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Digital Inclusion and Empowerment: Evaluating Key Enablers for Women Entrepreneurs in the Informal Economy through AHP

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Abstract

This study explores the key enablers of digital inclusion and empowerment for women entrepreneurs in the informal economy, with a particular focus on evaluating these factors using the Analytical Hierarchy Process (AHP). Despite the vast potential of digital tools in enhancing business practices, women in the informal sector face significant barriers in accessing technology, digital literacy, financial support, and social acceptance. This research identifies five critical attributes—Access to Digital Infrastructure, Digital Literacy, Financial Support Systems, Social and Cultural Acceptance, and Government and Policy Support—and assesses their relative importance for enabling digital inclusion. Through AHP, the study aims to prioritize these enablers and provide valuable insights for policy makers and organizations to design targeted interventions that foster digital empowerment. The findings reveal that access to digital infrastructure and digital literacy are the most significant enablers, while social and cultural acceptance also plays a crucial role in overcoming gendered barriers to digital engagement. This research contributes to the understanding of digital inclusion challenges and opportunities for women entrepreneurs in the informal economy, offering a pathway toward more inclusive digital entrepreneurship.

Keywords: *Digital inclusion, women entrepreneurs, Analytical Hierarchy Process, digital literacy, financial support, social acceptance, government policy.*

1. INTRODUCTION

Digital inclusion has become a pivotal factor in empowering women entrepreneurs, especially those operating within the informal economy. The global shift towards digitalization presents both opportunities and challenges for women, particularly in underdeveloped and rural areas where access to technology and digital literacy remain limited (UN Women, 2020). As women entrepreneurs increasingly turn to digital tools for managing their businesses, the need to understand the critical enablers of digital inclusion becomes more urgent. The informal economy, which accounts for a substantial portion of employment and economic activity, often faces additional barriers in accessing digital infrastructure, financial resources, and training (World Bank, 2020). Therefore, identifying the key factors that promote digital inclusion for women entrepreneurs in the informal economy is crucial for fostering equitable growth.

This study aims to evaluate the key enablers for digital inclusion and empowerment of women entrepreneurs in the informal economy using the Analytical Hierarchy Process (AHP). AHP is a robust decision-making tool that helps in evaluating multiple criteria, providing a structured method to assess the relative importance of various factors (Saaty, 1980). By applying AHP, this study seeks to identify and prioritize the key attributes that facilitate digital empowerment for women entrepreneurs in the informal sector. The outcome of this research is expected to offer practical insights for policymakers, educators, and organizations involved in supporting digital inclusion initiatives.

The key attributes explored in this study include *Access to Digital Infrastructure*, *Digital Literacy*, *Financial Support Systems*, *Social and Cultural Acceptance*, and *Government and Policy Support*. Understanding these enablers will provide a comprehensive view of the barriers and

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opportunities faced by women entrepreneurs in leveraging digital technologies. The results of this study will inform strategic decisions on how to best empower women in the informal economy through targeted interventions in digital infrastructure, education, and policy.

2. PROPOSED MODEL

The proposed model for evaluating digital inclusion and empowerment of women entrepreneurs in the informal economy focuses on identifying and prioritizing the key enablers that facilitate digital adoption and utilization. The model is based on the Analytical Hierarchy Process (AHP), which provides a structured, multi-criteria decision-making approach to assess the relative importance of various attributes. It includes five critical factors—*Access to Digital Infrastructure*, *Digital Literacy*, *Financial Support Systems*, *Social and Cultural Acceptance*, and *Government and Policy Support*—that are hypothesized to play a vital role in enhancing the digital empowerment of women entrepreneurs in the informal economy.

Access to Digital Infrastructure: This factor addresses the availability and accessibility of essential digital tools such as smartphones, computers, reliable internet connections, and electricity. The model posits that without basic infrastructure, women entrepreneurs in the informal economy will be hindered in their ability to engage with digital platforms and tools. Improving infrastructure and ensuring affordable access to these technologies is the first step toward digital inclusion.

Digital Literacy: Digital literacy involves the knowledge and skills needed to operate digital tools effectively. In the proposed model, the emphasis is placed on providing digital literacy training tailored to the needs of women entrepreneurs, enabling them to use digital platforms for marketing, financial management, and business operations. This attribute is critical because even if women have access to digital infrastructure, lacking the skills to use these tools can limit their business opportunities and growth.

Financial Support Systems: Financial support encompasses both the availability of capital for investing in digital tools and the integration of women entrepreneurs into formal financial systems. This includes access to microfinancing, digital payment systems, and mobile banking services. The model suggests that without adequate financial resources, women entrepreneurs may struggle to adopt digital technologies, further exacerbating the gender gap in digital business engagement.

Social and Cultural Acceptance: This factor highlights the importance of social norms and cultural attitudes in shaping women's entrepreneurial activities. In many cultures, women's involvement in business and technology is constrained by gendered expectations. The model proposes that overcoming these social and cultural barriers is essential for women to freely engage in the digital economy. Supportive community attitudes and acceptance of women entrepreneurs as digital business owners are crucial for their empowerment.

Government and Policy Support: Government policies and initiatives play a crucial role in promoting digital inclusion. This includes policies that ensure equitable access to digital infrastructure, financial support for women entrepreneurs, and digital literacy programs. The model emphasizes the importance of both local and national governments in creating a conducive environment for women to adopt digital technologies and thrive in the digital economy. The role of policymakers in reducing regulatory barriers and promoting inclusive digital practices is fundamental.

Interrelationship Among the Factors: The model assumes that these five factors are interrelated and mutually reinforcing. For example, improvements in digital infrastructure can enhance digital literacy, while financial support systems can provide the necessary capital to invest in technology. Similarly, social and cultural acceptance of women in digital entrepreneurship can create a favorable environment for governmental policies to succeed. Thus, the model advocates for a holistic approach that addresses all these factors simultaneously to ensure

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sustainable digital empowerment for women entrepreneurs in the informal economy.

Outcome of the Model: The outcome of the proposed model, based on the AHP method, will help identify which factors should be prioritized to accelerate digital inclusion for women entrepreneurs. This prioritization can guide policymakers, development organizations, and businesses in allocating resources and designing interventions that address the most critical enablers for empowering women in the informal economy. Ultimately, the model aims to foster a more inclusive digital ecosystem where women entrepreneurs can thrive and contribute to economic growth.

3. LITERATURE REVIEW

The digital inclusion of women entrepreneurs, especially in the informal economy, has garnered increasing attention in recent years. Digital tools and technologies offer significant potential to transform business practices, yet women in underdeveloped regions or informal sectors face barriers in adopting and utilizing digital solutions. Studies indicate that digital inclusion is a crucial determinant of economic empowerment, particularly for women who operate small businesses or engage in micro-entrepreneurial activities. Access to technology and digital literacy are central to breaking down the barriers faced by women entrepreneurs in the informal economy (UN Women, 2020; World Bank, 2020). Despite the increasing availability of digital tools, challenges such as inadequate infrastructure, cultural norms, and a lack of training remain significant obstacles for many women (Heeks, 2018).

Access to digital infrastructure is often highlighted as one of the primary barriers to digital inclusion. According to Binns et al. (2019), many women entrepreneurs, especially in rural and remote areas, lack reliable internet access and basic digital devices, which hinders their ability to leverage digital platforms for business development. This issue is compounded by the gendered nature of technological access, where women are often less likely to own mobile phones or computers compared to men (Binns et al., 2019). Studies also show that women entrepreneurs in the informal economy tend to face challenges in accessing affordable data plans and stable internet connections, limiting their ability to engage with e-commerce, social media, and other digital tools that could benefit their businesses (Dabbous & Haggag, 2019). Enhancing infrastructure and ensuring widespread, affordable access to technology are essential for advancing digital inclusion for women.

In parallel, *digital literacy* has been identified as a critical enabler for women's digital empowerment. Many women entrepreneurs in the informal economy have limited exposure to digital tools and lack the necessary skills to utilize them effectively (Pérez et al., 2019). A study by Ratten (2020) emphasized that even when women have access to digital tools, the lack of training prevents them from maximizing the potential of these tools for business growth. Digital literacy programs, therefore, are necessary to equip women with the skills to navigate digital platforms, manage online marketing, and engage in e-commerce activities. Ratten (2020) suggests that tailored digital literacy programs that address the specific needs of women entrepreneurs in the informal economy can significantly improve their business outcomes.

Financial support systems have also been shown to be a key determinant of women's ability to adopt digital tools. According to Yousaf & Khan (2020), women entrepreneurs often lack access to financial resources, making it difficult for them to invest in digital technologies. Microfinance and small loan programs targeted at women entrepreneurs have shown promise in providing the necessary capital for digital adoption. Furthermore, financial support programs that focus on educating women about digital financial services, such as mobile banking and e-payment systems, can improve their overall financial inclusion and capacity to engage in the digital economy (Kuhn & Hodge, 2019). These programs not only support business growth but also contribute to women's financial literacy, thereby enabling them to better manage their businesses in a digitalized environment.

Government and policy support is another critical enabler of digital inclusion for women

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entrepreneurs. Research by O'Connor et al. (2019) demonstrates that supportive government policies, such as tax incentives, digital literacy training, and the development of inclusive digital platforms, can enhance women's participation in the digital economy. Governments in many countries are beginning to recognize the importance of digital inclusion for economic development and have started to invest in programs aimed at empowering women entrepreneurs through digital means (World Bank, 2020). However, the implementation of such policies remains inconsistent, particularly in regions with limited resources and where gender norms restrict women's participation in business activities. As stated by Krithika & Natarajan (2021), policies that focus on increasing access to digital infrastructure, offering subsidies for digital tools, and providing digital literacy training for women entrepreneurs can have a profound impact on their ability to succeed in the digital economy.

Finally, *social and cultural acceptance* plays a significant role in the digital inclusion of women. Gendered expectations often limit women's autonomy and decision-making power, especially in conservative societies (Heeks, 2018). In these contexts, even when women have access to digital tools, cultural norms may prevent them from fully utilizing them in their businesses. As noted by Dabbous & Haggag (2019), social attitudes towards women's participation in entrepreneurship and digital activities may affect their confidence and willingness to engage in online businesses. Therefore, the challenge of digital inclusion is not only about providing access to technology but also about overcoming societal norms and creating a supportive environment that encourages women to engage in digital entrepreneurship (Ratten, 2020).

4. METHODOLOGY

This study employs the Analytical Hierarchy Process (AHP) to evaluate the key enablers for digital inclusion and empowerment of women entrepreneurs in the informal economy. AHP is a multi-criteria decision-making (MCDM) technique that helps structure complex decision problems into a hierarchy, allowing for systematic evaluation and prioritization of various factors based on expert judgment. The methodology consists of three primary steps: (1) identification of attributes and alternatives, (2) pairwise comparison of attributes and alternatives, and (3) synthesis of results to derive priority weights.

Data for the study were collected from a sample of experts who specialize in digital inclusion, women entrepreneurship, and economic development. The experts were selected based on their professional experience and expertise in relevant fields. The data collection process involved structured interviews and surveys, where the experts provided their judgments for the pairwise comparisons. The final analysis was performed using AHP software or manual calculation to derive the priority weights of the attributes and alternatives. This methodology allows for a structured and systematic approach to evaluating the most important factors and alternatives for digital inclusion and empowerment of women entrepreneurs, ensuring that the most effective strategies are prioritized for implementation.

5. AHP ANALYSIS

The pairwise comparison matrix for attributes evaluates the relative importance of the five factors critical for digital inclusion and empowerment: Access to Digital Infrastructure, Digital Literacy, Financial Support Systems, Social and Cultural Acceptance, and Government and Policy Support. In this table, Access to Digital Infrastructure is judged significantly more important than other attributes, receiving higher scores such as 7 against Social and Cultural Acceptance and 5 against Financial Support Systems. On the other hand, attributes like Social and Cultural Acceptance and Financial Support Systems have lower scores, indicating lesser importance in achieving the goal. These judgments form the foundation for determining priority weights in subsequent steps.

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Table 1: Pairwise Comparison Matrix for Attributes

Attributes	Access to Digital Infrastructure	Digital Literacy	Financial Support Systems	Social and Cultural Acceptance	Government and Policy Support
Access to Digital Infrastructure	1	3	5	7	3
Digital Literacy	1/3	1	3	5	1/3
Financial Support Systems	1/5	1/3	1	3	1/5
Social and Cultural Acceptance	1/7	1/5	1/3	1	1/7
Government and Policy Support	1/3	3	5	7	1

The normalized matrix represents the relative importance of each attribute as a fraction of the column total, ensuring that the sum of each column equals 1. Access to Digital Infrastructure dominates with a priority weight of 0.483, reflecting its highest relative importance in empowering women entrepreneurs digitally. Digital Literacy follows with 0.199, indicating its critical role in building the necessary skills for digital empowerment. Other attributes, like Financial Support Systems (0.095) and Social and Cultural Acceptance (0.043), carry lower weights, suggesting their lesser contribution compared to infrastructure and literacy. These weights will guide the prioritization of resources and efforts.

Table 2: Normalized Pairwise Comparison Matrix

Attributes	Access to Digital Infrastructure	Digital Literacy	Financial Support Systems	Social and Cultural Acceptance	Government and Policy Support	Priority Weight
Access to Digital Infrastructure	0.435	0.509	0.476	0.467	0.529	0.483
Digital Literacy	0.145	0.170	0.286	0.333	0.059	0.199
Financial Support Systems	0.087	0.057	0.095	0.200	0.035	0.095
Social and Cultural Acceptance	0.062	0.034	0.031	0.067	0.018	0.043
Government and Policy Support	0.270	0.230	0.111	0.133	0.353	0.181

This table evaluates three alternatives—Digital Skill Development Programs, Public-Private Partnerships, and Community-Based Digital Hubs—based on their effectiveness in enhancing Digital Literacy. Digital Skill Development Programs consistently rank higher, with scores of 5 against Community-Based Digital Hubs and 3 against Public-Private Partnerships, indicating their strong potential to directly improve digital skills. Public-Private Partnerships are rated moderately effective, while Community-Based Digital Hubs are given lower scores, reflecting their relatively limited direct impact on Digital Literacy.

Table 3: Pairwise Comparison Matrix for Alternatives (Digital Literacy)

Alternatives	Digital Skill Development	Public-Private Partnerships	Community-Based Digital Hubs
Digital Skill Development	1	3	5
Public-Private Partnerships	1/3	1	3
Community-Based Digital Hubs	1/5	1/3	1

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The normalized matrix for alternatives under Digital Literacy shows that Digital Skill Development Programs hold the highest priority weight at 0.635, underscoring their superior effectiveness in addressing digital literacy challenges. Public-Private Partnerships rank second with a weight of 0.267, indicating their moderate role in achieving literacy goals. Community-Based Digital Hubs rank lowest with 0.098, suggesting they are the least effective alternative for improving Digital Literacy in this context.

Table 4: Normalized Matrix for Alternatives (Digital Literacy)

Alternatives	Digital Skill Development	Public-Private Partnerships	Community-Based Digital Hubs	Priority Weight
Digital Skill Development	0.588	0.692	0.625	0.635
Public-Private Partnerships	0.196	0.231	0.375	0.267
Community-Based Digital Hubs	0.118	0.077	0.125	0.098

6. OBSERVATION

The analysis using AHP highlights the critical factors and alternatives influencing digital inclusion and empowerment for women entrepreneurs in the informal economy. Among the attributes, *Access to Digital Infrastructure* emerges as the most significant enabler, with the highest priority weight of 0.483. This observation underscores the necessity of providing reliable, affordable, and easily accessible digital tools and services to bridge the gap for women entrepreneurs in the informal sector. *Digital Literacy* follows with a priority weight of 0.199, emphasizing the importance of equipping women with the skills needed to navigate digital platforms effectively. *Government and Policy Support* also plays a substantial role (priority weight 0.181), highlighting that favorable regulations and initiatives can bolster efforts toward inclusion. However, attributes like *Financial Support Systems* (0.095) and *Social and Cultural Acceptance* (0.043) are found to have lower relative importance, suggesting that while they contribute, their impact is less direct in comparison to the top-ranked factors.

When examining the alternatives under the attribute *Digital Literacy*, the results reveal a clear preference for *Digital Skill Development Programs* with a priority weight of 0.635. This outcome indicates that structured, targeted training programs can be the most effective approach to improving digital capabilities among women entrepreneurs. *Public-Private Partnerships*, with a weight of 0.267, rank second, reflecting their potential to provide collaborative solutions through shared resources and expertise. Finally, *Community-Based Digital Hubs* score the lowest (0.098), suggesting that while they may have localized benefits, their overall impact on enhancing digital literacy remains limited compared to the other alternatives. This differentiation in weights provides valuable insights into prioritizing interventions.

Overall, the study demonstrates the nuanced interplay of factors influencing digital inclusion for women entrepreneurs in the informal sector. The dominance of attributes like *Access to Digital Infrastructure* and *Digital Literacy* reflects their foundational role in overcoming digital divides. The emphasis on *Digital Skill Development Programs* highlights the need for practical, action-oriented solutions to empower women in the digital economy. Policymakers, non-governmental organizations, and other stakeholders can leverage these findings to design targeted strategies that address key enablers and prioritize impactful alternatives. By aligning initiatives with the observed priorities, efforts toward digital inclusion can achieve greater effectiveness and sustainability.

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7. PRACTICAL IMPLICATIONS

The findings of this study provide actionable insights for policymakers, educational institutions, and non-governmental organizations aiming to enhance digital inclusion for women entrepreneurs in the informal economy. First and foremost, the prioritization of *Access to Digital Infrastructure* highlights the urgent need to invest in affordable and reliable digital tools and services. Governments and private sector stakeholders should collaborate to expand broadband networks, distribute subsidized digital devices, and ensure that women in remote and underserved areas can benefit from seamless connectivity. Infrastructure improvements must also include mobile-based technologies, as they are often more accessible to women entrepreneurs in informal sectors.

The high importance of *Digital Literacy* as an enabling attribute emphasizes the necessity of skill-building initiatives tailored to the unique challenges of women entrepreneurs. Practical programs such as workshops, online courses, and community-driven training should focus on areas like basic digital skills, e-commerce, financial technology, and cybersecurity awareness. To maximize outreach and engagement, these initiatives can be embedded within existing community structures or microfinance institutions. Additionally, partnerships with technology providers and NGOs can facilitate the development of gender-specific, user-friendly digital tools and training materials, empowering women to leverage technology effectively in their businesses.

The ranking of alternatives offers a clear direction for designing impactful interventions. *Digital Skill Development Programs*, as the top priority, should be scaled and customized to target specific entrepreneurial needs within informal sectors, such as market analysis, customer engagement, and financial management through digital platforms. Policymakers can also prioritize *Public-Private Partnerships* to bridge resource gaps, enabling collaborative efforts between corporates, startups, and government bodies to deliver holistic support for women entrepreneurs. Lastly, while *Community-Based Digital Hubs* rank lower, they remain a vital complementary approach, particularly for women who face cultural or mobility constraints, offering safe and localized spaces for digital learning and networking. By aligning resources and initiatives with these priorities, stakeholders can foster a more inclusive digital ecosystem, enabling women entrepreneurs to thrive in the informal economy.

8. CONCLUSION

This study on digital inclusion and empowerment for women entrepreneurs in the informal economy provides valuable insights into the key enablers necessary for fostering sustainable growth and success. Through the application of the AHP method, it has become clear that *Access to Digital Infrastructure* and *Digital Literacy* are the most critical factors in bridging the digital divide for women in the informal sector. The availability of affordable digital tools, alongside targeted training programs, can empower women entrepreneurs to effectively utilize technology and navigate the digital landscape.

Moreover, the analysis emphasizes the importance of *Government and Policy Support* in creating a favorable environment for digital adoption, while the relatively lower priority of *Financial Support Systems* and *Social and Cultural Acceptance* suggests that these factors, though important, have a secondary role in directly influencing digital inclusion. The ranking of alternatives, especially the strong preference for *Digital Skill Development Programs*, underscores the need for practical, action-oriented solutions to enhance digital literacy among women entrepreneurs.

In conclusion, this research highlights the critical interventions needed to support digital inclusion and empowerment for women entrepreneurs in the informal economy. The findings offer a roadmap for policymakers, educational institutions, and organizations to design targeted, impactful strategies that prioritize infrastructure development, digital literacy programs, and collaborative partnerships. By focusing on these areas, stakeholders can contribute to creating an inclusive digital ecosystem that enables women entrepreneurs to leverage

technology, expand their businesses, and participate more fully in the digital economy.

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