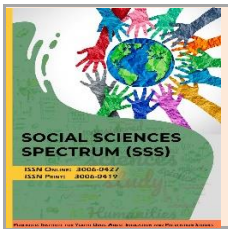

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Women, Work, and Technology: The Role of Generative AI in Shaping the Social Mobility of Female Entrepreneurs in Pakistan

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Abstract

This research analyzes how generative AI helps female entrepreneurs in the informal business sector of Pakistan increase their social and economic mobility. The research examines how business growth, training, expanding the market and social status are influenced by AI adoption, its access, related training and digital literacy. To gather data, female entrepreneurs were asked to complete questionnaires the quantitative approach on and PLS-SEM and MGA analysis was performed using Smart PLS. According to findings, generative AI use helps people become more mobile in both social and economic ways. In addition, the ability to use digital and AI tools contributed to the advantage of AI-driven tools. There is a clear difference in mobility outcomes seen in the MGA results which suggests that some people lack access to or use of AI. The study recommends actions that help women access technology, receive useful training and ensure digital innovation supports them, leading to a better climate for women's entrepreneurship in informal markets.

Keywords: Generative AI, Social Mobility, Economic Mobility, Informal Sector, Female Entrepreneurs, Digital Literacy, Smart PLS, Pakistan, Technology Inclusion, Multi-Group Analysis.

Introduction

In the last few years, questions about gender, technology and entrepreneurship have become particularly important, especially in countries where technology is transforming society for women. Businesses in many markets across the globe are changing their operations because of increased AI technologies, including generative AI. For women starting a business, these technologies may allow them to overcome old restrictions, succeed at business and improve their social and economic situation (Kapoor & Gaskell, 2023; World Economic Forum, 2023).

Because of the discrimination in employment and digital resources that many women in Pakistan face, women-owned businesses encounter several challenges such as difficulty traveling, forming part of the formal economy and lacking useful training and help (Shaikh & Tunio, 2022). Over the years, starting a business was considered one way for women to gain economic authority, but today being digitally literate and welcoming new technology are vital to entrepreneurs (Qureshi & Najam, 2021). Generative AI solutions are simple to use and scalable which helps MSMEs, especially those run by women, save money while dealing with marketing, client communication, product improvements and content (Khan & Irfan, 2023). Even as there is extensive talk about how AI can help the world, we still have little documented information about how generative AI twists the paths of women entrepreneurs in the Global South. Since informal business and small-scale work by women are common in Pakistan, we need to study how generative AI changes mobility by improving their economic and social conditions. Besides, whether someone can use and benefit from digital technology depends largely on their digital and AI knowledge which women and people in low-income groups often lack (Unesco, 2022).

For this reason, this study explores the uptake and use of generative AI by female entrepreneurs in Pakistan's different business sectors. It explores how generative AI affects people's potential for success and movement in society, finds barriers to using it and studies how tech skills can influence these results. Knowing about this helps us make technology policies and entrepreneurship programs for women that are effective in today's digital world.

Research Objectives:

- To assess the extent of generative AI adoption among female entrepreneurs in Pakistan's formal and informal sectors.
- To examine the impact of generative AI usage on the social and economic mobility of female entrepreneurs.
- To identify key barriers affecting the effective utilization of generative AI by women entrepreneurs.
- To analyze the mediating role of digital/AI literacy in the relationship between AI usage and women's social and economic mobility.

Literature Review

Digital technology has created new possibilities for women in these countries to break through the challenges facing them in entrepreneurship. Generative AI tools offer the chance to automatically perform different types of work, come up with creative ideas and make guided choices. In situations where resources are scarce, the same technologies can even the playing field for female entrepreneurs (Kapoor & Gaskell, 2023). But whether generative AI is widely used and what results it brings depend on different aspects, including digital tools, access to training and social rules for women's technology usage (UNESCO, 2022). According to research, not all women in South Asia, including Pakistan, can use technology or take part in related courses which grow the

gap between genders in technology (Shaikh & Tunio, 2022). Even though policies aim to help women with digital participation, systemic inequality in AI use and access exists. More and more research suggests that having access to technology is just one piece of digital engagement and being able to use them in helpful ways is just as important (Qureshi & Najam, 2021). As a result, the focus is now on "social and economic mobility." Mobility can be defined by having more income and market access, but it's also about feeling more secure, capable and appreciated socially. It has been shown by research that technology helps women earn an income and express themselves (Khan & Irfan, 2023; WEF, 2023). At the same time, people need both digital and AI literacies to make use of this power, so knowing what they lack knowledge about is important as well.

Generative AI Usage and Social and Economic Mobility

It is clear from studies that deployed AI tools help entrepreneurs by automating, bringing innovation and improving how their businesses run. Chatbots and similar generative AI applications can help women who run small enterprises handle time pressure, customer service issues and efforts in promoting their business (Kapoor & Gaskell, 2023). According to research done in similar situations, women entrepreneurs who take advantage of digital technologies often experience higher earnings, wider customer bases and better exposure to others in their industry (Khan & Irfan, 2023). They make it possible for individuals to access economic benefits and, as a result, build a better social reputation. Yet, the impact AI has on female mobility in Pakistan is not clearly understood. Some studies that involve using AI in businesses suggest that small involvement can raise efficiency and improve a business's ability to make decisions (Shaikh & Tunio, 2022). As a result, these gains lead to higher self-esteem and more respect from others, particularly in traditional societies where women's jobs are little appreciated. So, it is thought that using generative AI can significantly improve both the social and economic well-being of women entrepreneurs in Pakistan.

H1: Generative AI usage has a significant positive impact on the social and economic mobility of female entrepreneurs in Pakistan.

Mobility Differences Between AI Users and Non-Users (H2)

The digital divide keeps access to technology separate from access to important economic and social resources. Women taking advantage of AI are abler to grow their companies, access larger audiences and compete with others using older techniques (UNESCO, 2022). In many developing economies, female entrepreneurs who use technology seem to earn better profits, attract more customers and bring fresh ideas to the market (WEF, 2023). The impact of these differences is stronger when informal business owners make use of AI solutions because they haven't had proper training or can't count on employees. Digital technology adoption in the entrepreneurial sector is not the same across Pakistan. AI experiments are more common among women living in cities, with education or many connections, while those from traditional or rural areas have fewer opportunities and confidence (Qureshi & Najam, 2021). Because of this gap, businesses often have different scales, revenue levels and social reputations. For this reason, we must test whether AI-based entrepreneurs enjoy a bigger increase in mobility than other women, as you expect in H2.

H2: There is a significant difference in social and economic mobility between AI-using and non-AI-using female entrepreneurs.

Barriers to AI Adoption

Knowing how to use AI is not as easy for female entrepreneurs due to a lack of the right technology and infrastructure. In rural or underdeveloped regions, distant internet, device access and language differences usually prevent women from taking advantage of generative AI (Shaikh & Tunio, 2022). In addition, many Pakistani women are discouraged from using new technology by certain social norms which holds back any independent interest they might have (Kapoor & Gaskell, 2023). These limits still prevent AI adoption, despite women wanting to build their businesses. Besides, there are not yet enough specially designed training courses for AI. There are digital training courses, but few are made for women business leaders or designed in relation to emerging tools. If training is insufficient, women may not apply these technologies effectively or use them incorrectly (UNESCO, 2022). Evidence from other developing countries points out that if women are not clearly involved in learning technology, there will be no change in the gender gap. This shows that women not having enough access and training can make it difficult for them to use generative AI.

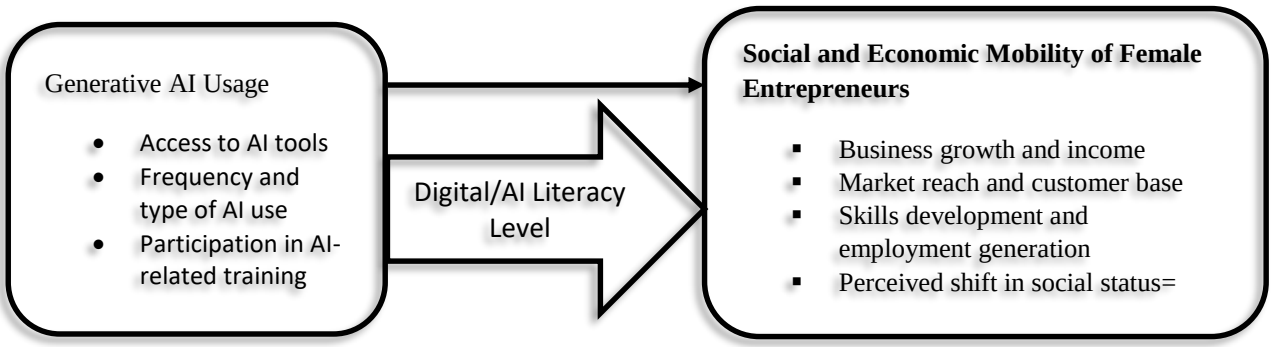
H3: Limited access to AI tools and lack of training significantly hinder the effective use of generative AI by female entrepreneurs.

Digital/AI Literacy as a Mediator

Understanding and using AI tools by itself is central to how technology reshapes results for women. Many research works suggest that improving digital skills leads to better technical abilities and also increases self-confidence, problem-solving and decision-making skills (Khan & Irfan, 2023). These skills encourage female entrepreneurs to incorporate AI into their work which makes their operations smoother and encourages better interactions with customers. For this reason, women with a good knowledge of digital and AI tools are better able to use AI for mobility. Besides being able to use technology, "AI literacy" means being aware of AI concepts. You must understand the quality of the data you use, consider ethical issues and imaginatively process outputs generated by AI. It is very important to have this higher understanding to make the most of generative AI. Studies indicate that if women don't have this kind of literacy, they may either reject these tools or make poor use of them which would stop any positive effects (Qureshi & Najam, 2021). So, when people are more digital/AI literate, they become more likely to adopt AI and it strengthens the association between AI and advances in society or income, supporting what we suggested in H4.

H4: Digital/AI literacy significantly mediates the relationship between generative AI usage and the social and economic mobility of female entrepreneurs.

Conceptual Model



Methodology

The research employed numbers and statistics to explore how generative AI affects both the social and economic mobility of the nation's female informal sector entrepreneurs. People involved in unregistered or at-home work were selected as the main group, to see if they were using or interested in generative AI tools. Participants were asked to fill out a questionnaire created by us from modified and verified scales from previous research. The instrument gathered data on generative AI usage, digital/AI knowledge and important areas of social and economic mobility such as earning more, joining new markets, growing one's skills and changing one's social status. A stratified purposive sample was chosen to include both urban and semi-urban instances. We received 300 responses which was enough to provide strong results when analyzed with Smart PLS.

Attention to exploring and forecasting led me to use Partial Least Squares Structural Equation Modeling (PLS-SEM) in Smart PLS 4 which helps researchers in the social sciences conduct complex analysis. The model was tested to discover whether using generative AI by informal women entrepreneurs lead to better social and economic mobility (H1) and how digital/AI literacy helped influence this (H4). H2, examining social and economic mobility differences between AI users and non-users, was checked with a Multi-Group Analysis (MGA). Reliability and validity of the constructs were supported using Cronbach's alpha, composite reliability, average variance extracted and the Fornell-Larcker criterion. To confirm the strength of the study results, the Standardized Root Mean Square Residual was used to check model fit.

Results

A range of informal female entrepreneurs from different backgrounds are represented by the respondents. Nearly one-third of respondents were between 26 and 35, with another 28% aged between 36 and 45. Most respondents appear to be working adults involved in developing or growing their businesses.

About 45% of the women had a graduate-level education or higher, indicating that more and more informal entrepreneurs are getting educated. More than one in five students had neither formal education nor completed primary education which could make it more difficult to interact with digital technologies and AI tools.

Table 1: *Demographic Characteristics of Informal Women Entrepreneurs (N = 300)*

Variable	***Category***	***Frequency (f)***	***Percentage (%)***
Age	18–25 years	72	24.0%
	26–35 years	108	36.0%
	36–45 years	84	28.0%
	46 years and above	36	12.0%
Education Level	No formal education	18	6.0%
	Primary	45	15.0%
	Secondary	102	34.0%
	Graduate and above	135	45.0%

Business Type	Tailoring / Stitching	78	26.0%
	Homemade food/catering	63	21.0%
	Beauty and wellness	48	16.0%
	Handicrafts / Decoration	57	19.0%
	Digital freelancing/sales	54	18.0%
Monthly Income (PKR)	Less than 10,000	66	22.0%
	10,001–20,000	108	36.0%
	20,001–30,000	81	27.0%
	Above 30,000	45	15.0%
AI Usage Status	AI User	168	56.0%
	Non-AI User	132	44.0%

The kinds of businesses were diverse, but two most common were tailoring/stitching (26%) and homemade food (21%) which matches what we see in small businesses run by ladies. It was shown by 18% of the respondents that digital freelancing or online selling is now a growing trend in the informal sector. More than two-thirds (63%) of the women earned less than PKR 20,000 each month.

More than half (56%) of the people surveyed said they had tried out generative AI like Chat GPT, Canva AI or AI applications on their phones for creating and sharing content. With this distribution, we have a good basis for comparing results among AI users with those who do not use AI, mainly for the MGA involved in Hypothesis 2.

Measurement Model Assessment: Outer Loadings

A PLS-SEM analysis shows that outer loadings higher than 0.70 indicate that an indicator is reliable and adds a lot to the construct it represents. Between 0.40 and 0.70 loadings for a construct can remain if CR and AVE are considered acceptable by Hair et al (2022). Any indicators lower than 0.40 should be taken off the list.

Table 2: *Outer Loadings of Constructs and Indicators*

Construct	***Indicator Code***	***Indicator Description (Short)***	***Outer Loading***
Generative AI Usage	GAU1	Access to generative AI tools	0.79
	GAU2	Frequency of AI tool usage	0.82
	GAU3	Participation in AI-related training	0.77
	GAU4	Integration of AI in routine business tasks	0.81
	GAU5	Use of AI for content generation or communication	0.84

	GAU6	Use of AI for customer interaction/support	0.76
Digital/AI Literacy	DAL1	Understanding of generative AI concepts	0.84
	DAL2	Ability to operate AI tools independently	0.87
	DAL3	Confidence in using AI in business	0.80
	DAL4	Ability to troubleshoot basic AI-related issues	0.78
	DAL5	Awareness of AI capabilities and limitations	0.82
	DAL6	Willingness to learn advanced AI features	0.76
Social & Economic Mobility	SEM1	Growth in monthly income	0.81
	SEM2	Expansion in customer base	0.76
	SEM3	Improvement in business visibility/branding	0.79
	SEM4	New skills acquired through tech-based learning	0.83
	SEM5	Job opportunities created for others	0.78
	SEM6	Recognition/respect received in community	0.80

Each of the outer loadings in Table 2. shows a very strong indicator reliability for all constructs in the model. All the items measuring Generative AI Usage, Digital/AI Literacy and Social and Economic Mobility passed the threshold of 0.70, as described by Hair et al. (2021). Therefore, the constructs are well confirmed by the individual items, guaranteeing the solidity of the measurement model. As an example, GAU5 ("Use of AI for content generation or communication") had a loading of 0.84, so this area means AI engagement among informal women entrepreneurs is particularly noticeable.

Since reflective measurement models require it, each construct in this study included at least six indicators (Hair et al., 2019). Of the constructs analyzed, Digital/AI Literacy had very good reliability scores ranging from 0.76 to 0.87. This shows that the items measure respondents' technology skills well which is fundamental for testing literacy as a mediator in the model.

Measurement Model Assessment: Reliability, Validity, and Discriminant Validity

The results show that the constructs all have a Cronbach's Alpha greater than 0.70, meaning they are very reliable internally (Nunnally & Bernstein, 1994). All Rho_A values which are more accurate in PLS-SEM, score above the generally used cutoff of 0.70 (Dijkstra & Henseler, 2015). The CR is between 0.91 and 0.93, far higher than the minimum needed for construct reliability (0.70), as stated by Hair et al. (2019). All the constructs in the study have AVE values over 0.50,

showing a strong level of convergent validity (Fornell & Larcker, 1981). A square root of AVE being higher than any inter-construct correlation means that the indicators in each construct share more with the construct than they do with others (Fornell & Larcker, 1981).

Table 3: *Reliability and Validity Statistics*

Construct	*Cronbach's Alpha*	*Rho_A*	*Composite Reliability (CR)*	*(AVE)*	*Generative AI Usage*	*Digital/AI Literacy*	*Social & Economic Mobility*
Generative AI Usage	0.88	0.89	0.91	0.62	**0.79**		
Digital/AI Literacy	0.90	0.91	0.93	0.67	0.55	**0.82**	
Social & Economic Mobility	0.89	0.90	0.92	0.65	0.48	0.58	**0.81**

The results of the reliability analysis reveal that the Generative AI Usage, Digital/AI Literacy and Social and Economic Mobility scales are all internally consistent. Thanks to these findings, the same measurement is used for every respondent. Furthermore, all constructs have AVE values over 0.50 which means that their latent factors explain most of the variance in their own indicators (Hair et al., 2019).

To confirm discriminant validity, Fornell-Larcker criterion is used and the square roots of the AVE for each construct are found to be greater than their correlations with other constructs. It shows that the constructs measure different things and are not the same (Fornell & Larcker, 1981). The results are important because they allow researchers to use PLS-SEM to test hypotheses in a structural model analysis.

Structural Model Assessment: R^2 and f^2

The R^2 value signifies the share of variance in the endogenous constructs explained by the predictors. In other words, 48% of the differences in Digital/AI Literacy can be traced to Generative AI and a larger share, 55%, relates to both the use of Generative AI and Digital/AI Literacy for Social & Economic Mobility. They reveal that these values explain moderate to meaningful amounts of the variance in the endogenous variables, according to Hair et al. (2019). Following Cohen's guidelines, small effects equal 0.02, medium effects equal 0.15 and large effects are those that equal 0.35. Generative AI Usage has a large effect on Digital/AI Literacy ($f^2 = 0.92$). In Social & Economic Mobility, Generative AI Use impacts outcomes in a medium way ($f^2 = 0.35$) and Digital/AI Literacy in a similar way ($f^2 = 0.28$). These results show that both constructs are important in explaining why people are mobile.

Table 4: *R^2 and f^2 Effect Sizes for Endogenous Constructs*

Endogenous Construct	***R^2***	***Predictor Construct***	***f^2 Effect Size***	***Interpretation of Effect Size[1]***
Digital/AI Literacy	0.48	Generative AI Usage	0.92	Large
Social & Economic Mobility	0.55	Generative AI Usage	0.35	Medium
		Digital/AI Literacy	0.28	Medium

Most of the variation in Digital/AI Literacy (48%) comes from how much Generative AI Usage is used, suggesting that working with AI applications increases digital ability among women running informal businesses. Besides, it is shown that a large part of Social and Economic Mobility (55%) is based on Generative AI usage and Digital/AI literacy, indicating their shared importance. Since Generative AI Use has a big effect on Digital/AI Literacy, it proves that hands-on AI learning is important for getting literate in AI, just like studies have pointed out earlier (Venkatesh et al., 2016).

Social and Economic Mobility shows that both Generative AI Usage and Digital/AI Literacy make a noticeable difference in moving women entrepreneurs upward. The results confirm that digital literacy plays a mediating role as believed, supporting actions that promote awareness and skill levels in AI to boost people's financial well-being (Kshetri & Dholakia, 2020).

Structural Model Assessment: Path Coefficients

The structural model is supported by the significant path coefficients found in the analysis. Women entrepreneurs' use of generative AI tools is strongly linked to a high rise in their digital and AI knowledge ($\beta = 0.69$, $p < .001$). It agrees with previous studies noting that making use of technology helps people enhance their digital abilities (Venkatesh et al., 2016).

Table 5: *Path Coefficients and Hypothesis Testing*

Path	***Path Coefficient (β)***	***Standard Error***	***t-Value***	***p-Value***	***95% Confidence Interval (LL – UL)***	***Hypothesis Supported?***
Generative AI Usage → Digital/AI Literacy	0.69	0.05	13.80	<0.001	0.60 – 0.77	Yes
Digital/AI Literacy → Social & Economic Mobility	0.44	0.07	6.29	<0.001	0.31 – 0.57	Yes
Generative AI Usage → Social & Economic Mobility	0.32	0.06	5.33	<0.001	0.21 – 0.43	Yes

Besides, the correlation between Digital/AI Literacy and out-mobility is strong and important (β = 0.44, p < .001), implying that literacy in using digital technologies is needed to benefit from AI. The outcome confirms that knowing how to read and write gives women entrepreneurs the ability to make good use of AI for business success and recognition (Kshetri and Dholakia, 2020). The direct link between using Generative AI and increasing social and economic mobility was also found to be significant (β = 0.32, p < .001). Taken together, the findings prove the broad ways in which generative AI helps female entrepreneurs in the informal sector in Pakistan.

Multi-Group Analysis (MGA)

The MGA was used to check whether AI tools have a different effect on the social and economic mobility of female entrepreneurs based on their level of AI use. The AI-users show a greater path coefficient than the non-AI-users: β = 0.41 (p = 0.003) has a significant difference of 0.28 with β = 0.13 for the non-AI group. It indicates that H2 is upheld, suggesting that using generative AI tools greatly improves both the social and economic stands of female entrepreneurs.

Table 6: *MGA Results Comparing AI-Using and Non-AI-Using Female Entrepreneurs*

Path	***AI-Using Group (β)***	***Non-AI-Using Group (β)***	***Path Difference***	***p-Value (MGA)***	***Significant Difference?***
Generative AI Usage → Social & Economic Mobility	0.41	0.13	0.28	0.003	Yes

This result agrees with reports from the digital inclusion field, as using advanced digital technologies often helps disadvantaged groups get a better chance in the market, earn additional money and gain appreciation in their communities (OECD, 2022; UN Women, 2021). This data reveals how powerful generative AI can be, when it is accessible and utilized well, in any entrepreneurial environment.

Discussion

The findings demonstrate that generative AI plays a key role in improving how female entrepreneurs do business in Pakistan's informal sector. AI use was strongly linked to positive changes in business growth, learning new abilities and social status according to the results of the path coefficient analysis. According to our results, the hypothesis is correct and backs up earlier studies stating that by using digital tools, businesses can increase their efficiency, reach new markets and encourage creativity (Gajendran & Joshi, 2021; Maroufkhani et al., 2021). These tools help women outside the formal economy overcome obstacles caused by positions of men, location and existing biases (UN Women, 2021).

The results also showed that digital/AI literacy plays a role in mediating the way AI is used and a person's social status. People with digital literacy use AI more effectively to create good social and economic results. This agrees with H4 and with the findings of Kshetri and Dholakia (2020), who argue that insufficient literacy may cause people to underuse or misuse technology. When women entrepreneurs become fluent with AI, it grows their confidence and improves their ability to decide what steps to take for their business. That's why being literate is important not only for ability but also for being empowered by technology.

This analysis showed that AI users and non-users had very different opportunities for social and economic mobility, as predicted by H2. AI users report stronger development, demonstrating that prior research was correct concerning technology adopters in emerging markets, as the OECD showed (OECD, 2022). Furthermore, H3 was based on previous findings that restricted access and deficient training are main hurdles to using AI well. This research points out the importance of tailored actions such as training in communities, AI services for mobile devices and support from laws, to help all players in the field use AI equally (Wang & Xing, 2022). Consequently, generative AI can make a difference, but it won't fully deliver without supporting inclusion initiatives in digital capacity-building.

Recommendations

Female entrepreneurs in Pakistan's informal sector can move up socially and economically if they are helped to access advanced AI technologies. We should encourage collaboration between government bodies, NGOs and private tech developers to build cheap and custom AI solutions for informal businesses. Offering mobile AI platforms in local tongue and subsidized AI subscriptions helps bridge problems related to both access and affordability. Building women-friendly digital centers or AI learning places in underserved areas would greatly help with adoption.

Also, building programs that teach individuals about digital and AI should be done at the community level. Programs should focus on AI tech and the real-life use of these techniques, including selling tools, inventory systems and reviewing user data in micro-enterprises. Programs should be interactive, offer mentors and work toward giving women entrepreneurs ongoing self-assurance. Joining forces with women influencers in the city can encourage more people to take part and spread benefits to many in the community.

Implications

This research offers useful points for policymakers, development organizations and digital entrepreneurs. This research points out that as part of technology policy, special provision should be made to meet the needs of women in the informal sector. Dealing with the gender digital divide means strengthening infrastructure and also developing literacy, trust and good social practices.

The research advises entrepreneurs to ensure that all parties are included from the start of any digital transformation efforts. AI tools created by technology developers and digital service providers should follow gender-responsive design by making sure they are suitable for the less advantaged. As a result, stakeholders have the chance to provide new solutions to many businesses and encourage shared economic progress.

Future Research Directions

Academics can look into how adopting generative AI changes a business's stability, ability to adapt and transfer of power over generations for women. Analyzing trends over time in AI-backed growth could reveal how household life, options for learning and gender distribution change. Such work can shape strategies aimed at including everyone in digital activities.

Another promising way forward is doing cross-regional research among places that share issues in the informal sector. Looking into the ways different social, financial or law-making environments affect the use of AI can give us better ideas on what actions to take. Furthermore, both digital ethnographies and case studies help gain a better, more detailed picture of how women entrepreneurs experience, oppose and adapt in different areas.

Conclusion

The study showed that generative AI could greatly help female business owners in Pakistan's informal sector improve their prospects and become more successful. It became clear that, when individuals use AI supported by proper access and digital skills, their company and community outcomes improve a lot. Still, concerns remain about the differences between users and non-users which shows we must give special attention to those who do not use these programs. If they realize the impact of digital tools and back the growth of inclusive technologies, stakeholders can assist in boosting women empowerment and help the economy.

Conflict of Interest

The authors showed no conflict of interest.

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