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Financial Inclusion in Smart Cities in the European Union: The Role of Marketplaces and Financial Technology

Abstract

This study investigates the role of marketplaces and financial technology (fintech) in enhancing financial inclusion within the smart cities of the European Union (EU). Fintech, defined as the convergence of finance and technology, has been identified as a significant factor influencing financial inclusion. The research aims to determine how fintech can support the sustainable and balanced development goals set by the United Nations Sustainable Development Goals (UN SDGs) through the development of technology infrastructure within the smart city. The literature review provides a foundational understanding of financial inclusion and smart cities. This is followed by a comparative analysis using secondary data to examine the importance of fintech for existing smart cities in the EU. Our findings indicate that fintech substantially enhances financial inclusion in these urban settings. The social impacts observed include: reduced poverty levels, improved financial literacy, expanded access to financial services, and increased interactions between individuals and financial service providers. This study contributes to a deeper understanding of the relationship between fintech, marketplaces, and financial inclusion in the context of the EU's smart cities.

Keywords: Smart City, Financial Inclusion, Marketplaces, Fintech, Financial Services

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Financial Inclusion, Smart Cities, and UN SDGs – A Conceptual Framework From the EU Perspective

The principles of financial inclusion and smart cities, although seemingly disparate, are intricately interconnected. Financial inclusion refers to the systematic effort to ensure the general availability of reasonably priced and easily accessible financial services to all individuals, whereas smart cities are urban areas that leverage technological advancements to enhance the overall well-being and living standards of their inhabitants (Aryeetey, Chijor, 2022). As time has progressed, the importance of financial inclusion has become more widely acknowledged. It is seen as a crucial factor in stimulating economic growth, lessening inequality, and combating poverty. This recognition highlights the essential role that accessible financial services play in creating a more equitable and prosperous society. (Bianco, Marconi, Romagnoli, Stacchini, 2022). The integration of financial inclusion initiatives is a linchpin in the development and proliferation of smart cities, serving as a bridge between advanced financial systems and urban advancement (Mohanty, Choppali, Kougianos, 2016). These initiatives introduce various mechanisms that could catalyze the progress of smart cities. Particularly, the burgeoning relationship between the fintech sector and financial inclusion represents a fundamental component of contemporary financial systems. This relationship is a multifaceted one, influencing a range of outcomes from economic growth to the democratization of financial services. M. Folwarski delineates the significant impacts of this dynamic, as summarized in Table 1, aligning closely with the main thesis by demonstrating how financial technology acts as a catalyst for both economic development and the inclusive expansion of smart city infrastructures.

Table 1. Variables and Concepts of Financial Inclusion

Variable/Concept	Significance	References
Economic Growth and Education	These are key determinants of financial inclusion.	Pickens et al., 2009; Allen et al., 2016; Dai-Won et al., 2018; Grohmann et al., 2018
Use of Digital Finance	Facilitates greater financial integration.	Malady, 2016
Digital Financial Inclusion	Offers banking access to underserved populations.	Peric, 2015
Digitization of Banking	Lowers service costs, promoting financial inclusion.	Milan, 2019; Alameda, 2020; Allen, 2012

Source: Folwarski, 2021.

Smart cities, viewed through a multi-dimensional lens, are more than just an aggregate of technological advancements; they are a synthesis of theory, tangible urban developments, and policy objectives (Lytras, Visvizi, 2018; Visvizi, Lytras, 2019). As unique entities and subjects of academic inquiry, smart cities are fertile grounds for research-informed policies. Definitions of smart cities vary among OECD countries and international organisations as well as the private sector, reflecting differing geopolitical contexts and specific concerns (see Table 2).

Table 2. Selected Definitions of “Smart Cities”

National Governments	International Organizations	The Private Sector
Denmark: An evolving concept initially focused on ICT for environmental and infrastructure efficiency, now expanded to welfare areas using data and digital platforms.	European Union: Efficiency in traditional networks and services through digital and telecommunication technologies.	Smart Cities Council: Data from embedded sensors is shared via smart systems and processed into valuable services.
Latvia: A strategic approach addressing challenges and enhancing competitiveness through resource-saving measures, efficient services, societal well-being, and smart development planning.	United Nations: Emphasizes opportunities from digitalization, clean energy, and innovative transport technologies for sustainable choices and growth.	IBM: Optimal use of interconnected information for better operation control and resource optimization.
Spain: A holistic approach using ICT for quality of life, accessibility, and sustainable development, with interactive citizen-city engagement.	Inter-American Development Bank: An innovative city using ICT to improve quality of life, efficiency, and competitiveness, while considering the needs of present and future generations.	Cisco: Scalable ICT solutions that enhance efficiency, reduce costs, and improve quality of life.
United Kingdom: A process by which cities become more liveable and resilient to respond quickly to challenges.		

Source: own research based on data from OECD (2020).

As aforementioned, according to the European Commission (2014), a smart city is an urban area where digital and telecommunication technologies enhance traditional networks and services, thereby elevating residents’ quality of life and promoting economic growth. The burgeoning digital revolution in financial inclusion, propelled by the fintech-philanthropy-development nexus, offers opportunities to widen and monetize digital footprints but also raises concerns about the profiling of impoverished households (Gabor, 2017, p. 430). The use of Information

and Communication Technology (ICT) in urban areas can significantly and positively influence the lives of those residing in smart cities. (Lytras, Visvizi, 2018; Visvizi, Lytras, 2019). Financial inclusion is defined by the World Bank Group as when “individuals and businesses have access to useful and affordable financial products and services that meet their needs—transactions, payments, savings, credit and insurance—delivered responsibly and sustainably” (World Bank, 2018), possesses the capacity to contribute towards the realisation of the objective of eradicating extreme poverty and fostering shared prosperity. Moreover, it is intricately connected to a minimum of eight out of the seventeen UN SDGs (*United Nations Sustainable Development Goals*) namely: no poverty; zero hunger; good health and well-being; gender equality and women’s empowerment; decent work; economic growth and full employment; industry, innovation and infrastructure; reduced inequalities; partnerships for the goals.¹

Financial inclusion is at the centre of current global policy attention, driven e.g. by the G20, the World Bank and major development organizations (Arner, 2020). However, it is commonly observed that smart cities primarily focus on implementing initiatives that utilize digital innovation to enhance the efficiency of urban service delivery, thereby augmenting the overall competitiveness of a community. While the smart city concept continues to prioritise digital innovation, a crucial inquiry pertains to the extent to which investing in smart technology and digital advances enhances the welfare of individuals within the city (Masłoń-Oracz, Mazurewicz, p. 339). Despite Europe’s advancements, there remains a gap in the full realization of smart city potential, which led the European Commission to amalgamate the “European Innovation Partnership on Smart Cities and Communities (EIP-SCC)” and the “Smart Cities Information System (SCIS)” into the Smart Cities Marketplace. The platform aims to unite cities, companies, SMEs, investors, banks, researchers, and many other smart city players with the common goal of improving the quality of life of citizens (European Commission, 2023).

¹ SDG 1 and SDG 9 encompass initiatives that aim to enhance financial inclusion through the provision of infrastructure. Notable examples of such infrastructure include MTN, M-Pesa, TenCent, and Alipay. SDG 8 is to promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all. One potential avenue for achieving this goal is using micropayments to small and medium-sized enterprises (SMEs), which can effectively permit remote payment of workers. SDG 10: Enhancing the Impact of the Digital Divide, SDG 5, and SDG 10 aim to facilitate the provision of financial services to women and marginalised communities.

The Potential of Smart City Marketplaces in Enhancing Financial Inclusion

The proposition that fintech enhances financial inclusion is widely acknowledged. However, the actual drivers of financial inclusion – such as education, financial literacy, digital literacy, technology acceptance, security concerns, GDP, along with other macro and microeconomic factors – warrant deeper examination within the context of marketplaces for smart cities. This nuanced approach could yield more substantial insights into how smart cities can harness these drivers to foster a more inclusive economic environment.

Smart cities are positioned to weave together marketplaces, fintech and financial inclusion within their strategic blueprint, paving the way for environments that are not merely technologically progressive but also characterized by fairness and sustainability. The Smart Cities Marketplace serves as a central hub for individuals and organisations seeking assistance and facing obstacles in financing Smart City solutions. Smart cities leverage embedded technologies, open data platforms, and artificial intelligence to enhance services, mitigate congestion, and foster the development of more sustainable trajectories. The platform aims to catalyse the convergence of intelligent initiatives from across European urban centres, transforming pioneering ideas into actionable results. It stands as a collaborative market where cities, authorities, businesses, and investors come together to share expertise, establish partnerships, and drive mutual progress.

This marketplace is more than a mere aggregation of opportunities; it's a conduit for resources vital for stakeholders invested in smart city solutions. It acts as a fulcrum for support and guidance, aiding those who encounter financial obstacles in the implementation of smart city innovations. Within this ecosystem, smart cities utilize technologies like IoT (Internet of Things), open data platforms, and AI to refine services, alleviate congestion, and chart more sustainable futures.

As a subset of this ecosystem, the smart city marketplace is also poised to make significant strides in advancing financial inclusion. By leveraging the power of fintech and the collaborative nature of the marketplace, smart cities can create a fertile ground for inclusive financial growth. This fusion of innovation and inclusivity is essential for the development of smart cities that are not only efficient and responsive but also equitable and financially accessible to all citizens.

Table 3 outlines various aspects of how smart cities can facilitate financial inclusion and their respective descriptions.

Table 3. The Potential of Smart Cities in Facilitating Financial Inclusion

Aspect of Smart Cities	Description
Leveraging technology for inclusion	Employing tech solutions to reach unbanked/underbanked individuals through mobile banking services and financial literacy training via community centres.
Collaboration with financial institutions	Partnering with financial entities to create novel financial products tailored to residents' needs, like specialised savings accounts for housing down payments.
Utilisation of data	Using empirical evidence to identify and address gaps in traditional banking access within different areas.
The prospective trajectory of financial inclusion	Essential for smart city development; requiring cooperation among governments, financial institutions and tech companies for equitable financial services.
Emergence of mobile banking and payments	Significantly increases access to financial services, especially in emerging economies with low access to traditional financial services.
Utilisation of data and analytics	Applies to creating custom financial products for marginalized groups by identifying barriers to financial inclusion.
Emergence of blockchain technology	Has the potential to revolutionize the financial sector with secure, transparent financial services, advancing financial inclusion.
Mutual reinforcement of financial inclusion and smart cities	Financial inclusion and smart cities enhance each other, aiming for a globally inclusive and equitable environment through collaborative efforts.

Source: own research based on data from CITYkeys indicators for smart city projects and smart cities (Bosch, 2017).

Marketplaces and financial technology have the potential to make significant contributions to the domain of financial inclusion. The interplay among smart cities, the marketplaces they foster, and the subsequent opportunities that arise – particularly in terms of financial inclusion – is multifaceted. At the heart of the smart city concept is the financial underpinning, embodied by contemporary banking systems, which dictates the scope of activities essential for the evolution of a smart city. These smart cities, in turn, give rise to vibrant marketplaces – often referred to as “smart markets” – and the array of opportunities they offer. When these opportunities are channelled through the lens of technology and finance, they pave the way for the emergence of financial technologies and the advancement of financial inclusion.

Financial Inclusion in Smart Cities Through Fintech Companies

The utilisation of financial technology holds promise in facilitating the advancement of financial inclusion within smart cities of the European Union (IMF, 2020). Nevertheless, it is imperative to acknowledge the

existence of some obstacles that must be overcome to effectively execute these endeavours. One of the primary concerns that must be addressed are the various challenges that arise in this context. The regulatory environment presents a significant hurdle for fintech companies working within the smart city domain, as they must navigate intricate regulatory frameworks and accommodate diverse regulatory demands across different European Union member states.

The provision of digital literacy skills and access to technology is crucial to enable individuals to effectively engage with fintech solutions, hence facilitating their involvement in financial inclusion activities.

Digital and financial exclusion are inextricably linked and must be tackled in tandem for true inclusivity. According to Eurostat (2021), a considerable number of over 13 million adults inside the European Union lack access to formal financial services. In certain regions within the EU, the proportion of individuals who do not have access to banking services exceeds 30%.

Here is the figure 1 comparing the number of unbanked adults aged 15 and above in various countries for the years 2017 and 2021. The blue bars represent the year 2017, and the red bars represent the year 2021.

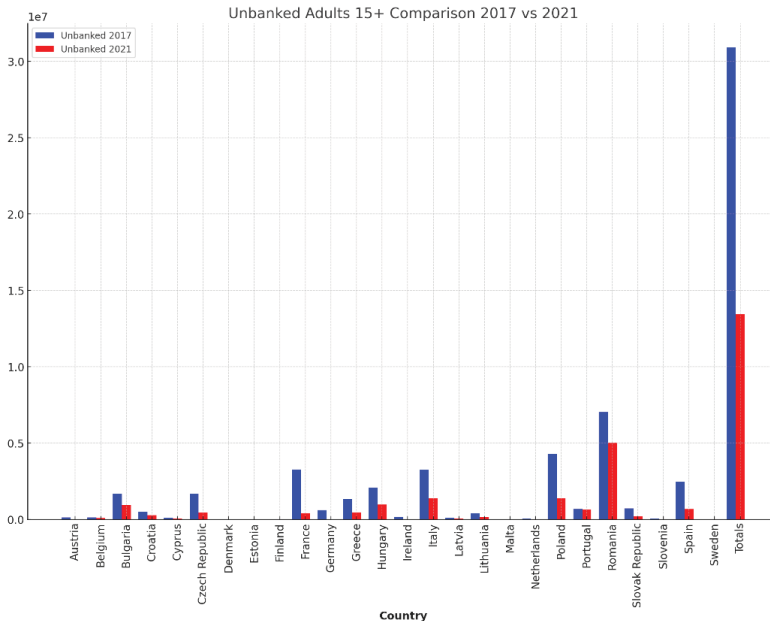


Figure 1. Financial Inclusion in EU Member States, Unbanked Adults

Sources: own calculation based on Global Findex – 2021 data on Luxembourg is missing in Global Findex so has been omitted, analysis by WSBI-ESBG.

The pandemic exacerbated these disparities, leading to an increased prevalence of digital poverty and exclusion. Furthermore, on a global scale, women constitute a majority, specifically 56 percent, of the adult population lacking access to formal banking services (Global Findex, 2021).

The aforementioned figures highlight the necessity of introducing inventive approaches to address the financial requirements of a substantial proportion of population, particularly focusing on women and marginalised groups throughout Europe, such as those with limited income.

There exists a compelling ethical argument for the imperative of equipping individuals with the necessary tools and fostering their success in the digital age. Moreover, individuals and enterprises that possess the appropriate access and competencies to engage in Europe's digital economy make substantial contributions to its economic growth and enhanced productivity.

In parallel, fintech enterprises are at the forefront of addressing this need, particularly for marginalized groups within the European Union. Recognizing the gaps in traditional banking access, fintech companies are deploying innovative strategies to bring financial products and services to those often left out.

Fintech enterprises are employing diverse strategies to deliver inventive financial products and services to marginalised groups within the European Union. Fintech companies are leveraging mobile technology to offer banking and payment services to individuals lacking access to conventional brick-and-mortar bank facilities. This holds particular significance in rural regions and among individuals with impairments. Fintech companies are employing peer-to-peer lending platforms to establish direct connections between borrowers and lenders. This alternative may prove advantageous for individuals with suboptimal credit scores or those encountering difficulties in securing a loan from a conventional financial institution. Microinsurance refers to the provision of insurance products by fintech businesses, specifically tailored to cater to the needs of individuals residing in low-income neighbourhoods, with a focus on affordability and accessibility. These items have the capacity to offer safeguarding measures against a diverse range of hazards, including natural calamities and agricultural yield deficiencies. Fintech companies are currently offering digital financial literacy materials to facilitate individuals' comprehension of financial products and services. This can assist them in making well-informed decisions on the management of their financial resources (Maurer, 2015).

Fintech companies are employing alternative data sources, such as mobile phone records and social media activity, to evaluate an individual's

creditworthiness. This can facilitate financial inclusion for those without a conventional credit history, enabling them to avail themselves of various financial services. Fintech enterprises are additionally engaging in innovation across other domains that are delivering inventive financial offerings and solutions to marginalised communities within the European Union. Banka Intesa Sanpaolo is an Italian banking institution that provides a range of digital financial literacy resources. The available materials encompass a variety of educational opportunities, such as online courses and workshops. Kreditech is a German financial technology enterprise that employs non-traditional data sources to evaluate the creditworthiness of individuals. Kreditech has established collaborative alliances with several European financial institutions to extend lending facilities to individuals lacking a conventional credit background.

The utilisation of data analytics by fintech organisations has facilitated the customization of customer service interactions. This has the potential to enhance consumer happiness and foster customer loyalty. The following are notable instances wherein fintech enterprises employ data analytics and artificial intelligence to enhance the accessibility and affordability of financial services within the European Union. Klarna is a Swedish financial technology enterprise that provides a range of payment alternatives, encompassing the buy now, pay later (BNPL) option. Klarna employs data analytics techniques to discern prospective clients who exhibit a high likelihood of expressing interest in BNPL offerings. Adyen is a Dutch financial technology enterprise that offers payment processing solutions to commercial entities. Adyen employs artificial intelligence technology to identify and mitigate instances of fraudulent activity. N26 is a financial institution based in Germany that leverages data analytics to tailor client service encounters. N26 utilises data analytics to foster the creation of novel financial products and services. Revolut is a prominent fintech enterprise headquartered in the United Kingdom, providing a diverse range of financial services encompassing banking, currency exchange, and investment. It employs artificial intelligence technology to streamline and automate the underwriting and risk assessment procedures.

The impact of this is that, with an excellent technology infrastructure, there is a great opportunity for innovation. The fintech sector thrives on it and provides products and services that allow for increased financial inclusion in Europe (see Table 3).²

² Based on 11 parameters, each of which was assigned a score out of 100 and was divided into three categories (tech infrastructure, green infrastructure, and tech jobs market). The following factors were considered: broadband download speeds, airport accessibility, number of IoT enterprises (plus the number of IoT companies per

Table 4. Technology Infrastructure (A Key Driver of Smart Cities and the Associated Marketplace) for Ten European Cities

#	City	Technology infrastructure	Green infrastructure	Tech job market	Score (out of 100)
1	London, UK	89	95	36	73.7
2	Amsterdam, Netherlands	86	88	27	66.9
3	Berlin, Germany	82	77	26	61.6
4	Paris, France	91	68	25	61.6
5	Lisbon, Portugal	78	64	29	56.9
6	Oslo, Norway	76	83	11	56.4
7	Budapest, Hungary	80	74	15	56.3
8	Dublin, Ireland	76	63	27	55.2
9	Madrid, Spain	87	54	22	54.3
10	Helsinki, Finland	77	62	19	52.4

Source: <https://proptechos.com/smart-city-index/>, based on OECD data.

The data analysis reveals a heterogeneous progression among these cities with respect to their technological infrastructure, green infrastructure, and technology job markets. Metropolitan areas such as London and Amsterdam demonstrate superior performance, exhibiting robust scores in both technological and ecological infrastructures. In contrast, cities like Oslo and Budapest manifest a differential developmental trajectory, especially in the realm of technology-related employment markets, indicating potential sectors for enhancement and strategic growth. This variation highlights the multifaceted nature of urban development and the need for tailored approaches in advancing smart city initiatives.

Conclusions

Smart city marketplaces and financial technology can play a significant role in promoting financial inclusion in smart cities. On the one hand they provide a platform for individuals and businesses to access financial services, while on the other fintech can offer innovative and cost-effective solutions for reaching underserved populations.

This is a viewpoint paper, devoid of primary data, and it was prepared by using the unstructured review of smart cities in the European Union

100,000 inhabitants), number of 5G network towers, the number of public-access EV charging stations (plus the number of public-access EV charging stations per 10,000 people), the amount of “green certified” buildings, the quantity of available tech positions. Source: <https://proptechos.com/smart-city-index/>, based on OECD data.

to present qualitatively the possible outcomes of relations between smart cities, marketplaces, fintech and financial inclusion.

The use of marketplaces and fintech can lead to increased financial literacy and capability. By providing access to financial education and tools, marketplaces and fintech can help individuals and businesses manage their finances better. Marketplaces and fintech can help reduce the cost of financial services. By eliminating intermediaries and streamlining processes, marketplaces and fintech can make financial services more affordable for everyone. They can also help create new opportunities for financial inclusion. Moreover, by targeting specific underserved populations, they can help reach people who have been traditionally excluded from the financial system. Their success in promoting financial inclusion will depend on several factors, including the availability of infrastructure, the regulatory environment, and the level of consumer adoption.

The paper examined the capacity of marketplaces and financial technology to facilitate financial inclusion within smart cities in the European Union. Marketplaces have the potential to facilitate access to financial services for marginalised communities inside the EU through many mechanisms, including the consolidation of demand and supply, cost reduction, and the provision of financial education. Fintech enterprises possess the capacity to contribute to the advancement of financial inclusion through the utilisation of data analytics and artificial intelligence AI to enhance the accessibility and affordability of financial services. The contribution of this paper is to show the impact of fintech on smart cities and, in turn, lead to more research and debate into areas such as:

- Case studies of successful financial inclusion initiatives in smart cities around the world.
- Evaluation of the fintech's impact on financial inclusion and social equity.
- Development of ethical and inclusive algorithms for financial services.
- Exploration of alternative models for funding and delivering financial services in smart cities.

Future research fields that should be considered include, but are not limited to:

1. Impact Assessment and Equity:

- Measure the actual impact of marketplaces and fintech on financial inclusion through longitudinal studies with diverse demographics in different smart cities to assess if these technologies genuinely reach unbanked and underbanked populations.

- Analyse the distributional implications. Research how the benefits and risks of these technologies are distributed across different socioeconomic groups, ethnicities, and genders. Identify and address potential biases and unintended consequences.
 - Evaluate the effectiveness of interventions. Assess the impact of policy initiatives and regulations aimed at promoting inclusive financial services in smart cities.
2. Technological Innovation and User Behaviour:
- Explore emerging fintech solutions. Investigate the potential of blockchain, AI, and other innovative technologies to further expand financial access and affordability in smart city contexts.
 - Understand user needs and barriers. Conduct surveys and interviews with target populations to understand their financial literacy, digital literacy, and trust in these technologies. Identify key barriers to adoption and develop user-centric solutions.
3. Regulatory and Policy Frameworks:
- Evaluate existing regulatory frameworks. Analyse how existing financial regulations affect the development and adoption of inclusive financial technologies in smart cities. Identify areas for improvement and recommend policy changes.
 - Promote cross-border collaboration. Encourage collaboration between EU member states to develop harmonized regulations and standards for financial services in smart cities.

Research Approaches:

- Combined methods. Utilize a mix of quantitative and qualitative methods such as surveys, interviews, focus groups, and analysis of datasets from IT providers, public institutions, and financial institutions.
- Participatory research. Involve relevant stakeholders, including citizens, financial service providers, policymakers, and researchers, in co-designing and co-conducting research to ensure its relevance and effectiveness.
- Comparative studies. Compare and contrast the approaches and outcomes of different smart cities in the EU to identify best practices and transferable lessons.

By addressing these fields and employing diverse research approaches, we can gain a deeper understanding of the role of marketplaces and fintech in achieving financial inclusion in smart cities across the EU. This knowledge can inform the development of more effective policies, technologies, and business models to ensure that everyone benefits from the opportunities of the digital age.

The paper posits that the integration of marketplaces and fintech inside smart cities in the European Union can have a substantial impact on the advancement of financial inclusion. Nevertheless, it is imperative to acknowledge the existence of certain obstacles that require attention and resolution. One such problem involves guaranteeing that individuals possess the essential digital literacy competencies and adequate technological resources to utilise these proposed remedies proficiently. The use of marketplaces and fintech can lead to increased financial literacy and capability. By providing access to financial education and tools, marketplaces and fintech can help individuals and businesses better manage their finances. Through the identification and resolution of these aforementioned difficulties, as well as the facilitation of responsible digital financial inclusion projects, smart cities within the European Union have the potential to foster a society that is more inclusive and equitable for all individuals.

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