic classes, and the disabled population. Ziosi et al. (2024) states that insufficient digital competencies serve as a hindrance to citizen engagement in smart city programs such as digital governance, intelligent systems of transportation, and e-health affairs. Even in the presence of the necessary infrastructure, the non-equipped segments of the population are unable to benefit from the smart city initiative.

According to Jnr and Petersen (2019) the success of smart city projects is in most cases not achieved because the general population does not know or understand how to utilize digital services. These smart cities tend to be focused on infrastructure and technology without regarding the need for comprehensive digital literacy training. This cause-and-effect relation fails to provide residents with the tools and skills needed to live in a digital environment. Jnr and Petersen (2019) argues that smart city development should be more inclusive by giving digital education and skill training as much weight as the technology itself.

Additionally, Fernández-Díaz et al. (2023) noted that there are significant gaps in the accessibility of digital services in smart cities, which render urban tourism less effective. Their modern tourism services accessibility study showed no city fully adhered to the Web Content Accessibility Guidelines Standards (WCAG). This further demonstrates the lack of digital inclusion on smart city platforms.

3.2.3 Technological and Infrastructural Limitations

Besides the economic and educational constraints, the lack of proper infrastructure severely hinders digital engagement in smart cities. Research by Mora et al. (2017) mentions that an exclusionary form of urban planning plagues smart city projects because the physical aspects necessary for accessing digital services are neglected. The author stated that many smart cities invest in robust ICT networks, but gaps in a user-friendly interface and an overall lack of accessibility make equal participation impossible.

The absence of appropriately designated and inclusive digital services is a significant infrastructural challenge. Numerous smart city integrated platforms and e-governance services are designed without considering accessibility, posing problems for people with disabilities to utilize such digital urban services. Fernández-Díaz et al. (2023) state that although digital access is one of the preconditions for building inclusive smart cities, it is an aspect of planning that is still emerging. Their research discovered that poorly designed websites, a lack of assistive technologies, and insufficiently designed user interfaces continue to constitute barriers to access in the urban digital platforms.

Mutambik (2024) further identified governance and legal barriers as obstacles to digital accessibility in smart cities. The author further stated that weak regulatory frameworks and a lack of enforcement mechanisms contribute to the persistence of digital exclusion. Without clear policies mandating digital accessibility, smart city initiatives risk widening social inequalities rather than addressing them.

Barriers to digital accessibility and awareness in smart cities stem from a combination of socio-economic, educational, and infrastructural challenges. Economic disparities limit access to digital infrastructure, digital literacy gaps prevent full citizen engagement, and technological shortcomings hinder inclusive urban development. Addressing these barriers requires a multi-faceted approach that integrates policy reforms, educational initiatives, and infrastructure improvements. As research suggests, the success of smart cities depends not only on technological advancements but also on the ability of all residents to participate in and benefit from digital urban services (Fernández-Díaz et al., 2023; Mora et al., 2017; Mutambik, 2024; Ziosi et al., 2024).

Much work has been done to identify barriers to digital outreach and awareness in smart cities. Still, little empirical work has been done on assessing those barriers' impact in mid-sized European metropolitan cities (Fernández-Díaz et al., 2023; Mutambik, 2024). Many of these studies focus on metropolitan areas or single factors like infrastructure or even digital literacy.

3.3 Strategies for Enhancing Social Inclusion

3.3.1 Digital Inclusion: Bridging the Digital Divide

The development of smart urban technologies has changed cities, providing new methods to improve operational, ecological and economic efficiency. This is evident, where Kitchin et al. (2018) cites social inequalities arising from implementations without a comprehensive focus. Policies that make social inclusion possible must

be developed to achieve equity in the design and development of smart cities. To ensure social inclusion in smart cities, access to information and communication technology (ICT) must be available to all residents (Calzada et al., 2023). Bridging the digital divide requires more than simply providing affordable internet access; individuals must also have the required digital skills to navigate online platforms. Programs like Chicago Connected that provide high-speed internet services to economically disadvantaged students have significantly improved educational outcomes and community participation (Neirotti et al., 2014).

Cities must also address issues affecting the most vulnerable groups, such as the elderly and the physically challenged. The application of user-friendly design principles and assistive devices can enhance the level of participation on digital platforms. The Smart Cities for All has established a Digital Inclusion Maturity Model to enable cities to evaluate and enhance their digital inclusion towards fostering inclusive city development (Mutambik, 2024).

3.3.2 Participatory Governance: Engaging Citizens in Decision-Making

Encouraging citizens to participate in governance processes actively is crucial for enhancing social inclusion (Colding et al., 2024). A critical example of participatory governance is participatory budgeting. This process allows citizens to directly decide how our public funds are allocated, making it collaborative. In the beautiful town of Cascais, Portugal, the local government invests more than 15% of its budget in projects based on the ideas and votes of the community. This initiative creates a sense of ownership and collaboration among residents. As a result, there has been increased civic engagement and a growing trust in public institutions (Velooso et al., 2024).

3.3.3 Equitable Access to Urban Services

Equitable access to urban services requires designing infrastructure and public spaces that serve all city dwellers regardless of social class or ability (Mutambik, 2024). According to Mutambik (2024), breaking down barriers in public transportation using universal design principles brings greater mobility and independence for people with physical challenges. Velooso et al. (2024) stated that a women, children and elderly friendly public space in Vienna is an example of inclusive design.

Smart city frameworks integrating affordable housing can reduce the marginalization of low-income residents. Policies that require a certain percentage of new constructions to be set aside as affordable housing tend to sustain socio-economic diversity in urban areas (Kitchin et al., 2018).

3.3.4 Collaborative Partnerships: Engaging Diverse Stakeholders

To foster inclusivity within smart cities, there is a need to integrate government agencies, the private sector, non-profit organizations, and community groups (Calzada et al., 2023). Public and private collaborations have the potential to bring forth resources and expertise needed to carry out social inclusion projects. An illustration is the Digital Inclusion Strategy designed in San Francisco, whereby local businesses

and community groups partner to deliver digital literacy and internet access training to low-income groups (Neirotti et al., 2014).

Involving local residents in the planning and execution of smart city projects, such as through community participation, helps to ensure that the undertakings are culturally appropriate and address the real needs of community members. Such organizations can also act as brokers in the communication network and are responsible for bridging the gap between policymakers and the disenfranchised (Colding et al., 2024).

3.3.5 Ethical Use of Data and Technology

The use of technology in smart cities should consider ethical issues, such as invasion of privacy and voyeurism (Kitchin et al., 2018). The citizens' trust can be won by implementing clear policies on data governance, which allow citizens to comprehend and control how their personal information is used (Ferrer, 2017). Barcelona's model of data sovereignty, which holds that data produced by citizens should be regarded as a collective resource, serves as a model of responsible data stewardship. Furthermore, the inability to change algorithms entrenched in smart city technologies can cause new forms of social discrimination that need to be resolved (Veloso et al., 2024). Services offered to the public can be analyzed using algorithms that, through repeated testing, can render unbiased and equitable services to all community members, irrespective of discrimination.

3.3.6 Continuous Monitoring and Evaluation

Developing methods for monitoring and evaluating smart city projects is crucial for determining the effects on social inclusion (Mutambik, 2024). Assessing indicators like digital literacy, access to public spaces, and civic participation can reflect the effectiveness of implemented strategies. The set of measures provided by Social Inclusion Indicators can help assess the level of inclusivity of smart city initiatives (Calzada et al., 2023). Feedback incorporated into the design can help inform residents' experience, making it possible to integrate what users want into iterative change policies and programs, which is necessary for responsiveness to community needs.

Slightly smaller cities in Europe, especially smart cities, seem to be missing out on the gaping research void when evaluating the effectiveness of their sociocultural inclusion strategies and their optimization. This comes even after numerous attempts to emblemize smaller urban agglomerations like Barcelona, Amsterdam, or even San Francisco wherein the socialistic implementations have been noted (Colding et al., 2024; Ferrer, 2017; Mutambik, 2024). Ironically, the scientific literature regarding social outcome inclusiveness at the infrastructural level in mid-sized cities continues evolving. Also, the lack of empirical evidence poses significant difficulties for in-depth evaluations of integrated smart city initiatives and projects, such as the one launched in Turku, called Smart and Wise Turku. Consequently, my research tries to answer how Turku's smart city policies are aligned with the objectives of enhancing social inclusivity and equity for different demographic profiles.

4 The Case Study: Smart and Wise Turku

4.1 Project Background and Objectives

4.1.1 Introduction to Turku

Founded in the 13th century, Turku is one of the oldest cities in Finland and holds importance in history as the first capital of the country. It is situated in Southwest Finland. Turku is known for its rich cultural and historic heritage, cultural and educational institutions, and involvement in sustainable urban development. It is a central cultural and economic hub in the region. Considering Turku's demographics, governance, urban proactive practices, and forward-looking approaches towards sustainability, digitization, system integration, and smart governance, the city offers a unique context for smart city research (Turku, 2020).

4.1.2 Smart and Wise Turku Initiative

The Smart and Wise Turku (SAWT) project commenced in September 2017 and continued until 2021. This project attempts to fuse together Turku's aspirations of reaching carbon neutrality with a holistic smart city framework. Other specific goals include climate and urbanization-resilient public services structure digitalization, augmenting residents' e-literacy skills, and fostering active social participation by promoting digital inclusion (SAWT, 2021). Public government, University of Turku, Turku University of Applied Sciences, local businesses, and community institutions were all involved in the SAWT project. This comprehensive model was used to enable digital solution acceptance, foster innovation adoption, and maximize system benefits (SAWT, 2021).

4.1.3 Core Objectives

There are three main objectives for the SAWT initiative (SAWT, 2021).

- The first objective is about enhancing digital public services and accessibility by implementing inclusive digital infrastructure.
- The second objective is about increasing public awareness by informing the general public about the available digital services and their benefits.
- The third objective is about promoting social inclusion by actively including vulnerable groups such as the elderly, youth, migrants, and individuals with disabilities through targeted digital and social initiatives.

4.2 Study Area Description

Turku, located in the southwest region of Finland, is the study area for this thesis. Turku has significant historical importance and continues to be a major cultural and economic hub in the region. The city is strategically positioned at the mouth of the Aura River, making it a vital maritime gateway that connects Finland to other

parts of Scandinavia and the Baltic Sea (Turku, 2020).

Geographical Context: Turku’s geography, characterized by its archipelago and riverine landscape, heavily influences its urban development and infrastructure. The city’s layout facilitates both maritime and land-based transportation, which are crucial for its trade and local economy. This geographic advantage also positions Turku as a key player in regional logistics and tourism, impacting its urban development strategies (Turku, 2020).

Demographic Context: With a population of approximately 200,000, Turku is the third-largest city in Finland by population. The city boasts a diverse demographic profile with a significant proportion of young adults and students, thanks to its status as an educational center with several institutions of higher learning, including the University of Turku and Åbo Akademi University. This youthful demography is crucial in the city’s strategy to adopt new technologies and innovations (Finland, 2025).

Economic Context: Economically, Turku is a mixed economy with strong sectors in shipbuilding, high-tech industries (particularly information technology and biotechnology), and services. The presence of major shipyards like Meyer Turku, as well as numerous tech startups and established IT firms, highlights the city’s industrial diversity and capacity for technological innovation.

Technological Context: Technologically, Turku is at the forefront of adopting smart city solutions. This includes developments in digital infrastructure, public service digitization, and sustainable urban planning. The ‘Smart and Wise Turku’ project itself reflects the city’s commitment to leveraging technology to enhance urban life. The city’s approach integrates digital technologies across various services and administration, aiming to improve efficiency, reduce environmental impact, and enhance the quality of life for its residents (SAWT, 2021).

These geographical, demographic, economic, and technological factors combine to provide a unique setting for the ‘Smart and Wise Turku’ project. Understanding these contexts is essential for appreciating how and why certain digital solutions were implemented and how they align with the city’s broader urban development goals. This backdrop not only shapes the project’s implementation but also influences how it is received and integrated by the community, thereby playing a critical role in the evaluation of its outcomes in terms of digital accessibility, public awareness, and social inclusion.

4.3 Implementation of Digital Technologies and Services

4.3.1 Technological Solutions

The SAWT initiative was an example of the diverse application of technology designed to improve urban movement as well as the consumption of resources on many levels. One such example was the Föli public transportation smart card system, which allowed users to purchase tickets digitally, plan their trips, and pay for them

remotely in real time. These features, along with many others, made public transport easier to access, thus improving user convenience by overcoming payment and awareness of service-related barriers.

Turku also implemented new AI-powered parking management systems. These systems enabled the management of data and payments, or digital payments, and automatic parking control in real time. The use of various sensors and intelligence by the city made it possible to improve the availability of parking, which lowered congestion, improved the flow of traffic, and improved the use of urban space (SAWT, 2021).

4.3.2 Digital Public Services

Turku was also an early adopter of e-governance systems, thus improving the scope of municipal transparency and citizen participation. Citizens could use “Decidim Turku”, a next-generation online participatory governance system, to interact with local government, advance their proposals, and actively participate in local decision-making. The system enhanced transparency and civic participation, thus making urban governance responsive to the citizenry.

Throughout the COVID-19 pandemic, Turku embraced the opportunity to roll out new digital public services, utilising AI-powered chatbots and multilingual systems. These innovative services made a meaningful impact by providing accurate and well-contextualised information in 100 languages. This helped maintain public safety and health and played a vital role in bridging information gaps for many marginalized and isolated groups, ensuring that the services were culturally, linguistically, and geographically tailored to meet their needs (SAWT, 2021).

4.3.3 Approaches to Digital Accessibility and Inclusion

To achieve complete digital inclusivity, Turku acted quickly by rolling out different initiatives. Economically disadvantaged communities were provided with subsidized broadband. Elderly migrants and people who are not technology literate were targeted through regular digital literacy workshops and specialized training sessions. Using online forums and the Decidim Turku platform allowed residents to voice their concerns and solutions for policy developments with advanced participatory design frameworks. Regular campaigns and media engagement were supplemented with public surveys to assess perceived effectiveness and maintain sustained engagement. These initiatives captivated citizens and garnered their confidence in digital initiatives. These initiatives served to improve community cohesion and reinforce attempts to bridge the existing digital divide (SAWT, 2021).

4.4 Outcomes, Challenges, and Link to Research Questions

4.4.1 Initial Outcomes and Feedback

The SAWT initiative’s first evaluations indicated marked improvements in public service productivity and a notable increase in resident satisfaction. The efficiency of the Föli public transport system and AI-powered parking solutions helped save

commuters' time. It provided easier access to urban services, which enhanced convenience at a broader scale. While the overall opinion of users was positive, many cited ease of use, reliability, and improved service quality as primary benefits. Also, citizens' participation in local governance decisions through digital tools such as "Decidim Turku" improved municipal transparency and trust in the government, empowering residents even further (SAWT, 2021).

4.4.2 Identified Challenges

The SAWT initiative had considerable pieces of evidence supporting its success, but there were also challenges encountered during its execution. The existence of different demographic groups poses a challenge in digital literacy, more so for elderly residents and some marginalized groups, presenting a noticeable challenge (CGI, 2022). There are sometimes temporary service interferences due to issues with integrating certain technologies, limiting the overall effectiveness of various services. Additionally, engaging with vulnerable populations, including migrants and low-income groups, on an ongoing basis proved difficult, illustrating the need for sustained proactive inclusion approaches (SAWT, 2021).

4.4.3 Connection to Research Questions

The Smart and Wise Turku initiative provides clear insights aligned with the thesis research questions:

- **RQ1 (Digital Accessibility):** Through analyzing digital infrastructures such as Föli and AI-driven parking, the project explicitly identifies successful enhancements and ongoing demographic barriers to accessibility.
- **RQ2 (Public Awareness):** Extensive awareness campaigns and participatory digital platforms emphasise the significance of targeted public information strategies and how increased awareness correlates positively with greater citizen engagement.
- **RQ3 (Social Inclusion):** Focused digital inclusion efforts and programs for vulnerable groups offer practical examples and evidence of strategies that effectively address social exclusion. The insights gained from Turku's initiative highlight notable successes and critical improvement areas, especially in fully engaging marginalized communities.

4.5 Rationale for Case Study Selection

The 'Smart and Wise Turku' project was selected as a case study for this research due to its comprehensive approach to integrating digital solutions into urban development with a strong focus on sustainability and inclusivity. This project represents a significant effort by a mid-sized European city to transition into a smart city, making it an ideal candidate for studying the practical impacts of such initiatives on urban populations. Several factors contributed to selecting this case study:

Relevance: The project's goals align closely with the contemporary challenges and objectives of urban development globally, particularly in terms of integrating digital technology to enhance city living.

Data Availability: The project was well-documented, with accessible data on project outcomes, initiatives, and community feedback, providing a rich base for empirical analysis.

Timeliness: Having been initiated in 2017 and concluded in 2021, the 'Smart and Wise Turku' project's recent completion means that the data and outcomes are current and reflect modern technological and social dynamics.

Geographic Specificity: Turku offers a unique context as a Nordic city with specific social, economic, and cultural characteristics, providing insights that can contribute to the broader discourse on smart cities in similar and diverse locales.

Impact Assessment Opportunity: The project's wide range of initiatives, from AI-driven public services to enhanced digital infrastructure, offers a varied field for evaluating the multidimensional impacts of smart city projects on different facets of urban life, particularly in terms of digital accessibility and social inclusion.

These factors make the 'Smart and Wise Turku' project a fitting subject for a detailed study on the effectiveness and societal impacts of smart city initiatives, providing valuable lessons and insights that can be generalised to similar urban development projects worldwide.

5 Methodology

5.1 Research Design

The research onion provides multiple layers, each focusing on different depths of qualitative data integration (Saunders et al., 2023). This also makes it suitable for cross-disciplinary studies in the social sciences and humanities. The framework created by Saunders et al. (2023) is a model that offers quantitative approaches to constructive systematic inquiry. The research onion was adopted because it provides a well-structured methodology for the in-depth quantitative evaluation of the effects of urban development projects such as 'Smart and Wise Turku'.

5.1.1 Research Philosophy

Research philosophy is a set of beliefs that guide the methodology of a study and can be categorized into four main types (Jansen, 2023). Firstly, Positivism focuses on measurable, observable data analyzed statistically through surveys (Jansen, 2023). Realism shares similarities with Positivism but recognizes an independent reality that may influence the results (Newman, 2024). Interpretivism talks about understanding human behavior, especially emphasizing personal insight, and typically aligns with qualitative research methods. Lastly, Pragmatism is flexible, advocating for the use of any methods, qualitative or quantitative, that effectively address the research questions (Saunders et al., 2023).

This research adopts positivism as the research philosophy. This approach aligns with the case where the intention is to collect data to analyze statistically and try to find some patterns, trends, or relationships among particular variables. The decision to adopt a quantitative, positivist stance was informed by foundational literature in urban studies and technology adoption, for example, the research by Neirotti et al. (2014), which analyzed digital technology's influence on urban life.

5.1.2 Research Approach

There are two broad classifications of research approach: the deductive approach and the inductive approach (Woiceshyn & Daellenbach, 2018). A deductive approach is a reasoning approach that usually begins with general theories or hypotheses (Newman, 2024). Then, it attempts to test the theories through empirical data collection and analysis. This approach is associated with positivism and quantitative research because it seeks to confirm or disprove existing hypotheses. An inductive approach starts with specific observations and moves to broader generalizations (Woiceshyn & Daellenbach, 2018). The inductive research approach is mainly used in qualitative research. This thesis follows a deductive approach driven by specific questions concerning the 'Smart and Wise Turku' project's impact on digital accessibility, social inclusion, and public awareness. The works of Drost (2011) utilizes the same research approach as well. The research aims to prove the assumptions by analyzing the survey data collected from residents of Turku, which has already been postulated in the theories and prior studies.

5.1.3 Research Strategy

The research strategy outlines the broad approach to address the research problems. There are various research strategies, such as secondary research, case study analysis, mixed methods, qualitative approaches, and experimental designs. This research adopts the primary research strategy that utilizes surveys, which is appropriate for quantitative research (McCombes, 2025). Surveys make it possible to obtain considerable amounts of standardized information from a wide segment of the population (McCombes, 2025). This makes it possible to conduct statistical analysis aimed at discovering certain patterns, relationships and even trends among different sets of people in the population. This method was chosen because it addresses the needs of many Turku residents and engages with them to gauge their experiences related to digital accessibility, public awareness, and social inclusion regarding the 'Smart and Wise Turku' project. For studies that intend to make generalisations about a larger population, surveys are the best option because they offer data that is measurable and can be compared (McCombes, 2025). Eilola (2021) conducted a survey-based study on resident feedback and digital accessibility challenges in urban planning initiatives.

5.1.4 Research Choice

The research choice can be mono-method, multi-method, or mixed-method (Jansen, 2021). A mono-method refers to a technique where a single type of data, either qualitative or quantitative, is gathered and analyzed using one technique. Multi-method is an approach that employs more than one technique of the same paradigm, such as multiple forms of qualitative methods. In contrast, a mixed-method approach uses qualitative and quantitative methods in one study to offer a more comprehensive insight (Jansen, 2021). For this thesis, the approach chosen was a mono-method with quantitative analysis. Descriptive statistical analysis was conducted using solely survey data from structured questionnaires. A mono-method results in a concentrated systematic analysis, which is important given the nature of this study (Ojebode et al., 2018).

5.1.5 Time Horizon

The time horizon is defined as a period during which the data is collected and analyzed (Wang & Cheng, 2020). Usually, researchers decide between conducting a cross-sectional or a longitudinal study (Kesmodel, 2018). Cross-sectional studies are carried out by data collection at a specific point in time, providing a snapshot of a phenomenon (Thomas, 2020). Longitudinal studies are focused on data collection over an extended period to identify changes and developments (Wang & Cheng, 2020). For this thesis, a cross-sectional time horizon was selected. Data were collected from residents of Turku during a specific period, from mid-February to the end of March. This was done because the project factors could be measured without long-term tracking. Cross-sectional design has proved helpful in quantitative studies focused on identifying relationships and trends within a specific timeframe, as highlighted by Kesmodel (2018).

5.2 Data Collection and Analysis

5.2.1 Method of Data Collection

The data collection method describes how the primary data were collected to answer the research questions (Regmi et al., 2017). In this research, data were collected via an online survey from the residents of Turku. The survey was created using Webropol, an online survey tool that is easy to operate, distribute surveys, and safely collect information. The questionnaire primarily comprises Likert scale items, complemented by demographic questions classifying respondents by age, gender, education, and employment. These questions were used to gauge public perceptions of the project factors. The survey link was shared multiple ways, including community email lists, QR codes, and through interactions with residents at local cafés. Also, some copies of the survey were printed to aid people who do not have access to digital tools. The survey questions can be found in Appendix A. Various journals widely use this method of data collection, like the works of Salmons (2024) and Wu et al. (2022).

5.2.2 Sample and Sampling

The sampling technique is defined as how participants were gathered to ensure the data collected was a true reflection of the target population of interest (Howell et al., 2020). A stratified random sampling technique was employed to capture all demographic groups, including age, gender, education, and employment level. The population was divided into strata based on these characteristics, and participants from each group were selected to reduce sampling bias and improve the representativeness of the findings. The initial decision was to collect roughly 1,000 responses to guarantee adequate statistical power; however, 348 responses were received. While this figure falls short of the original goal, it nonetheless meets the analysis benchmark set by other studies of this scope (El Barachi et al., 2022; Shin et al., 2021).

5.2.3 Target Population

The target population for this study includes all individuals aged 18 years and older residing in Turku, Finland. This age range is considered appropriate within the context of this study, as participants would have legally attained adulthood, can provide informed consent, and are likely familiar with the ‘Smart and Wise Turku’ project initiatives. To clarify eligibility, specific inclusion and exclusion criteria were set as shown in the table below.

Table 1. Inclusion and Exclusion criteria

Criteria	Details
Inclusion Criteria	<ul style="list-style-type: none">- Residents of Turku- Aged 18 years and above- Capable of providing informed consent
Exclusion Criteria	<ul style="list-style-type: none">- Non-residents of Turku- Individuals under the age of 18- Individuals unable to provide informed consent

As described, identifying a clear target population and using strict inclusion and exclusion criteria enhances the validity and representativeness of the sample in relation to the target population's overall experience with smart city initiatives.

5.2.4 Data Analysis Techniques

This study employed several quantitative techniques, including descriptive statistics, correlation analysis, and regression analysis, aligning with the research questions and considerations for the data collected from the residents of Turku through the open survey. Similar methodologies have been utilized in prior research; for instance, the study by Singh integrated descriptive statistics and regression analysis to explore the dynamics between smart cities and urbanization patterns in the United States (Singh, 2024). Additionally, Jnr and Petersen (2019) conducted a descriptive analysis of smart city dimensions to assess sustainable living improvements.

The quantitative data collected was analyzed through the following steps.

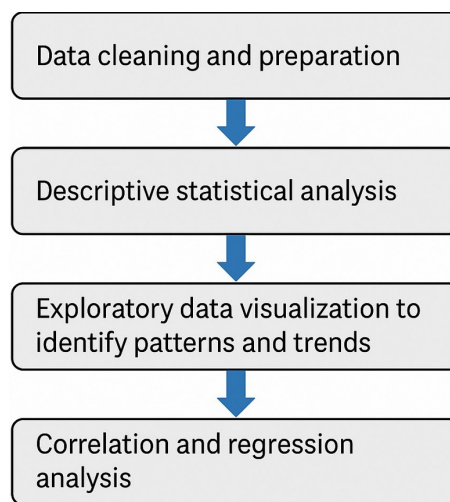


Figure 1. Steps used in Data Analysis

MS Excel was used in organizing and cleaning the survey data. Afterwards, SPSS (Social Package for the Social Sciences) was utilized for statistical analysis. SPSS has established credibility in the social science domain and can perform intricate analyses without programming expertise. According to Aljandali (2016), SPSS is one of the most utilized data analysis tools, thanks to its straightforward design and advanced statistical functions, which were helpful for this study.

Types of Analysis Conducted

Descriptive Statistics gives a broader overview of the characteristics and range of the data. It highlights the underlying patterns and trends (Hartley, 2023). It includes computation of the average value, median, mode and standard deviation (Wirtz et al., 2021). Nam and Pardo (2011) used the same approach in their study, analyzing citizen engagement in smart cities. This thesis aims to find general trends in

respondents’ profiles. Therefore, descriptive statistics were appropriate to facilitate an orderly presentation of the data.

Correlation analysis examines the strength and type of relationship between two variables (Rodríguez Bolívar et al., 2023). Research on smart city initiatives in Korea by Sasaki et al. (2021) applied correlation analysis to study the technological and sociological variables influencing satisfaction of citizens and their satisfaction (Sasaki et al., 2021). Similarly, a correlation analysis was conducted to discover the patterns from different variables relating to the “Smart and Wise Turku” project. In this case, Pearson’s correlation was more effective than Spearman or Kendall, given that the former is better suited to understanding linear relationships between continuous variables such as those in this study’s survey.

Regression analysis facilitates forecasting and rationalising the impact that independent variables have on a dependent variable (Bastos et al., 2022). Consequently, multiple linear regression was conducted primarily to evaluate the effects of public awareness, digital literacy, and other demographic characteristics on the outcomes of digital accessibility and social inclusion. The regression analysis was performed by giving special attention to R-squared (R^2) and Adjusted R-squared to assess what proportion of the variance in the dependent variable was explained by the independent variables. Additionally, an ANOVA test was performed to evaluate the overall significance of the regression models. Similar research projects such as Shin et al. (2021) and Nam and Pardo (2011) applied regression models to study smart city policies or initiatives. Hence, this study uses multiple linear regression to ascertain the factors contributing to the success of digital endeavors in Turku and to ensure statistical rigor in the analysis of the survey data (Rahman & Muktadir, 2021). The whole data analysis process in SPSS involves the following steps as showing the figure.

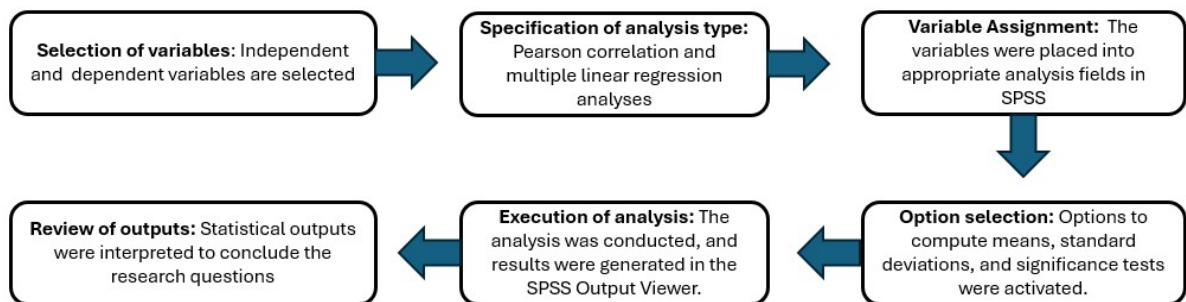


Figure 2. Data analysis process in SPSS

5.3 Conceptual Framework

A conceptual framework was created to depict the structured relationship between the independent and dependent variables (See Figure 3).

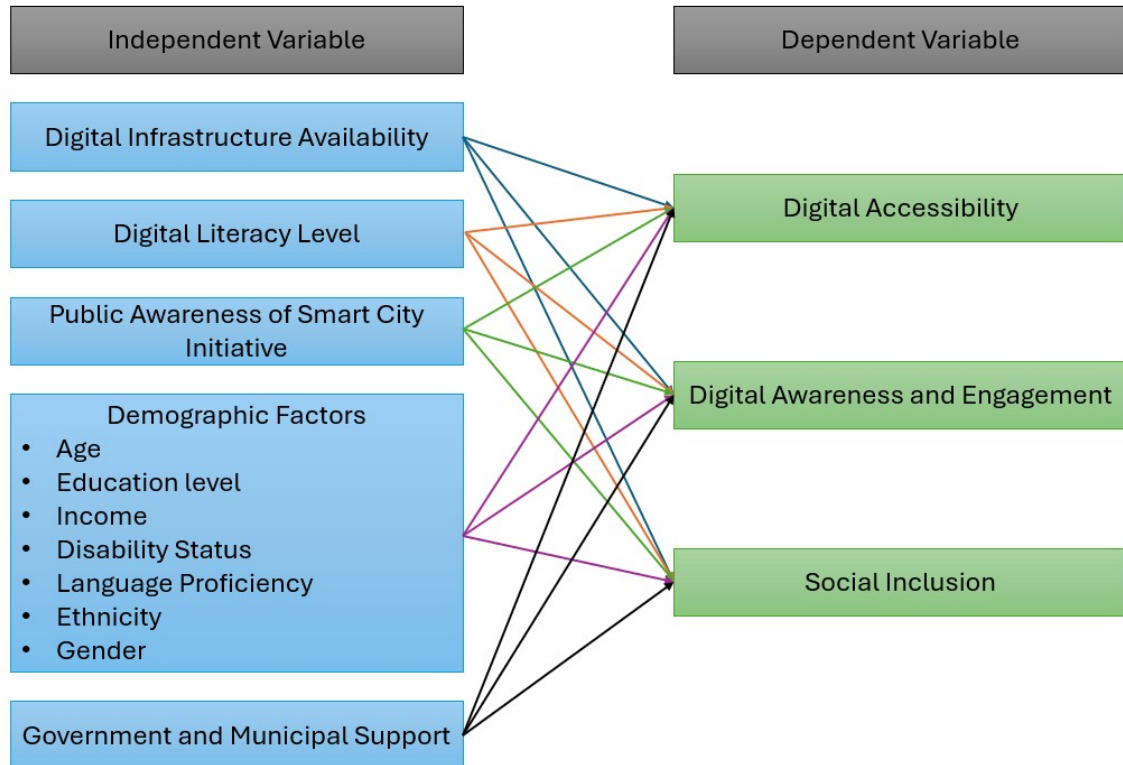


Figure 3. Conceptual framework and variable category relations

5.4 Limitation of Data

Although this study was carefully designed and executed, the possibility of response bias in surveys could be present because participants, especially when it comes to sensitive issues like social inclusion or the digital divide, may provide more socially acceptable answers than their true feelings. Furthermore, using self-reported data may have resulted in some participants interpreting the questions differently or possessing different levels of digital competence within the bounds of the questions asked. Also, the study's focus was geographically limited to the city of Turku, which renders the findings specific but not generalizable.

While Turku serves as a significant case study for mid-sized European smart cities, its interactions with other metropolitan or rural areas and regions outside Finland with different socio-economic contexts may be underrepresented. Including additional cities or regions in future studies could improve the comparative context and broaden the scope. Considerations of the project's scope also pose other limitations.

The study emphasized the digital infrastructure and the public's level of awareness and support from the local government, without considering other possible factors, such as political engagement, community networks, or broader economic conditions, that might influence perceptions of social inclusion and digital accessibility. Despite efforts to include a broad participant base, data availability issues arose due to the study's self-reported nature. Some groups, such as non-native speakers, the elderly, and more socially disadvantaged groups, may have been un-

derserved even when the surveys had multilingual options. This has implications for the sample’s representativeness and the derived conclusions.

5.5 Validity and Reliability of Data

Validity and reliability has a clear impact on credibility and the overall trust of the research findings (Drost, 2011). Validity is an estimate of how accurately a study will measure what it is purported to measure (Estremera & Sarmiento, 2024). To achieve greater validity, the survey questions were constructed following a detailed analysis of existing literature about smart cities and digital accessibility to ensure that all relevant dimensions, such as public awareness, digital accessibility, and social inclusion, were covered. While designing the questionnaire, routine consultations with my supervisor were made to ensure the questions were clear, relevant, and goal-oriented to achieve the study’s objectives. Moreover, a pilot survey was conducted using a subset of Turku residents to resolve ambiguity and misinterpretation issues, thus strengthening the instrument’s validity (Drost, 2011).

Table 2. Reliability Statistics

Construct	Cronbach’s Alpha	Number of Items	Interpretation
Digital Infrastructure Availability	.747	3	Acceptable reliability; items are reasonably consistent in measuring digital infrastructure quality and availability.
Digital Literacy Levels	.792	5	Good reliability; consistently captures digital literacy levels as intended.
Public Awareness of Smart City Initiatives	.779	5	Good reliability; effectively measures public awareness of smart city initiatives.
City & Municipal Support	.738	5	Acceptable reliability; consistent measure of perceived support from city and municipal authorities.
Digital Accessibility	.691	5	Moderate reliability; generally measures digital accessibility but could benefit from refinement.
Digital Awareness and Engagement	.688	5	Moderate reliability; enhancements in item selection or phrasing might improve consistency.
Social Inclusion	.744	5	Acceptable reliability; items are suitably consistent in measuring social inclusion facilitated by digital technologies.

Reliability refers to the measurement’s repeatability and dependability over time. In this research, internal consistency reliability was determined through Cronbach’s alpha for critical perceptions of digital accessibility, public awareness accessibility, and all other perceptions of multi-item constructs (Edelsbrunner et al., 2025). An acceptable value of Cronbach’s alpha was set at 0.70, which meant that the scale items

had a reasonably good reliability and values between 0.60 and 0.70 are considered to be acceptable for exploratory research. This technique helps prevent the problem of construct validity within a research framework relying on a survey (Sigudla & Maritz, 2023). Standardised procedures for data collection and consistent administration of the survey to all respondents also aided in reliability throughout the research. An overview of the reliability statistics for each construct can be seen in the table below.

Each scale's reliability indicates a decent level of internal consistency, with most scales showing good to acceptable reliability scores. These results affirm that the survey instruments used are adequately reliable for conducting this research. However, for scales with lower reliability scores, such as Digital Accessibility and Digital Awareness and Engagement, further investigation into item effectiveness and potential revisions could be warranted to ensure a more robust measurement of these constructs.

5.6 Ethical Consideration

This work addressed all ethical issues, rights, privacy, and welfare of the participants. Participation in the survey was entirely voluntary. Participants were informed beforehand about the study's purpose, how their involvement would proceed, and their option to withdraw at any time without repercussions. Afterwards, participants completed the questionnaire after they gave their consent. The research was designed for participants 18 years and above, who autonomously consented, ensuring ethical considerations were duly met.

Not collecting personally identifiable information ensured anonymity and confidentiality, and all survey responses were kept confidential and used solely for academic purposes. The data was processed in compliance with data protection laws such as the supplementary Finnish implementation of GDPR, which maintained the confidentiality and security of participants' information. Additionally, the survey was offered in Finnish, Swedish, and English to cater to Turku's multicultural population, allowing equitable and inclusive engagement.

Before gathering data, the design and the ethical treatment of the participants and the data handling procedures were aligned with the ethics policies set by academic institutions. Without the focus on ethical considerations, the integrity of the research and the dignity and rights of the participants in the study would be at risk. Therefore, the study emphasized these issues (Okorie et al., 2024).

6 Results and Findings

6.1 Demographic Profile of Respondents

All responses from the sample population resulted in 348 complete records, with no missing values. The sample was also fairly balanced across age groups, with the three most significant segments being respondents aged 18 to 24 years (66, 19%), 25 to 34 years (61, 17.5%), and 35 to 44 years (61, 17.5%) (see Figure 4). Regarding gender, the sample contained 206 males (59.2%), 124 females (35.6%), 6 non-binary participants (1.7%), and 12 respondents (3.4%) who did not respond to this question (see Figure 4).

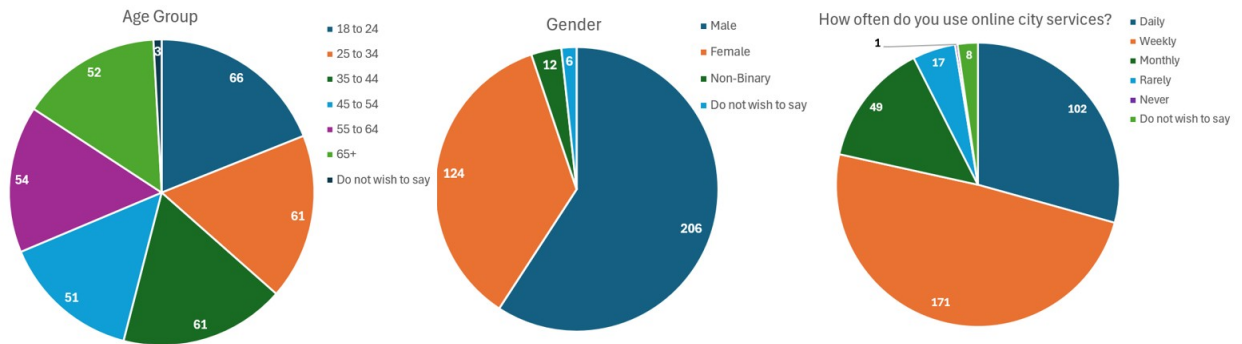


Figure 4. Age Group, Gender, How often do you use online city services?

Regarding nationality, the majority of respondents were Finnish (234, 67.2%), with 83 identifying as Swedish (23.9%) and 26 identifying as ‘Other’ nationalities (7.5%), while 5 respondents (1.4%). The share of respondents whose primary language spoken at home was Finnish totaled 211 (60.6%), followed by 96 who spoke Swedish (27.6%), and 15 who spoke English (4.3%); additionally, 20 respondents (5.7%) reported other languages, and 6 (1.7%) chose not to disclose (see Figure 5). The sample showed relatively high levels of educational attainment: 201 respondents (57.8%) reported holding a bachelor’s degree, and 85 (24.4%) reported having a master’s degree or higher. Other educational levels included secondary education (25, 7.2%), vocational training (24, 6.9%), primary education ($n = 4$, 1.1%), and no formal education (2, 0.6%) (see Figure 5).

Employment status varied, with 100 respondents (28.7%) employed full or part-time, 97 self-employed (27.9%), 83 retired (23.9%), and 46 students (13.2%). Additionally, 15 respondents (4.3%) were unemployed, 3 identified as “other” (0.9%), and 4 (1.1%) did not wish to disclose their employment status (see Figure 5). The participants’ usage of online city services was also assessed: 171 respondents (49.1%) reported using digital city services on a weekly basis, while 102 respondents (29.3%) used them daily. This indicates high participation with municipal online services.

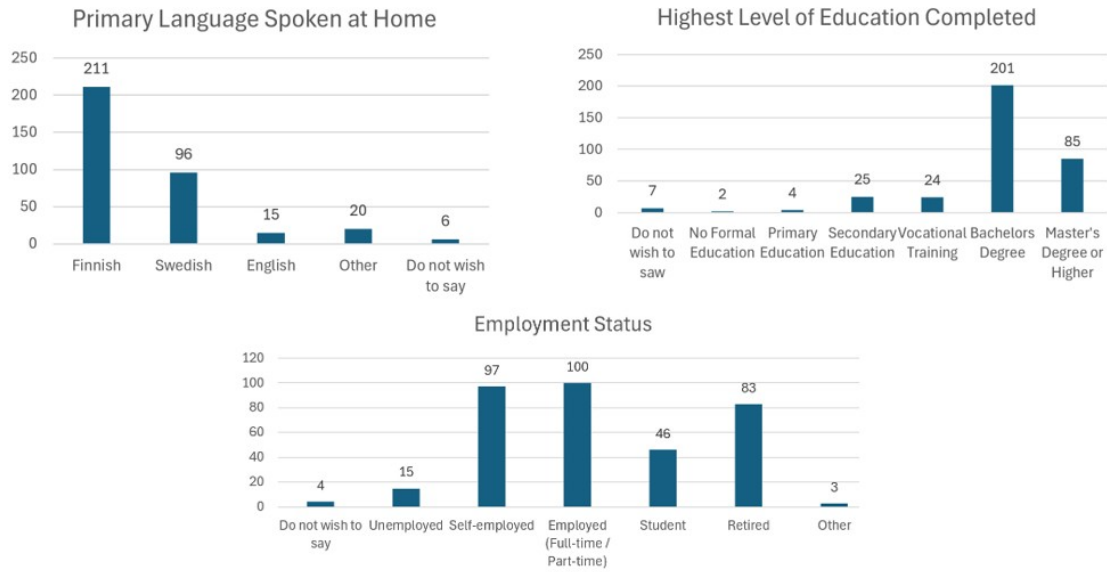


Figure 5. Primary language spoken at home, Highest level of education completed, Employment status

6.2 Descriptive Statistics of all the Variables

The descriptive analysis of the key study variables is summarized in table 3. This captures the digital engagement profile of the population surveyed and represents both the strengths and weaknesses of the collected data. The results demonstrate the availability of Digital Infrastructure Availability (Mean 4.16) and Digital Accessibility (Mean 4.02), indicating that the majority of respondents view the technological ecosystem of the city as both functional and usable. This technological infrastructure likely enables citizens to use the available digital services efficiently. On the other hand, the results for Digital Literacy Levels (Mean 3.96) and Social Inclusion (Mean 3.96) suggest that the population perceives itself as moderately adept at using technology and not fully integrated into the digital infrastructure. At the same time, the standard deviations suggest some variability that demonstrates gaps in digital literacy and inclusion that exist among some subgroups, driven by age, education, or employment.

Notably, Public Awareness of Smart City Initiatives had the lowest average (Mean 3.83), suggesting that many individuals remain uninformed or lack full knowledge of the implementation of smart city programs. This points to an information gap between people and municipal officials. Likewise, City & Municipal Support (Mean 3.94) reflects the respondents' perception as to how local government authorities have and continue to aid or undertake measures to encourage the use of digital initiatives within the municipality, which is also moderately low, indicating a need for improvement in engagement, participation, and even policy decision transparency. The variable Awareness and Engagement with Digital Services (Mean 3.93) indicates that although the population is moderately aware and engaged with the digital services offered, there is still an ample opportunity to increase participation and usage levels through tailored service delivery, education, or user-friendly design.

Overall, the range of approximately 0.61 to 0.82 for the standard deviations indicates a consistent single response pattern with little divergence across the sample. This pattern enhances the validity of the data by showing that the perceptions captured are, indeed, uniform among the participants. These findings imply that although a robust digital infrastructure exists within the city and there is some level of access and digital literacy, far more effort is needed for strategic communication, awareness initiatives, and trust cultivation concerning smart city programs and digital services. That would help accompany citizens to a more inclusive and engaged digital transformation and bridge the gap between their experiences and the intended goals of the policies and emerging technologies.

Table 3. Descriptive Statistics

<i>Variable</i>	<i>N</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Mean</i>	<i>Std. Deviation</i>
<i>Digital Infrastructure Availability</i>	348	2.0	5.0	4.158	0.614
<i>Digital Literacy Levels</i>	348	1.4	5.0	3.963	0.767
<i>Public Awareness of Smart City Initiatives</i>	348	1.4	5.0	3.832	0.824
<i>City & Municipal Support</i>	348	1.6	5.0	3.939	0.699
<i>Digital Accessibility</i>	348	1.8	5.0	4.015	0.623
<i>Digital Awareness and Engagement</i>	348	1.4	5.0	3.930	0.698
<i>Social Inclusion</i>	348	0.8	5.0	3.964	0.645

6.3 Digital Accessibility and Its Determinants

6.3.1 Correlation Analysis

This section examines the factors influencing Digital Accessibility among the respondents, based on correlation and regression analyses. The interpretation is supported by the correlation table (see Table 4), model summary (see Table 5), and ANOVA results (see Table 6). Correlation Analysis indicates that the Availability of Digital Infrastructure has a positive, moderate, and statistically significant correlation with Digital Accessibility ($r = .371, p < .001$). As individuals consider the availability of the Internet and access to devices more readily available, they also reported higher levels of digital accessibility. This underscores the importance of infrastructure, as digital systems and services cannot be readily utilized without basic underlying frameworks.

Digital Literacy Levels have a strong positive and statistically significant correlation ($r = .550, p < .001$) with Digital Accessibility. This is one of the strongest correlations seen in the analysis. It emphasizes that Digital Literacy is essential in today's information-driven world; hence, without continuous education and training programs, people will be digitally illiterate, irrespective of their demographic group.

The correlation with Public Awareness of Smart City Initiatives and Digital Accessibility is also strong and statistically significant ($r = .528, p < .001$). This indicates that individuals who have greater awareness of smart city activities, undertakings, and associated technological advancements tend to possess a feeling of inclusion and digital services accessibility. City & Municipal Support emerges as the most influential factor with the strongest positive and statistically significant correlation with digital accessibility ($r = .580, p < .001$). This means that citizens who

perceive adequate city government support in the form of accessible websites, automated services, and other digital help tend to have much better access. It follows that effective local governance and community outreach are necessary to enhance digital inclusion.

For the Age Group, the correlation with digital accessibility is not statistically significant ($r = -0.052$, $p = 0.330$). Although the association is somewhat negative, the lack of significance suggests that no usable value is found, and age within this population is irrelevant compared to other factors. This might indicate that attempts to bridge the access and training divide within different age groups, eliminating the generational gap, are successful.

The relationship between one's Nationality and Digital Accessibility is also not statistically significant ($r = -0.072$, $p = 0.183$). This means that, regardless of being Finnish, Swedish, or belonging to any other nationality, their reported level of access to digital facilities does not differ significantly. This could indicate to what extent digital systems are available, the fairness of representation regarding nationalities in terms of outreach and services offered, or the inclusive nature of the systems.

The correlation between Primary Language Spoken at Home and Digital Accessibility is not statistically significant ($r = -0.043$, $p = 0.423$). This suggests that the language spoken at home may not impede access to digitized services and the extent of a digitally serviceable public. It highlights the importance of considering multiple languages in public digital services and design practices that accommodate diverse users.

The correlation between the highest level of education completed and Digital Accessibility is not statistically significant ($r = -0.004$, $p = 0.940$). This reveals that the respondents' formal education does not appear to influence their engagement. In this case, it suggests that the digital exposure is not significantly dependent on formal levels of education, perhaps due to the construction of user-friendly interfaces, which are, however, intuitively designed, as well as the widespread availability of technology across all education levels.

As indicated by the statistics, Employment Status had a weak negative but statistically significant correlation with Digital Accessibility ($r = -0.125$, $p = 0.020$). This suggests employment status does indeed matter within a limited scope, in this case relating to accessibility – the unemployed or retired tend to feel less included digitally. While the effect may not be strong, it is important to understand that some level of attention must be paid to the digitally poorer people when mapping out plans for digital access because socioeconomic factors, especially low-income earners, are often ignored.

In conclusion, City & Municipal Support, Digital Literacy Levels, Public Awareness Of Smart City Initiatives, and Digital Infrastructure Availability, all show a statistically significant positive correlation and the most substantial impact. These are considered the most crucial predictors of Digital Accessibility. Age Group, Nationality, Primary Language, and Education Level are not significant, whereas Employment Status displays a weak yet significant effect. This presents opportunities for future policies and interventions.

Table 4. Correlation - Digital Accessibility

		Digital Infrastructure Availability	Digital Literacy Levels	Public Awareness of Smart City Initiatives	City & Municipal Support	Age Group (Coded)	Nationality (Coded)	Primary language spoken at home (Coded)	Highest level of education completed (Coded)	Employment status (Coded)	Digital Accessibility
Digital Infrastructure Availability	Pearson Correlation	1	.451**	.420**	.372**	-.056	.040	.083	.046	-.105*	.371**
	Sig. (2-tailed)		<.001	<.001	<.001	.295	.459	.124	.389	.050	<.001
	N	348	348	348	348	348	348	348	347	348	348
Digital Literacy Levels	Pearson Correlation	.451**	1	.715**	.644**	.114*	-.097	-.069	.057	-.083	.550**
	Sig. (2-tailed)	<.001		<.001	<.001	.034	.072	.201	.287	.122	<.001
	N	348	348	348	348	348	348	348	347	348	348
Public Awareness of Smart City Initiatives	Pearson Correlation	.420**	.715**	1	.706**	.063	-.071	-.044	-.033	-.158**	.526**
	Sig. (2-tailed)	<.001	<.001		<.001	.244	.189	.416	.536	.003	<.001
	N	348	348	348	348	348	348	348	347	348	348
City & Municipal Support	Pearson Correlation	.372**	.644**	.706**	1	.011	-.105*	-.057	-.043	-.139**	.580**
	Sig. (2-tailed)	<.001	<.001	<.001		.841	.050	.288	.420	.010	<.001
	N	348	348	348	348	348	348	348	347	348	348
Age Group (Coded)	Pearson Correlation	-.056	.114*	.063	.011	1	-.163**	-.134*	.434**	.343**	-.052
	Sig. (2-tailed)	.295	.034	.244	.841		.002	.012	<.001	<.001	.330
	N	348	348	348	348	348	348	348	347	348	348
Nationality (Coded)	Pearson Correlation	.040	-.097	-.071	-.105*	-.163**	1	.798**	.002	.049	-.072
	Sig. (2-tailed)	.459	.072	.189	.050	.002		<.001	.963	.359	.183
	N	348	348	348	348	348	348	348	347	348	348
Primary language spoken at home (Coded)	Pearson Correlation	.083	-.069	-.044	-.057	-.134*	.798**	1	-.036	.058	-.043
	Sig. (2-tailed)	.124	.201	.416	.288	.012	<.001		.500	.284	.423
	N	348	348	348	348	348	348	348	347	348	348
Highest level of education completed (Coded)	Pearson Correlation	.046	.057	-.033	-.043	.434**	.002	-.036	1	.143**	-.004
	Sig. (2-tailed)	.389	.287	.536	.420	<.001	.963	.500		.008	.940
	N	347	347	347	347	347	347	347	347	347	347
Employment status (Coded)	Pearson Correlation	-.105*	-.083	-.158**	-.139**	.343**	.049	.058	.143**	1	-.125*
	Sig. (2-tailed)	.050	.122	.003	.010	<.001	.359	.284	.008		.020
	N	348	348	348	348	348	348	348	347	348	348
Digital Accessibility	Pearson Correlation	.371**	.550**	.526**	.580**	-.052	-.072	-.043	-.004	-.125*	1
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	.330	.183	.423	.940	.020	
	N	348	348	348	348	348	348	348	347	348	348

** . Correlation is significant at the 0.01 level (2-tailed).
 * . Correlation is significant at the 0.05 level (2-tailed).

6.3.2 Regression Analysis and Model Validation

The ANOVA results and the model summary validate these findings by illustrating the regression model’s strength in predicting Digital Accessibility. The model consists of nine predictors: Employment Status, Nationality, Digital Infrastructure Availability, Education Level, Municipal Support, Age Group, Digital Literacy, Public Awareness of Smart City Initiatives, and Primary Language Spoken at Home. It yields an impressive R value of .641 and an R square of .411. In other words, the model accounts for 41.1% of the variance in Digital Accessibility. The adjusted R-squared value of .395 indicates the model’s reliability after controlling for the number of predictors, while the standard error of the estimate (.4846) shows high consistency in prediction.

Based on the R-squared change (.411) and the F-change of 26.130 with a p-value of less than 0.001, it can be said that the model is statistically valid and that the model is improved with the inclusion of the predictors. The chosen parameters are good enough to describe the relevant factors of digital accessibility and trust, further proving the trust of the model’s ability to incorporate these factors. Two other models were also presented for comparison. However, Model 1 was selected as it demonstrated the highest explanatory power, lowest error margin, and strongest statistical significance in capturing the key predictors of Digital Accessibility.

The ANOVA results confirm this conclusion. The Regression Sum of Squares (55.236) exceeds the Residual Sum of Squares (79.154), and an F-value of 26.130 with $p < .001$ clearly indicates statistical significance. The model, incorporating nine predictors, explains a substantial portion of the total variability (134.390) in Digital Accessibility. These results verify that the regression model is a statistically sound and meaningful fit for analyzing the key factors influencing digital accessibility

among the Turku population.

Table 5. Model Summary - Digital Accessibility

<i>Model</i>	<i>R</i>	<i>Adjusted R Square</i>	<i>Std. Error of Estimate</i>	<i>R Square Change</i>	<i>F Change</i>	<i>df1</i>	<i>df2</i>	<i>Sig. F Change</i>	
1	0.641	0.411	0.395	0.485	0.411	26.130	9	337	<.001
2	0.467	0.218	0.206	0.558	0.218	15.992	5	342	<.001
3	0.598	0.358	0.345	0.499	0.358	23.864	8	339	<.001

- Predictors:** Employment, Nationality, Education, Age, Language, Digital Infrastructure, Digital Literacy Levels, Awareness of Smart City Initiatives, City and Municipal Support
- Predictors:** Employment, Nationality, Education, Age, Language
- Predictors:** Employment, Nationality, Education, Age, Language, Digital Literacy Levels, Awareness of Smart City Initiatives, City and Municipal Support

Table 6. ANOVA - Digital Accessibility

	<i>Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>Sig.</i>
Regression	55.236	9	6.137	26.130	<.001
Residual	79.154	337	0.235		
Total	134.390	346			

- Dependent Variable:** Digital Accessibility
- Predictors:** Employment status, Nationality, Digital Infrastructure Availability, Highest level of education completed, City & Municipal Support, Age Group, Digital Literacy Levels, Public Awareness of Smart City Initiatives, Primary language spoken at home.

6.4 Digital Awareness and Engagement and its determinants

This section examines the factors influencing digital awareness and engagement among the respondents, based on correlation and regression analyses. The interpretation is supported by the correlation table (see Table 7), model summary (see Table 8), and ANOVA results (see Table 9).

6.4.1 Correlation Analysis

The correlation analysis of independent variables with the dependent variable, Awareness and Engagement with digital services, reveals interesting insights regarding the demographic and contextual factors that significantly influence citizens' interactions with digital services and platforms. The awareness and engagement with digital infrastructure shows a moderate positive correlation, which is statistically significant at $R = .297$ and $P < .001$. This indicates that as people perceive greater availability of infrastructure, they tend to be more aware of and engaged with digital services, which further necessitates the development of basic foundational technologies.

Digital Literacy Levels positively and significantly correlate with awareness and engagement ($r = .571$, $p < .001$). This is among the strongest correlations in the entire dataset, suggesting that those who are more digitally literate, nuanced and

sophisticated understood and wielded the underlying tools, were far more likely to be digitally serviced and active. This illustrates the impact continuous digital education drives alongside skill development initiatives. Public Awareness of Smart City Initiatives and Engagement with Digital Services correlate strongly and statistically significantly ($R = .602, P < .001$). Better awareness regarding the city's digital development strategies and smart initiatives correlates with available digital services. Such enhanced understanding equips citizens to better participate in available opportunities. This clearly indicates that public awareness is fundamental when it comes to active digital engagement and implies that advocacy and open access should take precedence in modern digital governance.

Furthermore, City and Municipal Support emerged as a primary contributor with the strongest positive and statistically significant correlation with Digital Engagement ($R = .644, P < .001$). If a city or municipal institution is seen as supportive and responsive and is making progress in integrating digital transformation, the likelihood of citizens engaging with various digital platforms and tools increases. This underscores the critical role of local governance in a municipality and emphasizes the importance of a well-developed digital strategy in municipalities. The relationship between age group and digital engagement is not statistically significant, with the correlation coefficient measured at $R = .066, P = .218$. This indicates that age has no significant impact on the level of awareness and participation in digital services. The lack of a statistically significant correlation might suggest that considerable efforts have been made to cater to various age groups and/or indicate that people of all ages, regardless of the generation they belong to, can easily access the digital services offered.

Nationality, on the other hand, displays a weak but statistically significant negative relationship with digital engagement ($R = -0.153, P = .004$). This suggests that nationality has some effect on the level of engagement; non-majority nationalities are less involved with digital services. This lack of engagement may stem from cultural or language barriers, or even access issues that require further investigation. The correlation between Primary Language Spoken at Home and awareness engagement is not statistically significant ($R = -0.067, P = .214$). These results indicate that the primary language spoken at home has little to no impact on the level of engagement with digital services, which might indicate that public services are offered in many languages, at least on the level of providing effective communication with relevant targeted audiences.

Highest Level Of Education Completed shows no statistically significant correlation with engagement ($r = .021, p = .702$). Although surprising, this suggests that educational achievement does not notably influence a person's engagement or participation with digital services. It may be interpreted that the services offered are so simple that they can be operated without any education. Employment status shows a weak negative but statistically significant correlation with engagement and awareness ($r = -0.117, p = .029$). This suggests that some categories of employment, especially those not working or training at the moment (e.g. retired, unemployed), may have slightly lower digital engagement. Even though the impact is minimal, it supports the idea that despite one's economic or social standing, there is an effort to participate in the digital world meaningfully and that more needs to be done to

support these people.

Table 7. Correlation - Digital Awareness and Engagement

		Digital Infrastructure Availability	Digital Literacy Levels	Public Awareness of Smart City Initiatives	City & Municipal Support	Age Group (Coded)	Nationality (Coded)	Primary language spoken at home (Coded)	Highest level of education completed (Coded)	Employment status (Coded)	Awareness and Engagement with Digital Services
Digital Infrastructure Availability	Pearson Correlation	1	.451**	.420**	.372**	-.056	.040	.083	.046	-.105*	.297**
	Sig. (2-tailed)		<.001	<.001	<.001	.295	.459	.124	.389	.050	<.001
	N	348	348	348	348	348	348	348	347	348	348
Digital Literacy Levels	Pearson Correlation	.451**	1	.715**	.644**	.114*	-.097	-.069	.057	-.083	.571**
	Sig. (2-tailed)	<.001		<.001	<.001	.034	.072	.201	.287	.122	<.001
	N	348	348	348	348	348	348	348	347	348	348
Public Awareness of Smart City Initiatives	Pearson Correlation	.420**	.715**	1	.706**	.063	-.071	-.044	-.033	-.158**	.602**
	Sig. (2-tailed)	<.001	<.001		<.001	.244	.189	.416	.536	.003	<.001
	N	348	348	348	348	348	348	348	347	348	348
City & Municipal Support	Pearson Correlation	.372**	.644**	.706**	1	.011	-.105*	-.057	-.043	-.139**	.644**
	Sig. (2-tailed)	<.001	<.001	<.001		.841	.050	.288	.420	.010	<.001
	N	348	348	348	348	348	348	348	347	348	348
Age Group (Coded)	Pearson Correlation	-.056	.114*	.063	.011	1	-.163**	-.134*	.434**	.343**	.066
	Sig. (2-tailed)	.295	.034	.244	.841		.002	.012	<.001	<.001	.218
	N	348	348	348	348	348	348	348	347	348	348
Nationality (Coded)	Pearson Correlation	.040	-.097	-.071	-.105*	-.163**	1	.798**	.002	.049	-.153**
	Sig. (2-tailed)	.459	.072	.189	.050	.002		<.001	.963	.359	.004
	N	348	348	348	348	348	348	348	348	347	348
Primary language spoken at home (Coded)	Pearson Correlation	.083	-.069	-.044	-.057	-.134*	.798**	1	-.036	.058	-.067
	Sig. (2-tailed)	.124	.201	.416	.288	.012	<.001		.500	.284	.214
	N	348	348	348	348	348	348	348	347	348	348
Highest level of education completed (Coded)	Pearson Correlation	.046	.057	-.033	-.043	.434**	.002	-.036	1	.143**	.021
	Sig. (2-tailed)	.389	.287	.536	.420	<.001	.963	.500		.008	.702
	N	347	347	347	347	347	347	347	347	347	347
Employment status (Coded)	Pearson Correlation	-.105*	-.083	-.158**	-.139**	.343**	.049	.058	.143**	1	-.117*
	Sig. (2-tailed)	.050	.122	.003	.010	<.001	.359	.284	.008		.029
	N	348	348	348	348	348	348	348	347	348	348
Awareness and Engagement with Digital Services	Pearson Correlation	.297**	.571**	.602**	.644**	.066	-.153**	-.067	.021	-.117*	1
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	.218	.004	.214	.702	.029	
	N	348	348	348	348	348	348	348	347	348	348

** . Correlation is significant at the 0.01 level (2-tailed).
 * . Correlation is significant at the 0.05 level (2-tailed).

In conclusion, City and Municipal Support, Public Perception of Smart City Initiatives, and levels of digital literacy emerge as the most significant positive predictors of Awareness and Engagement with Digital Services in a society. These factors, together with the availability of reliable Digital Infrastructure, are very important in digital engagement. Conversely, demographic variables such as Age, Primary Language, and Education Level carry little significance, while Nationality and Employment Status show weak but statistically significant negative correlations.

6.4.2 Regression Analysis and Model Validation

These correlation results are also supported by the regression model summary and ANOVA outputs that confirm the statistical robustness of the model in predicting awareness and engagement with digital services. The model has an R value of .697 and an R-squared of .486, indicating that approximately 48.6% of the variance in the dependent variable is explained by the nine predictors. The adjusted R-squared (0.472) demonstrates the model's credibility after accounting for the number of variables, sample size, and other factors, while the standard error of the estimate (0.5077) offers reasonable prediction reliability. Furthermore, the R-squared change (0.486), along with F CHANGE (35.356, $p < .001$), confirms that the set of independent variables significantly impacts the explanation of variation in engagement levels. Two other models were also presented for comparison. However, Model 1 was selected as it demonstrated the highest explanatory power, lowest error margin, and strongest statistical significance in capturing the key predictors of Digital Awareness and Engagement. These findings highlight the necessity for more targeted strategies that promote inclusivity within digital transformation frameworks.

The ANOVA results confirm this conclusion. The Regression Sum of Squares (82.027) exceeded the residual sum of squares in the ANOVA (86.873), and an F-value of 35.356 with $p < .001$ clearly indicates statistical significance. The model, with its deterministic components, explains the total variability in awareness and engagement. These findings verify that the regression model is a robust fit that computes the relationship between the main factors affecting digital engagement in the population studied.

Table 8. Model Summary - Digital Awareness and Engagement

<i>Model</i>	<i>R</i>	<i>R Square</i>	<i>Adjusted R Square</i>	<i>Std. Error of Estimate</i>	<i>R Square Change</i>	<i>F Change</i>	<i>df1</i>	<i>df2</i>	<i>Sig. F Change</i>
1	0.697	0.486	0.472	0.508	0.486	35.356	9	337	<.001
2	0.488	0.238	0.225	0.573	0.238	16.902	5	341	<.001
3	0.653	0.426	0.412	0.524	0.426	28.850	8	338	<.001

1. **Predictors:** Employment, Nationality, Education, Age, Language, Digital Infrastructure, Digital Literacy Levels, Awareness of Smart City Initiatives, City and Municipal Support
2. **Predictors:** Employment, Nationality, Education, Age, Language
3. **Predictors:** Employment, Nationality, Education, Age, Language, Digital Literacy Levels, Awareness of Smart City Initiatives, City and Municipal Support

Table 9. ANOVA - Digital Awareness and Engagement

	<i>Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>Sig.</i>
Regression	82.027	9	9.114	35.356	<.001
Residual	86.873	337	0.258		
Total	168.900	346			

- a. **Dependent Variable:** Digital Awareness and Engagement
- b. **Predictors:** Employment status, Nationality, Digital Infrastructure Availability, Highest level of education completed, City & Municipal Support, Age Group, Digital Literacy Levels, Public Awareness of Smart City Initiatives, Primary language spoken at home

6.5 Social Inclusion and Its Determinants

This section covers the independent variables and the dependent variable, social inclusion. The interpretation to explain the data, highlighting the predictors from the digital context dealing with social inclusion includes the correlation matrix (See Table 10), model summary (See Table 11) and ANOVA (See Table 12).

6.5.1 Correlation Analysis

The correlation analysis of the relationship between the selected independent variables and the dependent variable, Social Inclusion, has several important highlights. Digital Infrastructure Availability has a moderate and significant positive correlation to social inclusion ($r = .372$, $p < .001$). This means that participants who consider digital infrastructure to be more accessible and reliable tend to experience greater social inclusion within the digital ecosystem.

Digital Literacy Levels have a strong and statistically significant positive correlation with social inclusion ($r = .499, p < .001$). Those with higher levels of digital literacy, i.e. those confident with digital tools and services, are more likely to feel socially included. This accentuates the importance of digital competence not only in enabling access to technology but also in promoting identity and social inclusion within the digital community. Increased efforts to enhance the digital literacy of the different population groups may therefore help bridge the divides of social inclusion.

The variable Public Awareness Of Smart City Initiatives is also positively and significantly correlated with Social Inclusion ($r = .458, p < .001$). This shows that the population with a deeper understanding of the digital enhancement activities of their cities considers themselves more included. Awareness enables agency and mobilization wherein people feel they are part of sophisticated civic activities made possible through technology. Therefore, education and information regarding smart initiatives are means to improve inclusion.

City and Municipal Support shows a strong and statistically significant positive correlation with social inclusion ($r = .480, p < .001$). Residents have a higher socio-psychological perception and feel more integrated and valued within the social and spatial structure of the city if local governments are perceived as supportive, providing inclusive services and resources. Engagement by the municipal authorities seems to facilitate effective outcomes of digital inclusion.

Age Group has no statistically significant correlation with social inclusion ($r = -0.031, p = .563$). This suggests that the age of the participants does not have a noteworthy bearing on their level of inclusion within the context of technology. The lack of correlation suggests the existence of user-friendly digital interfaces designed for all ages and indicates that factors more significant than age, such as digital literacy, support, or even the perception of age, are responsible.

Nationality also shows no relationship with Social Inclusion of any statistical significance ($r = -0.042, p = .431$). This means that from the context of other digitized services offered, nationality does not significantly influence one's perception of inclusion. It may suggest that within existing policies and digital services, diverse national backgrounds are mainly catered for, or that nationality-related barriers are not as significant in this context.

Primary Language Spoken at Home, however, shows a correlation with social inclusion that is very strong, positive, and statistically significant ($R = .798, P < .001$). This is the strongest relationship observed and indicates that language plays a crucial role in fostering digital and social inclusion. Those who speak the dominant or officially supported languages are more likely to access the information and navigate through different services digitally, which enhances their overall sense of participation and, therefore, inclusion. The Highest Level of Education Completed reveals no significant statistically significant correlation with social inclusion ($r = .002, p = .823$). This finding seems to indicate that a higher formal education level does not alter how included or excluded an individual feels in a digitally service-oriented environment. The finding could suggest the existence of relatively low barriers to access, or high user-friendly design in the digital services offered, which increases their accessibility.

Employment Status indicates a weak negative correlation where the correlation is

statistically significant with social inclusion ($r = -0.106$, $p = .048$). This highlights that not employed individuals may feel slightly less socially included. Although weak, it does suggest that employment status, possibly signifying some economic or social marginalization, impacts one’s sense of social and digital presence, necessitating active measures for the unemployed or economically inactive population.

Table 10. Correlation - Social Inclusion

		Digital Infrastructure Availability	Digital Literacy Levels	Public Awareness of Smart City Initiatives	City & Municipal Support	Age Group (Coded)	Nationality (Coded)	Primary language spoken at home (Coded)	Highest level of education completed (Coded)	Employment status (Coded)	Social Inclusion
Digital Infrastructure Availability	Pearson Correlation	1	.451**	.420**	.372**	-.056	.040	.083	.046	-.105*	.372**
	Sig. (2-tailed)		<.001	<.001	<.001	.295	.459	.124	.389	.050	<.001
	N	348	348	348	348	348	348	348	347	348	348
Digital Literacy Levels	Pearson Correlation	.451**	1	.715**	.644**	.114*	-.097	-.069	.057	-.083	.499**
	Sig. (2-tailed)	<.001		<.001	<.001	.034	.072	.201	.287	.122	<.001
	N	348	348	348	348	348	348	348	347	348	348
Public Awareness of Smart City Initiatives	Pearson Correlation	.420**	.715**	1	.706**	.063	-.071	-.044	-.033	-.158**	.458**
	Sig. (2-tailed)	<.001	<.001		<.001	.244	.189	.416	.536	.003	<.001
	N	348	348	348	348	348	348	348	347	348	348
City & Municipal Support	Pearson Correlation	.372**	.644**	.706**	1	.011	-.105*	-.057	-.043	-.139**	.480**
	Sig. (2-tailed)	<.001	<.001	<.001		.841	.050	.288	.420	.010	<.001
	N	348	348	348	348	348	348	348	347	348	348
Age Group (Coded)	Pearson Correlation	-.056	.114*	.063	.011	1	-.163**	-.134*	.434**	.343**	-.031
	Sig. (2-tailed)	.295	.034	.244	.841		.002	.012	<.001	<.001	.563
	N	348	348	348	348	348	348	348	347	348	348
Nationality (Coded)	Pearson Correlation	.040	-.097	-.071	-.105*	-.163**	1	.798**	.002	.049	-.042
	Sig. (2-tailed)	.459	.072	.189	.050	.002		<.001	.963	.359	.431
	N	348	348	348	348	348	348	348	347	348	348
Primary language spoken at home (Coded)	Pearson Correlation	.083	-.069	-.044	-.057	-.134*	.798**	1	-.036	.058	-.014
	Sig. (2-tailed)	.124	.201	.416	.288	.012	<.001		.500	.284	.792
	N	348	348	348	348	348	348	348	347	348	348
Highest level of education completed (Coded)	Pearson Correlation	.046	.057	-.033	-.043	.434**	.002	-.036	1	.143**	-.012
	Sig. (2-tailed)	.389	.287	.536	.420	<.001	.963	.500		.008	.823
	N	347	347	347	347	347	347	347	347	347	347
Employment status (Coded)	Pearson Correlation	-.105*	-.083	-.158**	-.139**	.343**	.049	.058	.143**	1	-.106*
	Sig. (2-tailed)	.050	.122	.003	.010	<.001	.359	.284	.008		.048
	N	348	348	348	348	348	348	348	347	348	348
Social Inclusion	Pearson Correlation	.372**	.499**	.458**	.480**	-.031	-.042	-.014	-.012	-.105*	1
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	.563	.431	.792	.823	.048	
	N	348	348	348	348	348	348	348	347	348	348

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

In conclusion, the strongest and most significant positive predictors of social inclusion are the primary language spoken at home, digital literacy levels, city and municipal support, and public awareness of smart city initiatives. Alongside these predictors, inclusion is enhanced by demographic variables, which include age, nationality, and education level. These factors are relatively less significant, while employment status creates a weak but meaningful negative link. Furthermore, the predictive value of Digital Infrastructure Availability is not to be overlooked. The findings of this research suggest that overcoming barriers related to language and digital skills, providing inclusive municipal services, and increasing public awareness are essential for constructing a sociodigitally inclusive community society.

6.5.2 Regression Analysis and Model Validation

These results corroborate information presented in the regression model summary and ANOVA analysis, which confirms statistical significance and the strength of the predictive model. The model reports an R value of .562 and R square value of .316, indicating that, with the combination of the nine independent variables, approximately 31.6% of The Variance in Social Inclusion is explained. The model is supported by an adjusted R-squared of .298—valid after considering the number of predictors relative to sample size. The standard error of the estimate (.5409) suggests that the model’s predictions are sufficiently accurate. Also, the F change value of

17.311 ($P < .001$) and R square change of .316 illustrate that these variables added value to the model. The ANOVA table represents the significance of the model with an F value of 17.311, $P < .001$, with a regression sum of squares of 45.580, which is greater than the residual (98.591) of the value. This adds to the claim that the model is statistically valid, and it successfully captures major factors that determine social inclusion. Two other models were also presented for comparison. However, Model 1 was selected as it demonstrated the highest explanatory power, lowest error margin, and strongest statistical significance in capturing the key predictors of Social Inclusion. The social dynamics of inclusion, together with the correlation and regression results, highlight particular focus areas such as language access and digital skills, local government participation, and smart city consciousness. At the same time, they point out other policy support gaps, like unemployment, that require proactive measures so that no group or community is marginalised in the context of the digital shift.

Table 11. Model Summary - Social Inclusion

<i>Model</i>	<i>R</i>	<i>R Square</i>	<i>Adjusted R Square</i>	<i>Std. Error of Estimate</i>	<i>R Square Change</i>	<i>F Change</i>	<i>df1</i>	<i>df2</i>	<i>Sig. F Change</i>
1	0.562	0.316	0.298	0.541	0.316	17.311	9	337	<.001
2	0.422	0.178	0.165	0.583	0.178	13.689	5	341	<.001
3	0.521	0.272	0.258	0.553	0.272	21.450	8	338	<.001

1. **Predictors:** Employment, Nationality, Education, Age, Language, Digital Infrastructure, Digital Literacy Levels, Awareness of Smart City Initiatives, City and Municipal Support
2. **Predictors:** Employment, Nationality, Education, Age, Language
3. **Predictors:** Employment, Nationality, Education, Age, Language, Digital Literacy Levels, Awareness of Smart City Initiatives, City and Municipal Support

Table 12. ANOVA - Social Inclusion

	<i>Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>Sig.</i>
Regression	45.580	9	5.064	17.311	<.001
Residual	98.591	337	0.293		
Total	144.171	346			

- a. **Dependent Variable:** Social Inclusion
- b. **Predictors:** Employment status, Nationality, Digital Infrastructure Availability, Highest level of education completed, City & Municipal Support, Age Group, Digital Literacy Levels, Public Awareness of Smart City Initiatives, Primary language spoken at home

7 Discussion and Conclusion

7.1 Discussion

RQ1: How does the ‘Smart and Wise Turku’ Project affect digital accessibility for different demographic groups within the city?

The Smart and Wise Turku project results illustrate the nuanced consequences of Digital Accessibility among different demographic groups. The quantitative data collected for the thesis revealed uneven, yet statistically significant, service uptake among older adults, migrants, and low-income groups who appear to be the most disadvantaged regarding access to AI-powered public infrastructure and online digital services. This aligns with the existing literature on inequalities in digital smart cities (Makkonen & Inkinen, 2024).

Compared to Inkinen (2006), who studied the first stage of integrating information technology (IT) into urban life in Tampere, we observe a striking contemporary parallel with historical exclusionary digital trends. Inkinen pointed out that the adoption of IT was predominantly focused on the younger, middle class, and professionally active population. These patterns of socio-technological exclusion and marginalisation, which were already present in Turku, are now even more widespread and persistent.

From a purely infrastructural perspective, Goddard et al. (2021) discuss the potential for new Robotics and Autonomous Systems (RAS) to transform urban services but warn that, without equitable approaches to their design, such advancements are likely to worsen the existing gaps in the digital divide. Despite the relative improvement in mobility brought by Föli and AI parking systems in Turku, these systems did not include suitable design features for people with disabilities or for non-native language speakers, limiting wider usability.

This concern aligns with findings by Yigitcanlar et al. (2022), where inclusivity perceptions of AI systems attended to users as stakeholders rather than merely “users” on an access level. In Turku, digital accessibility was obstructed not only because of the lack of infrastructure, but also owing to low digital self-efficacy among the marginalised population. Thus, more than simply a question of technology, the issue of digital inequality is profoundly social.

RQ2: What is the level of public awareness about the ‘Smart and Wise Turku’ Project, and how does it influence engagement with the project’s digital initiatives?

The survey results indicate that limited public awareness is a significant obstacle to participation in digital initiatives in Turku. This was particularly true for older citizens and those who spoke native languages like Finnish and Swedish. Despite the efforts made to share information about available resources, there was a positive relationship between awareness and engagement levels. The idea that primary participation depends on a certain level of awareness was evident.

This supports the findings by Yigitcanlar et al. (2022), who argued that people need to comprehend AI and smart systems to trust or use them. In numerous cities

worldwide, smart infrastructure is regularly implemented with little to no public engagement, prior discussion or communication. This is laden with risks of disaffection. For instance, citizens of Turku were provided with digital services. However, the absence of appropriate public relations substantiated the lack of tailored communication to enhance the services' effectiveness.

Inkinen (2006) pointed out an important observation: early ICT inventions often went unnoticed by the public. Similarly, Goddard et al. (2021) highlights the fact that new technologies need to be accompanied by knowledge transfer policies so that they can beneficially serve society fully. In Turku, the project's failure to provide multilingual or community-tailored campaigns limited greater citizen participation, resulting in restricted involvement at the community level.

RQ3: In what ways does the 'Smart and Wise Turku' Project contribute to social inclusion, particularly through its digital initiatives?

Turku's smart city vision includes social inclusion as a key strategic pillar, mainly aiming for a broad impact. Nevertheless, the findings indicate that the actual results regarding inclusiveness are varied. Regression models showed that the digitally literate population increased participation substantially and received enhanced services. Still, vulnerable populations such as elderly people, people with disabilities, and immigrants tended to remain passive participants in the digital world.

These types of gaps pose social challenges. These are highlighted in the works of Goddard et al. (2021), who warn that RAS deployments without inclusive paradigms are bound to create urban inequalities. They also caution that cities in the Global North overlook the social dimensions of planning in a technology-driven context.

Yigitcanlar et al. (2022) contend, as well, that inclusion does not emanate from smartness but instead from how policy is crafted. For example, although AI-enabled mobility services were well accepted by the residents of Turku, they lack the required digital skills training. Remarkably, Inkinen (2006) made such predictions two decades ago when he urged locally-centred ICT frameworks instead of deployable, top-down, technocratic ones. In Turku, the SAWT project did not have social participatory governance mechanisms, which constrained its social impact. A more effective approach may have been a co-creation model like those in Barcelona or Vienna.

Smart and Wise Turku made strides in integrating smart city technologies with the region's digital infrastructure. Nevertheless, lack of awareness, accessibility, inclusivity, and design remain prominent barriers.

7.2 Practical implication

The practical implications of this study are numerous and profoundly important to policy and decision making at the level of city governance, urban design, and technology with those being.

Community Digital Literacy Initiatives: Local governments must conduct digital literacy drives targeting the elderly, migrants, and persons with disabilities. Ef-

forts must be made to partner with community organisations to enhance further the cultural and linguistic appropriateness of the campaigns (Mullins, 2022).

Multilingual and Inclusive Service Design: All public relations initiatives and communication platforms should be able to ensure inclusion and accessibility. This would address the communication barrier in Turku’s current implementation, as revealed in the case study (UN-HABITAT, 2025).

Community-Based Awareness Strategies: To foster a positive perception of innovative services, trust and understanding can be developed through workshops, local ambassador programs, and partnerships with NGOs (Anthony, 2024).

Participatory Governance Models: For example, Turku would benefit from incorporating participatory decision-making systems within innovative governance, such as forums for digital town meetings or budgeting apps that allow citizens to set budget priorities and spend them. This would establish a feedback cycle between developers and users, increasing participation and inclusion (Potter & Olaoye, 2024).

Smart City Evaluation Frameworks: To assess social impact and technology adoption, regular monitoring and evaluation frameworks should be implemented. These metrics must include, but are not limited to, accessibility, satisfaction among various demographic groups, and indicators of digital exclusion (Hodson et al., 2023).

Replication Guidance For Mid-Sized Cities: Other mid-sized European cities can turn to Turku for guidance, as they are often overlooked in modelling. New initiatives should consider digital equity as the baseline for all future project constructions (Hodson et al., 2023).

Using these strategies will help municipalities and urban development areas adapt to digital advancements and promote equality as cities grow.

7.3 Limitations and Future Recommendations

Methodological and Sampling Limitations: This study used self-reported surveys, which may lead to response bias regarding social inclusion, as it is a sensitive subject. Also, the sample size met the requirements for analysis. However, it was still lower than the initial quota, and some demographic categories (such as non-English speakers, older adults, and economically disadvantaged people) were underrepresented in the received responses. **Future recommendation:** Develop diverse and larger samples through mixed methods, such as follow-up interviews or focus group sessions with unrepresented groups, to enhance measurement accuracy and representation.

Geographic and Contextual Specificity: These findings focused on the city of Turku, a unique city with special social and technological features that might not be found in other places or in larger, less technologically advanced municipalities. **Future recommendation:** For broader generalizability, future research should study

several mid- to large-sized cities, both within and outside Finland. This will enhance understanding of digital inclusion and awareness across various regional contexts.

Measurement Limitations: Even though the survey instruments applied in this study have good reliability, other measures, such as forms of digital accessibility and engagement, had weaker internal reliability. Furthermore, responses to the Likert-scaled items could have been influenced by central tendency bias. **Future recommendation:** Improve the internal consistency among the themes through the development and pilot-testing of measurement tools. Response biases can be minimized by including open-ended questions or employing scenario-based approaches.

External Factors and Unmeasured Variables: This study did not capture some essential factors influencing technology use, such as personal attitudes, trust in authorities, previous trust in technology, or disabilities. **Future recommendation:** Future research should include more qualitative factors, such as digital trust, health, and past negative experiences with technology, to develop a comprehensive approach to tackle social exclusion.

Data Representation and Inclusion Challenges: The study may have excluded some marginalised groups with multilingual constituents due to underlying digital access or cultural barriers, which diminished the overall representativeness of the study. **Future recommendation:** Enhance the representativeness of the surveys by utilising local volunteer community ambassadors or mobile station volunteers to distribute and collect printed surveys in underserved, high-tech-poor communities.

7.4 Conclusion

This thesis analyses digital transformation's role in promoting fair urban development in the Smart and Wise Turku Project, focusing on digital accessibility, public awareness, and social inclusion. Based on survey data from 348 residents, the study observed some improvements and persistent gaps in smart city development in Turku.

The findings show that Turku is actively working to tackle digital inequality related to demographics and has made great strides in building digital infrastructure and services. This includes some fantastic AI-driven mobility solutions and participatory platforms like Decidim. However, it's important to note that accessibility still varies among different sociodemographic groups. Interestingly, inclusion depends less on age, educational background, or nationality, and more on factors like digital literacy, municipal support, and employment opportunities status. This indicates that broader structural discursive dynamics, rather than individual characteristics, are responsible for reduced digital engagement in the city.

Another essential outcome concerns public awareness, one of the most critical factors affecting citizens' usage and trust in digital services. Regardless of the existing platforms and surrounding campaigns, populations such as the economically vulnerable and diverse speakers in and out of the city do not know how these platforms

work and are meant to aid them. The gap between awareness and participation remains a significant area of concern, and it's clear that more targeted and inclusive strategies are necessary.

With regards to social inclusion, the project strengthened contributions through multilingual interfaces, literacy programs, and subsidised internet access. Nevertheless, the language spoken at home was the greatest determinant for inclusion than even more conventional factors such as educational attainment. This highlights the need for advanced services which are sophisticated on a technological level but also culturally and linguistically pertinent on human levels.

In a wider regard, the Smart and Wise Turku Project presents an agile attitude towards urban digitalisation. However, the initiative's outreach to all societal groups is only somewhat effective. There is no question that smart cities need sophisticated infrastructure development, but to be truly inclusive, it is important to create understanding, preparedness, and trust among the unserved and marginalised populations.

This research adds to the literature on urban digital equity by providing new evidence from a mid-sized European city, which is often overlooked in smart city studies. Although these conclusions are valuable, they come from within the confines of response bias and lack of sample diversity. Further studies should apply qualitative approaches, broaden to different urban areas, and assess enduring shifts in digital participation.

In summary, Turku's advancement toward becoming a smart city has been remarkable. However, achieving social inclusion will rely on continual funding towards digital literacy, inclusive outreach, and citizen-centric policy frameworks. The benchmark of progress for future smart cities turns out to be the ability to provide, comprehend, and help mould digital civic services to all.

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Appendix A

Smart City - Survey

Kyselyn projektitiedote

Tutkimuksen otsikko:

Digitaalisen saavutettavuuden, tietoisuuden ja sosiaalisen osallisuuden arviointi 'Smart and Wise Turku' -projektissa

Tutkijan tiedot:

Tutkijan nimi: Chandramohan Aisvaran

Affiliaatio: Turun yliopisto

Sähköpostiosoite: chaisv@utu.fi

Tutkimuksen tarkoitus:

Tämän tutkimuksen tavoitteena on kattavasti arvioida turkulaisten tietoisuutta, digitaalista saavutettavuutta ja sosiaalista osallisuutta 'Smart and Wise Turku' -projektin yhteydessä. Tutkimus keskittyy myös siihen, kuinka hyvin digitaaliset palvelut ja älykaupunkialoitteet ovat saavutettavia, osallistavia ja tehokkaasti hyödynnettyjä eri väestöryhmien keskuudessa, sekä tunnistamaan mahdollisia esteitä ja ehdotettuja strategioita tulevaisuuden parannuksille.

Tutkimuksen pääkohteena olevat digitaaliset palvelut:

- Tiedolla Johtamisen Portaali
- AuroraAI
- Syrjäytymisen Dynamiikkatyökalu
- Turku Citizen Dashboard
- Mikä Mua Auttais

Miksi sinut on kutsuttu osallistumaan?

Olet Turun asukas ja sinulla saattaa olla kokemusta digitaalisten palveluiden ja älykaupunkihankkeiden käytöstä.

Miten osallistuminen tapahtuu?

- Sinua pyydetään arvioimaan joitakin väitteitä ja antamaan mielipiteesi kahteen kysymykseen.
- Sinulta kysytään kokemuksistasi Turun digitaalisten palveluiden käytöstä, kuten:
 - Tiedolla Johtamisen Portaali
 - AuroraAI
 - Syrjäytymisen Dynamiikkatyökalu
 - Turku Citizen Dashboard
 - Mikä Mua Auttais
- Tietoisuuttasi älykaupunkialoitteista sekä näkemyksiäsi sosiaalisesta osallisuudesta digitaalisissa ympäristöissä tarkastellaan myös.
- Osallistuminen on vapaaehtoista, ja voit milloin tahansa jättää vastaamatta kysymykseen.

Pidetäänkö tietoni luottamuksellisina?

Kyselyn aikana ei kerätä henkilökohtaisia tietoja.

Onko osallistumisessa riskejä?

Ei riskejä.

Osallistumissuostumus

Jos suostut osallistumaan, anna vastauksesi liitettyyn kyselyyn.

Kiitos ajastasi ja arvokkaista näkemyksistäsi!**Projektinformatiionsblad för Enkät****Titel på forskningen:**

Utvärdering av digital tillgänglighet, medvetenhet och social inkludering i 'Smart och Vis Åbo'-projektet

Forskarens uppgifter:

Forskarens namn: Chandramohan Aisvaran

Affiliation: Åbo universitet

Kontakt e-post: chaisv@utu.fi

Syfte med studien:

Syftet med denna forskning är att grundligt utvärdera allmänhetens medvetenhet, digitala tillgänglighet och sociala inkludering bland Åbo-invånare i kontexten av 'Smart och Vis Åbo'-projektet. Forskningen fokuserar även på i vilken utsträckning digitala tjänster och smarta stadsinitiativ är tillgängliga, inkluderande och effektivt använda av olika grupper av Åbo-invånare, samt identifiera potentiella hinder och föreslagna strategier för framtida förbättringar.

Huvudfokus för de digitala tjänsterna i denna forskning är:

- Tiedolla Johtamisen Portaali
- AuroraAI
- Syrjäytymisen Dynamiikkatyökalu
- Turku Citizen Dashboard
- Mikä Mua Auttais

Varför har du blivit inbjuden att delta?

Du är en invånare i Åbo och kan ha erfarenhet av att använda digitala tjänster och smarta stadsinitiativ.

Vad innebär ditt deltagande?

- Du ombeds att betygsätta vissa påståenden och ge dina tankar kring två frågor.
- Du kommer att bli tillfrågad om dina erfarenheter av att använda Åbos digitala tjänster, såsom:
 - Tiedolla Johtamisen Portaali
 - AuroraAI
 - Syrjäytymisen Dynamiikkatyökalu
 - Turku Citizen Dashboard

- Mikä Mua Auttais

- Din medvetenhet om smarta stadsinitiativ samt dina åsikter om social inkludering i digitala miljöer kommer också att undersökas.
- Deltagande är frivilligt, och du kan välja att hoppa över en fråga när som helst.

Kommer min information att hållas konfidentiell?

Ingen personlig information kommer att samlas in under enkäten.

Finns det några risker med att delta?

Inga risker.

Samtycke till deltagande

Om du samtycker till att delta, vänligen fyll i den bifogade enkäten.

Tack för din tid och dina värdefulla insikter!

Project Information Sheet for Survey

Title of the Research:

Evaluating Digital Accessibility, Awareness, and Social Inclusion in the ‘Smart and Wise Turku’ Project

Researcher Details:

Researcher Name: Chandramohan Aisvaran

Affiliation: University of Turku

Contact Email: chaisv@utu.fi

Purpose of the Study:

The aim of this research is to comprehensively evaluate public awareness, digital accessibility and social inclusion among Turku residents in the context of the ‘Smart and Wise Turku’ Project. Also, this research focuses on the extent to which digital services and smart city initiatives are accessible, inclusive and effectively utilized by diverse groups of Turku residence, while also identifying potential barriers and suggested strategies for future improvement.

Main focus on the digital services for this research are

- Tiedolla Johtamisen Portaali,
- AuroraAI,
- Syrjäytymisen Dynamiikkatyökalu,
- Turku Citizen Dashboard
- Mikä Mua Auttais

Why Have You Been Invited to Participate?

You are a resident of Turku and may have experience related to using digital services and smart city initiatives.

What Will Your Participation Involve?

- You will be asked to rate some statements and give your thoughts on 2 questions.

- You will be asked about your experiences using Turku's digital services such as
 - Tiedolla Johtamisen Portaali
 - AuroraAI
 - Syrjäytymisen Dynamiikkatyökalu
 - Turku Citizen Dashboard
 - Mikä Mua Auttais
- your awareness of smart city initiatives, and your views on social inclusion in digital spaces.
- Participation is voluntary, and you can choose to skip any question

Will My Information Be Kept Confidential?

No personal information will be gathered during the survey.

Are There Any Risks in Participating?

No Risk

Consent to Participate

If you agree to participate, please give the responses to the questionnaire attached.

Thank you for your time and valuable insights!

1. Asutko Turussa? / Är du bosatt i Åbo? / Do you live in Turku?

- Kyllä / Ja / Yes
- Ei / Nej / No

2. Ikäryhmä / Åldersgrupp / Age Group

- 18 - 24
- 25 - 34
- 35 - 44
- 45 - 54
- 55 - 64
- 65 +

3. Sukupuoli / Kön / Gender

- Mies / Man / Male
- Nainen / Kvinna / Female

- Ei-binäärinen / Icke-binär / Non-binary
- En halua kertoa / Vill inte säga / Prefer not to say

4. Kansalaisuus (valinnainen) / Nationalitet (frivilligt) / Nationality (optional)

- Suomalainen
- Svensk
- Muu (Täsmennä) / Annan (Specificera) / Other (Please specify) _____

5. Primary language spoken at home / Huvudspråk som Talas hemma / Primary language spoken at home

- Suomi
- Svenska
- English
- Muu (Täsmennä) / Annan (Specificera) / Other (Please specify) _____

6. Korkein suoritettu koulutustaso / Högsta avslutade utbildningsnivå / Highest level of education completed

- Ei virallista koulutusta / Ingen formell utbildning / No formal education
- Peruskoulutus / Grundutbildning / Primary education
- Toisen asteen koulutus / Sekundärutbildning / Secondary education
- Ammatillinen koulutus / Yrkesutbildning / Vocational training
- Kandidaatin tutkinto / Kandidatexamen / Bachelor's degree
- Maisterin tutkinto tai korkeampi / Magisterexamen eller högre / Master's degree or higher

7. Työllisyystilanne / Sysselsättningsstatus / Employment status

- Työssä (kokoaikainen / osa-aikainen) / Anställd (heltid / deltid) / Employed (Full-time / Part-time)
- Yrittäjä / Egenföretagare / Self-employed

- Työtön / Arbetslös / Unemployed
- Opiskelija / Studerande / Student
- Eläkeläinen / Pensionär / Retired
- Muu (Täsmennä) / Annan (Specificera) / Other (Please specify)
-

8. Kuinka usein käytät verkossa olevia julkisia palveluja? / Hur ofta använder du offentliga tjänster online? / How often do you use online city services?

- Päivittäin / Dagligen / Daily
- Viikoittain / Veckovis / Weekly
- Kuukausittain / Månadsvis / Monthly
- Harvoin / Sällan / Rarely
- Ei koskaan / Aldrig / Never

Arvioi seuraavat väitteet asteikolla 1-5, jossa / Bedöm följande påståenden på en skala från 1 till 5, där / Please rate the following statements on a scale of 1 to 5, where

:

- 1 = Täysin eri mieltä / Helt oenig / Strongly disagree
- 2 = Eri mieltä / Oenig / Disagree
- 3 = Neutraali / Neutral / Neutral
- 4 = Samaa mieltä / Enig / Agree
- 5 = Täysin samaa mieltä / Helt enig / Strongly agree

Tutkimuksen digitaalisten palveluiden pääpaino on seuraavissa /Huvudfokus för denna undersöknings digitala tjänster är /The main focus of the digital services for this research are:

- Tiedolla Johtamisen Portaali
- AuroraAI
- Syrjäytymisen Dynamiikkatyökalu
- Turku Citizen Dashboard
- Mikä Mua Auttais

9. Digitaalisen infrastruktuurin saatavuus / Tillgången till digital infrastruktur / Digital Infrastructure Availability

	1	2	3	4	5
Minulla on tarvittavat digitaaliset laitteet (älypuhelin, tabletti tai tietokone) verkkopalveluiden käyttöön.					
Jag har de nödvändiga digitala enheterna (smarttelefon, surfplatta eller dator) för att använda onlinetjänster.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have the necessary digital devices (smartphone, tablet, or computer) to use online services.					
Turun digitaalinen infrastruktuuri vastaa kaikkien asukkaiden tarpeisiin.					
Tillgången till digital infrastruktur i Åbo motsvarar alla invånares behov.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The availability of digital infrastructure in Turku meets the needs of all residents.					
Koen harvoin yhteysongelmia käyttäessäni digitaalisia palveluita Turussa.					
Jag upplever sällan anslutningsproblem när jag använder digitala tjänster i Åbo.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I rarely experience connection problems when using digital services in Turku.					

10. Digitaalinen lukutaito / Digital kompetens / Digital Literacy Levels

	1	2	3	4	5
Tunnen oloni varmaksi käyttäessäni Turun kaupungin tarjoamia digitaalisia palveluja, kuten Tiedolla Johtamisen Portaali, AuroraAI, Syrjäytymisen Dynamiikkatyökalu, Turku Citizen Dashboard ja Mikä Mua Auttais.					
Jag känner mig trygg med att använda digitala tjänster som tillhandahålls av Åbo stad, såsom Tiedolla Johtamisen Portaali, AuroraAI, Syrjäytymisen Dynamiikkatyökalu, Turku Citizen Dashboard och Mikä Mua Auttais.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel confident using digital services provided by the City of Turku such as Tiedolla Johtamisen Portaali, AuroraAI, Syrjäytymisen Dynamiikkatyökalu, Turku Citizen Dashboard, and Mikä Mua Auttais					
Voin suorittaa suurimman osan verkkotehtävistä ilman apua.					
Jag kan utföra de flesta uppgifter online utan hjälp.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can complete most online tasks without assistance.					
Jos kohtaan teknisen ongelman, tiedän mistä löydän tukea.					
Om jag stöter på ett tekniskt problem vet jag var jag kan hitta support.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If I face a technical issue, I know where to find support.					

	1	2	3	4	5
Olen osallistunut koulutukseen tai saanut ohjausta digitaalisten palveluiden käytöstä.					
Jag har deltagit i utbildning eller fått vägledning om hur man använder digitala tjänster.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have attended training or received guidance on how to use digital services.					

Haluaisin lisää mahdollisuuksia parantaa digitaalisia taitojani.					
Jag skulle vilja ha fler möjligheter att förbättra mina digitala färdigheter.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would like more opportunities to improve my digital skills.					

11. Älykaupunkihankkeiden julkinen tietoisuus / Offentlig medvetenhet om smarta stadsinitiativ / Public Awareness of Smart City Initiatives

	1	2	3	4	5
Olen tietoinen 'Smart and Wise Turku' -hankkeesta ja sen tavoitteista.					
Jag är medveten om 'Smart and Wise Turku'-projektet och dess mål.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am aware of the 'Smart and Wise Turku' Project and its goals.					

	1	2	3	4	5
Saan säännöllisesti tietoa Turun digitaalisista palveluista virallisista lähteistä.					
Jag får regelbundet information om Åbos digitala tjänster genom officiella källor.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I regularly receive information about Turku's digital services through official sources.					
Kaupunki tarjoaa selkeää viestintää digitaalisista hankkeista ja parannuksista.					
Staden tillhandahåller tydlig kommunikation om digitala initiativ och förbättringar.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The city provides clear communication about digital initiatives and improvements.					
Uskon, että tarvitaan lisää tietoisuuskampanjoita, jotta asukkaat oppivat älykaupunkihankkeista.					
Jag anser att det behövs fler informationskampanjer för att utbilda invånarna om smarta stadsprojekt.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I believe more awareness campaigns are needed to educate residents about smart city projects.					
Etsin aktiivisesti tietoa Turun digitaalisen muutoksen edistysaskeleista.					
Jag söker aktivt information om Åbos digitala transformationsinsatser.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I actively seek information about Turku's digital transformation efforts.					

12. Hallinnon ja kunnallisen tuen saatavuus / Stöd från staden och kommunen / City & Municipal Support

	1	2	3	4	5
Turun kaupunki tarjoaa riittävästi tukea asukkaille digitaalisten palveluiden käyttöön.					
Åbo stad tillhandahåller tillräckligt stöd för invånarna att få tillgång till digitala tjänster.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The City of Turku provides adequate support for residents to access digital services.					
Tiedän, mistä voin hakea apua, jos minulla on vaikeuksia käyttää verkossa olevia kaupungin palveluja.					
Jag vet var jag kan söka hjälp om jag har problem med att få tillgång till stadens onlinetjänster.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I know where to seek help if I have trouble accessing online city services.					
Turku tarjoaa koulutusta tai resursseja niille, joilla on vaikeuksia digitaalisen saavutettavuuden kanssa.					
Åbo erbjuder utbildning eller resurser för dem som har svårt med digital tillgänglighet.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Turku offers training or resources for those who struggle with digital accessibility.					

	1	2	3	4	5
Kaupunki toteuttaa tarvittavia toimenpiteitä varmistaakseen digitaalisen osallisuuden kaikille asukkaille.					
Staden vidtar nödvändiga åtgärder för att säkerställa digital inkludering för alla invånare.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The city is taking the necessary steps to ensure digital inclusivity for all residents.					
Tarvitaan enemmän kaupungin tukea digitaalisen saavutettavuuden parantamiseksi heikommassa asemassa oleville ryhmille.					
Mer stöd från staden behövs för att förbättra den digitala tillgången för utsatta grupper.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
More city support is needed to improve digital access for disadvantaged groups..					

13. Digitaalinen saavutettavuus / Digital tillgänglighet / Digital Accessibility

	1	2	3	4	5
Turun verkkopalveluiden suunnittelu tekee niistä helppokäyttöisiä kaikille.					
Utformningen av onlinetjänster i Åbo gör dem enkla att använda för alla.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The design of online services in Turku makes them easy to use for everyone.					
Voin navigoida palveluissa ilman vaikeuksia.					
Jag kan navigera i tjänsterna utan svårigheter.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can navigate services without difficulty.					

	1	2	3	4	5
Turun digitaaliset palvelut ovat saavutettavia erityistarpeita omaaville.					
Åbos digitala tjänster är tillgängliga för personer med funktionsnedsättning.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Digital services in Turku are accessible to people with disabilities.					
En ole koskaan kohdannut esteitä käyttäessäni digitaalisia palveluita.					
Jag har aldrig stött på hinder när jag använder digitala tjänster.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have never faced barriers while using digital services.					
Digitaalisten palveluiden käyttäjäystävällisyyden parantamiseksi tarvitaan lisää kehitystä.					
Fler förbättringar behövs för att göra digitala tjänster mer användarvänliga.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
More improvements are needed to make digital services user-friendly.					

14. Digitaalisten palveluiden tunnettuus ja käyttäjäaktiivisuus / Medvetenhet och engagemang med digitala tjänster / Awareness and Engagement with Digital Services

	1	2	3	4	5
Suosin verkossa olevia kaupungin palveluja fyysisten toimistojen sijaan.					
Jag föredrar att använda stadens onlinetjänster framför att besöka fysiska kontor.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I prefer using online city services over visiting physical offices.					

	1	2	3	4	5
Olen osallistunut keskusteluihin tai tapahtumiin, jotka koskevat Turun digitaalisia palveluja.					
Jag har deltagit i diskussioner eller evenemang om digitala tjänster i Åbo.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have participated in discussions or events about digital services in Turku.					
Haluaisin olla enemmän mukana päätöksenteossa, joka koskee yhteisöni digitaalisia palveluja.					
Jag skulle vilja vara mer involverad i beslut om digitala tjänster i mitt samhälle.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would like to be more involved in decisions about digital services in my community.					
Käytän aktiivisesti mobiilisovelluksia tai verkkosivustoja, jotka liittyvät älykaupunkihankkeisiin.					
Jag använder aktivt mobilappar eller webbplatser relaterade till smarta stadsinitiativ.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I actively use mobile apps or websites related to the Smart City initiatives.					
Uskon, että asukkaiden palautetta huomioidaan, kun digitaalisia palveluja kehitetään.					
Jag tror att invånarnas feedback beaktas vid förbättringar av digitala tjänster.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I believe citizen feedback is considered when making digital service improvements.					

15. Sosiaalinen osallisuus / Social inkludering / Social Inclusion

	1	2	3	4	5
Koen, että Turun digitaaliset palvelut on suunniteltu kaikille asukkailla taustasta tai kyvyistä riippumatta.					
Jag upplever att Åbos digitala tjänster är utformade för alla invånare, oavsett bakgrund eller förmåga.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel that digital services in Turku are designed for all residents, regardless of background or abilities.					
En ole koskaan tuntenut itseäni ulkopuoliseksi käyttäessäni digitaalisia palveluita Turussa.					
Jag har aldrig känt mig exkluderad när jag använder digitala tjänster i Åbo.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have never felt excluded when using digital services in Turku.					
Kaupunki tarjoaa resursseja ja apua henkilöille, joilla on vaikeuksia digitaalisten palveluiden käytössä.					
Staden tillhandahåller resurser och stöd för personer som har svårt att få tillgång till digitala tjänster.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The city provides resources and assistance for people who struggle with digital access.					
Voin helposti käyttää ja ymmärtää Turun digitaalisia palveluita kielitaidostani riippumatta.					
Jag kan enkelt använda och förstå Åbos digitala tjänster, oavsett mina språkkunskaper.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can easily access and understand digital services in Turku, regardless of my language skills					

	1	2	3	4	5
Tarvitaan enemmän osallistavia politiikkoja digitaalisen saavutettavuuden varmistamiseksi kaikille.					
Mer inkluderande policyer behövs för att säkerställa digital tillgång för alla.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
More inclusive policies are needed to ensure digital access for all.					