

Digitalization and Employment among Small and Medium Enterprises in Ghana

Esther Azigi ^a , Priscilla Twumasi Baffour ^b  

ABSTRACT

Purpose – Digitalization is transforming the world of work in significant ways that are yet to be examined. Rapid proliferation of digital technologies is reshaping industries and altering traditional modes of production and service delivery with important implications for employment, particularly among small and medium-sized enterprises that are central to employment generation in developing countries.

Design/data/methodology – Using the latest round of the World Bank Enterprise Survey (2022) on Ghana, this study draws on the theoretical frameworks of labour market matching theory and skill-biased technological change to investigate the relationship between digitalization and employment, and the demand for skilled labour among small and medium scale enterprises (SMEs) in Ghana.

Findings – Findings indicate a significant positive relationship between digitalization and employment levels among SMEs in Ghana, while a negative relationship is observed between digitalization and skilled labour.

Originality/value – The study contributes to the literature by emphasizing the potential transformative impact of digitalization in employment generation.

Keywords: Digitalization, Employment, Enterprises, Ghana

Gana'daki Küçük ve Orta Ölçekli İşletmeler Arasında Dijitalleşme ve İstihdam İlişkisi

ÖZET

Amaç – Dijitalleşme, henüz incelenmemiş önemli şekillerde çalışma dünyasını dönüştürüyor. Dijital teknolojilerin hızla yayılması, endüstrileri yeniden şekillendiriyor ve istihdam için, özellikle gelişmekte olan ülkelerde istihdam yaratmada merkezi bir rol oynayan küçük ve orta ölçekli işletmeler arasında önemli etkileri olan geleneksel üretim ve hizmet sunum biçimlerini değiştiriyor.

Tasarım/veri/metodoloji – Gana'daki Dünya Bankası İşletme Anketi'nin (2022) son turunu kullanan bu çalışma, dijitalleşme ile istihdam arasındaki ilişkiyi ve Gana'daki küçük ve orta ölçekli işletmeler (KOBİ'ler) arasında kalifiye işgücüne olan talebi araştırmak için işgücü piyasası eşleştirme teorisi ve beceri odaklı teknolojik değişimin teorik çerçevelerinden yararlanıyor.

Bulgular – Bulgular, Gana'daki KOBİ'ler arasında dijitalleşme ile istihdam düzeyleri arasında önemli bir pozitif ilişki olduğunu, dijitalleşme ile kalifiye işgücü arasında ise negatif bir ilişki olduğunu gösteriyor.

Özgünlük/değer – Çalışma, dijitalleşmenin istihdam yaratmadaki potansiyel dönüştürücü etkisini vurgulayarak literatüre katkıda bulunuyor.

Anahtar Kelimeler: Dijitalleşme, İstihdam, İşletme, Gana

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^a Master's student, University of Ghana, Department of Economics, estherazigi95@gmail.com, Accra, Ghana;

^b University of Ghana, Department of Economics, ptbaffour@ug.edu.gh, Accra, Ghana;

Corresponding Author: Priscilla Twumasi Baffour, ptbaffour@ug.edu.gh



1. Introduction

The global economy has witnessed rapid proliferation of digital technologies in recent times, reshaping industries and altering traditional modes of production and service delivery (Baffour et al., 2018). This phenomenon of digitalisation has become increasingly relevant in developing economies like Ghana, where the adoption of digital technologies holds significant potential for economic growth and structural transformation (Arthur et al., 2024). This notwithstanding, the impact of digitalisation on employment dynamics, particularly among small and medium enterprises (SMEs) who constitute the backbone of many developing countries remains topical as researchers unravel it with important implications for policy.

As noted by Muntaka et al. (2023), integration of digital technologies into production processes often lead to increased productivity and efficiency gains in firms. These advancements can result in changes in the demand for labour, with some studies indicating a potential displacement of low-skilled workers as routine tasks become automated (Atiase et al., 2022). However, the literature also points to the emergence of new job opportunities driven by digitalisation, particularly in areas requiring advanced technical skills and digital literacy. For instance, the expansion of e-commerce platforms and digital marketing strategies has created demand for professionals with expertise in online sales and digital advertising (Baffour et al., 2022).

Moreover, the effects of digitalisation on skilled workers among SMEs is inconclusive due to limited empirical evidence, particularly in developing countries. While digital technologies may augment the capabilities of skilled workers by enabling them to perform tasks more efficiently or engage in higher value-added activities, there are concerns about the potential polarisation of the labour market (Smits et al., 2022). Although skilled workers proficient in utilising digital tools and analysing complex data may experience increased demand and higher wages, there is the risk of exacerbating inequality if the benefits of digitalisation accrue disproportionately to those with advanced skills, leaving behind those with limited access to training or education in digital technologies (Smaldone et al., 2022).

Additionally, the extent to which digitalisation contributes to job creation among SMEs in a developing country such as Ghana depends on various factors, including the pace of technological adoption, supportive regulatory frameworks, and investments in human capital development. Evidence from Baffour et al (2022) suggests that while digitalization has the potential to enhance the competitiveness of firms and stimulate economic growth, its benefits across different segments of the workforce may not be evenly distributed. Addressing skill mismatches and promoting inclusive digitalisation strategies are essential for maximizing the positive impacts of technological advancements on employment outcomes and fostering sustainable development in Ghana.

Existing literature such as Dou et al. (2023) and Laar et al (2023), highlight the

potential of digital technologies to improve productivity, efficiency, and competitiveness within firms. Despite the growing body of research on digitalisation in Ghana, evidence regarding its effect on employment dynamics, particularly with the SMEs ecosystem remain scanty. While some studies such as Mura and Donath (2023) and Kusairi et al. (2023) have examined the overall effects of digitalisation on productivity and economic growth, there is limited research that focuses specifically on its implications for employment and skill requirements.

As a result, this paper seeks to answer the following research questions;

- What relationship exists between digitalisation and employment at the SME level in Ghana?
- Is there a relationship between digitalisation and the demand for skilled labour by SMEs in Ghana?

Due to the limited knowledge regarding the effects of digitalisation on employment, particularly in small businesses, this study contributes to the literature by examining the relationship between digitalization and employment by SMEs in Ghana and ask if digitalization is important in the demand for skilled labour (defined as the number of workers with ICT skills).

The following presents the structure of the paper. Section 2 presents the literature review followed by empirical strategy and data in section 3. Section 4 details out the empirical findings. Section 5 discusses the findings and presents the policy recommendations. Section 6 provides the conclusion).

2. Literature Review

2.1. Theoretical channels through which digitalization influences employment

Digitalisation serves as a fundamental concept within the broader discourse on economic development and industrial transformation, transcending geographical boundaries to impact industries and societies worldwide (Urbaniec & Žmija, 2022). It represents the pervasive integration of digital technologies, such as artificial intelligence, machine learning, and internet-enabled devices, into various aspects of economic activities, including manufacturing, services, and commerce. This process fundamentally alters traditional modes of production, distribution, and consumption, reshaping business models, market dynamics, and labour markets in the process (Fernández-Macías, 2018).

At its core, digitalisation holds the promise of enhancing efficiency, productivity, and innovation across industries (Warhurst & Hunt, 2019). By harnessing the power of digital technologies, businesses can streamline operations, optimise resource utilisation, and respond more effectively to market demands. For instance, the adoption of advanced robotics and automation systems in manufacturing enables firms to achieve higher levels of precision, speed, and customisation in production processes. Similarly, service-oriented industries leverage digital platforms and data analytics to deliver personalised

experiences, optimize service delivery, and cultivate customer loyalty.

Arsić, (2020) argued that digitalisation catalyses the emergence of new economic opportunities and business models, disrupting traditional paradigms and fostering entrepreneurship and innovation. Digital platforms, such as e-commerce marketplaces, ride-sharing apps, and freelance platforms, enable individuals and businesses to connect, collaborate, and transact on a global scale, democratising access to markets and empowering small-scale entrepreneurs and freelancers. This phenomenon has fueled the growth of the gig economy, characterised by flexible work arrangements and digital-enabled income generation, thereby expanding economic participation and employment opportunities (Onyango, 2023).

However, the advent of digitalisation also raises significant challenges and concerns, particularly regarding its impact on employment dynamics and labour markets. While digital technologies create new job roles and skill requirements, they also have the potential to automate routine tasks and displace certain categories of workers, leading to job polarisation and structural unemployment (Freddi, 2018). Moreover, disparities in access to digital infrastructure, education, and training exacerbate inequalities, leaving marginalized communities and individuals at risk of being left behind in the digital economy. Addressing these challenges necessitates proactive policies and investments in education, training, and digital infrastructure to ensure inclusive growth and equitable distribution of the benefits of digitalisation across societies (Pärli, 2022).

Closely related is the concept of labor market polarization, a phenomenon that exacerbates the advent of digitalization, which is reshaping the landscape of employment across manufacturing and service industries. This polarisation manifests in the divergence of employment opportunities into high-skilled, high-wage roles and low-skilled, low-wage positions, with a decline in the availability of middle-skill occupations (Aubert-Tarby et al., 2018). Within the manufacturing sector, the adoption of digital technologies such as robotics and automation leads to the automation of routine tasks, displacing low-skilled workers engaged in repetitive assembly line work (Konle-Seidl & Danesi, 2022). Conversely, the demand for skilled technicians capable of operating and maintaining complex machinery increases, leading to a split of the labour market between high-skilled technicians and low-skilled production workers.

Similarly, in the service industries, digitalisation influences the composition of employment by creating demand for highly skilled professionals adept at utilizing digital tools and analysing complex data. Roles in digital marketing, data analysis, software development, and IT support emerge as sought-after positions, commanding higher wages and offering opportunities for career advancement (Asravor & Sackey, 2023). While low-skilled service jobs, such as manual labour in hospitality, retail, and transportation, face the risk of automation and outsourcing, contributing to the polarisation of the service sector (Azu, 2022).

The implications of labour market polarisation extend beyond economic disparities with social and political ramifications. The decline of middle-skilled occupations exacerbates income inequality, as high-skilled workers capture a larger share of economic gains while low-skilled workers experience stagnating wages and job insecurity (Thomas et al., 2023). Moreover, polarisation fosters social stratification, as individuals with access to education and training in high-demand sectors benefit disproportionately from economic opportunities, widening the gap between the affluent and the marginalised. Additionally, political polarisation may ensue, as disenfranchised segments of the workforce express discontent with perceived injustices and demand policy interventions to address labour market inequities (Charles et al., 2022).

In employment determination, Dale Mortensen and Christopher Pissarides in the 1980s, provided a framework of labour market matching theory which explains how employment outcomes are determined through the matching process between employers and job seekers (Berger et al., 2022). The theory posits that, the labour market operates as a dynamic system where employers and workers search for suitable matches based on their respective skills, preferences, and characteristics. This matching process involves information asymmetries, frictions, and search costs, which influence the speed and efficiency of matching between vacancies and job seekers (Bagnoli & Estache, 2022). The theory emphasizes the role of labour market institutions, such as job search mechanisms, hiring practices, and government policies, in shaping the dynamics of job creation and labour market equilibrium.

Dale Mortensen and Christopher Pissarides developed the labour market matching theory in the late 1970s and early 1980s. Their seminal contributions laid the groundwork for understanding the mechanisms driving unemployment and job matching processes in dynamic labor markets. Mortensen and Pissarides were awarded the Nobel Prize in Economic Sciences in 2010 for their pioneering work on search theory and labour market dynamics, which included the labour market matching framework as a central component (Berger et al., 2022).

The labour market matching theory provides a valuable lens through which to analyze the effects of digitalisation on employment dynamics within manufacturing and service sectors. As firms adopt digital technologies, the nature of job requirements and skill demands evolves, influencing the matching process between employers and workers. Digitalisation may lead to changes in the types of jobs available, the skills required, and the methods used for recruitment and hiring.

The theory also highlights the role of labour market frictions and search costs in adapting to technological changes and reallocating labour resources efficiently. Digitalisation may create opportunities for job creation in new industries or occupations while displacing workers in traditional roles that are susceptible to automation. The efficiency of labour market matching mechanisms, such as job search platforms, training

programs, and labour market policies, becomes crucial in facilitating transitions and reducing unemployment.

2.2. Theory of Skilled Biased Technological Change

The theory of skill-biased technological change (SBTC) which is central to the discourse on the effect of digitalization in the labour market posits that, technological advancements disproportionately favours skilled workers over unskilled workers by augmenting their productivity while substituting tasks performed by unskilled workers (McGuinness et al., 2023). Introduced in the 1980s, this theory suggests that certain technological innovations, particularly those related to information and communication technologies (ICTs), create a higher demand for workers with advanced technical skills, cognitive abilities, and problem-solving capabilities. Consequently, skilled workers experience an increase in their relative wages and employment opportunities compared to unskilled workers, leading to a widening gap in earnings and skill differentials in the labour market (Buera et al., 2022).

The theory of SBTC was initially proposed by economists David Autor, Lawrence Katz, and Alan Krueger in the late 1980s and early 1990s (Autor, 2022). Building on earlier works by economists such as Sherwin Rosen and Robert Solow, Autor, Katz, and Krueger who empirically showed how technological advancements, particularly those in ICTs, contributed to rising wage inequality and skill differentials in the United States (Autor, 2022). Their research highlighted the role of technological change in shaping the demand for different types of labour and its implications for income distribution and labour market outcomes.

The theory of SBTC has been widely applied in empirical studies across various disciplines. Recent empirical studies such as Diessner et al. (2022) and Autor (2022) examined how specific technological innovations, such as automation, robotics, and artificial intelligence, influence the relative demand for different skill levels within firms and industries. Moreover, the theory has helped to understand the mechanisms driving changes in occupational structures, educational attainment, and skill requirements in response to technological change.

SBTC theory therefore provides a compelling framework for analysing the effects of digitalization on the demand for skilled workers among SMEs. As firms adopt digital technologies, the demand for workers with advanced technical skills and digital literacy increases, leading to a higher relative demand for skilled labour compared to unskilled labour (Diessner et al., 2022). The theory also highlights the potential for digitalisation to exacerbate wage inequality and skill differentials within the labour market. Skilled workers with specialised technical skills in areas such as programming, data analysis, and digital marketing are better positioned to capitalise on the opportunities created by digitalisation, commanding higher wages and enjoying greater job security compared to

unskilled workers. By applying the theory of skill-biased technological change, this study analyses how digitalization shapes the demand for skilled labour and contributes to changes in the occupational structure of the labour market. This theoretical framework provides valuable insights into the mechanisms driving the effects of digitalisation on skilled workers to inform policy interventions aimed at addressing skill mismatches, promote skill development, and foster inclusive growth amidst technological change.

2.3. Empirical review and hypothesis

The empirical discussions on the relationship between digitalisation and employment encompass a diverse array of studies, each offering unique insights into the complex interplay between technological advancements and labour market dynamics. Fernández-Macías (2018) provides a comprehensive overview of the disruptive potential of digital technologies on employment. The report underscores how digitalisation permeates various sectors, introducing flexibility in production processes and facilitating information access. By examining vectors of change such as automation, digital technology integration, and platform coordination, the study sheds light on the transformative effects of digitalisation on employment patterns.

Warhurst and Hunt (2019), delve into the discourse surrounding the "future of work" in the era of digitalisation. Their review highlights the dichotomy between claims of job obsolescence and the nuanced policy responses aimed at preserving welfare and labour rights. By dissecting developments such as industries and urbanization the study emphasizes the importance of proactive policy interventions to shape the impact of digitalisation on employment outcomes.

Freddi (2018) addresses concerns regarding the potential displacement effects of digitalization on employment. The study underscores the need for micro-level analysis to understand the employment implications of emerging technologies comprehensively. The focus on specific technologies, such as robotics, and the emergence of new skill demands in manufacturing underscore the nuanced relationship between digitalisation and employment dynamics.

Arsić (2020) provides a broader context for understanding the relationship between digitalisation and employment by examining productivity growth trends and potential policy responses. The study highlights the uncertain net effect of digitalisation on employment and emphasizes the importance of education reform and vocational training in mitigating adverse labour market outcomes.

In addition, Aubert-Tarby, Escobar, and Rayna (2018), examine the impact of digitalisation on journalism employment, highlighting the role of digitalisation in reshaping job creation and contractual arrangements within the press. Similarly, Smits et al. (2022) explore the organizational implications of digital technology adoption, underscoring its potential to transform job content, working environments, and

employment conditions.

Baffour et al. (2018) investigate the impact of innovation, including digitalisation, on employment in Ghanaian manufacturing and service firms. Their empirical analysis reveals a positive association between product innovation and employment, emphasizing the potential of technology diffusion to alleviate employment challenges. This study contributes valuable evidence to the discourse by highlighting the role of innovation in driving job creation, particularly in the context of emerging economies like Ghana.

Pärli (2022) explores the transformative effects of digitalisation on labour relations and workers' participation rights within companies. By examining the implications of digital processes for organisational structures and decision-making processes, the study underscores the potential for digitalisation to democratise workplace decisions and foster cooperation across hierarchical boundaries. This perspective adds depth to the discussion by highlighting the organisational implications of digitalisation beyond its direct impact on employment.

Consequent on the literature reviewed, hypothesis for the relationship between digitalisation and employment being investigated in this study is as follows:

Hypothesis 1 (H1): There exists a positive relationship between digitalisation and employment, thus, the adoption of digital technologies leads to employment generation by SMEs.

This hypothesis is supported by evidence from studies such as Baffour et al. (2018), which found a statistically significant positive impact of product innovation, including digitalisation, on employment in Ghanaian firms. Their study finds that innovation, including digitalisation, has employment-enhancing effects in Ghana, with a particular emphasis on the importance of product innovation in driving employment growth. Additionally, Fernández-Macías (2018) highlights the potential of digital technologies to enhance production flexibility and create new job opportunities across various sectors, while Pärli (2022), suggests that digitalisation may democratise workplace decisions and foster cooperation, potentially leading to positive outcomes for employment. Thus, the evidence suggests that while digitalisation may pose challenges such as job displacement and skill mismatches, it also offers opportunities for job creation, productivity enhancement, and economic development. Therefore, the hypothesis posits a positive relationship between digitalisation and employment, emphasizing the potential for digital technologies to contribute to overall employment growth and welfare improvement.

On the relationship between digitalization and skilled workers, Smaldone et al. (2022) focused on the evolving role of data scientists by analyzing job advertisements to identify the skills, experience, and qualifications sought by employers for data scientists. This research underscores the growing demand for professionals with expertise in handling complex and heterogeneous big data. Their findings suggest that digitalisation leads to an increased demand for skilled workers with specialised skills in data analysis,

machine learning, and data visualisation, highlighting the importance of continuous skill development in adapting to evolving job requirements.

Dou et al. (2023), similarly investigated the impact of corporate digital transformation on the labour force structure using financial and text data from annual reports of listed companies in China. Their empirical analysis reveals that digital transformation significantly increases the proportion of highly educated, highly skilled, and research and development researchers in the labour force. This suggests that digitalisation promotes the upgrading of the labour structure by fostering the demand for skilled professionals with expertise in digital hardware and software. The study provides empirical evidence of how digitalisation drives changes in the composition of the labour force, favouring skilled over unskilled workers. As a result, the second hypothesis being tested in this study is;

Hypothesis 2 (H2): There exists a positive relationship between digitalisation and the number of skilled workers, thus digitalization leads to increased demand for workers with digital skills in SMEs in Ghana.

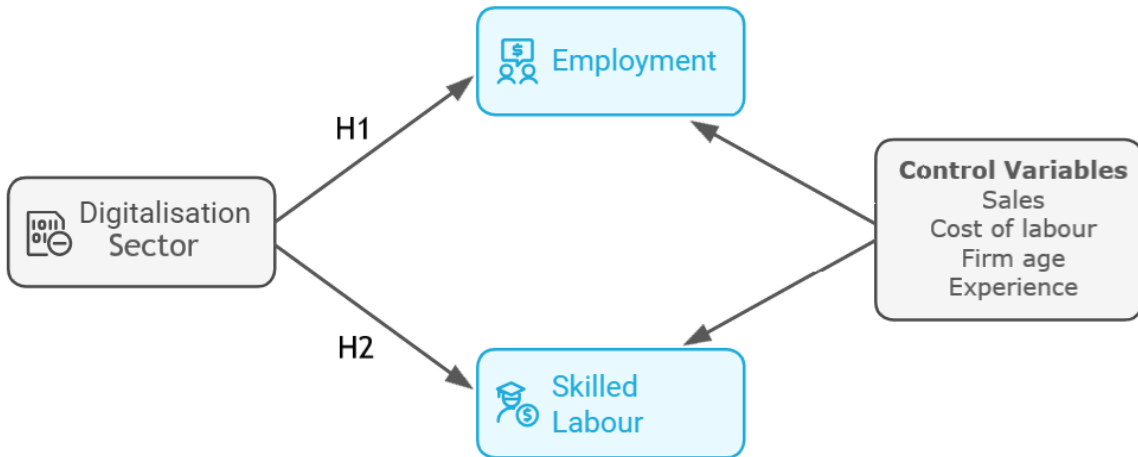
The empirical evidence from studies by Smaldone et al. (2022) supports the hypothesis of a positive relationship between digitalisation and skilled workers. This study highlights how digitalisation drives the demand for professionals with specialised digital skills, such as data analysis, machine learning, and digital hardware and software expertise. Job advertisements for data scientists reveal a growing demand for professionals capable of handling complex big data, while corporate digital transformation in China leads to an increase in the proportion of highly educated and highly skilled workers. Moreover, innovation, including digitalisation, is found to have employment-enhancing effects, particularly through product innovation, further emphasizing the positive relationship between digitalisation and job creation for skilled workers.

Our study contributes to the extant literature in two important ways. First, it is among the first set of studies to empirically test the relationships between digitalization and employment among informal small and medium sized enterprises that dominate economic activity in developing countries in the global south, particularly in sub-Saharan Africa. Second, this study contributes to closing the knowledge gap on digitalisation and the demand for skilled labour in informal enterprises by investigating the relationship that exist between the use of digital technology by SMEs and their demand for skilled labour, this makes a meaningful contribution to evidence-based policies within the SME space in terms of technology. Overall, the study contributes to the evolving literature as it unearths the employment generation potential inherent in technology usage in the informal sector, particularly in the context of a developing country in sub-Saharan Africa.

3. Empirical Strategy

The conceptual framework depicted in Figure (1) outlines the relationships between the predictor variables, outcome variables, and control variables in the study examining the effects of digitalisation on employment and skilled labour among SMEs in Ghana.

Figure 1. Conceptual Framework



The predictor variables digitalization, and sector, are hypothesised to influence the outcome variables, employment and skilled labour. Digitalisation encompasses the adoption and integration of digital technologies within the firm, which influences production processes, organizational structures, and labour requirements. The sector variable distinguishes between manufacturing and service firms, acknowledging their differing characteristics and labour demands. The outcome variables, employment and skilled labour, represent the key dimensions of labour market outcomes under investigation. Employment refers to the overall level of workforce participation within firms, while skilled labour denotes the number of workers in a firm who have ICT skills. These outcome variables are expected to be influenced by both digitalisation and the sector in which firms operate. Additionally, the conceptual framework includes control variables to account for potential confounding factors that may influence the relationship between predictor and outcome variables. Firm age, sales revenue, manager's years of experience, and cost of labour are identified as control variables, reflecting key firm characteristics and contextual factors that may affect employment and skilled labour outcomes independently of digitalisation and sector. By incorporating these control variables, the study aims to isolate the effects of digitalisation and sector on employment and skilled labour while accounting for other relevant factors that may influence labour market dynamics among SMEs in Ghana.

3.1. Empirical Model

The relationship between digitalisation and employment is investigated by examining the

relationship between digitalisation and employment measured as the number of existing jobs. The paper also tests the relationship between digitalisation and skilled labour measured as the number of employees within the firm who have ICT skills. Following König et al. (1995), Lachenmaier and Rottmann (2007) and Zimmermann (2009), we specify a labour demand function of the form:

$$L_i = f(T_i, X_i, \varepsilon_i) \quad (1)$$

Where labour demand (L_i) of firm i is specified to be dependent on technology (T_i) for firm i , and other observable variables (X_i) and non-observable variables (ε_i). The least squares estimation technique is applied to the model.

The empirical model employed in the paper aims to explore the relationship between digitalisation and employment among SMEs in Ghana. In the contemporary landscape of rapidly evolving technology, understanding how digitalisation influences employment dynamics is crucial for both policymakers and industry stakeholders. The model considers various factors, including digitalisation, firm age, sales, managerial experience, and manufacturing dummy, to examine the link between digitalisation and employment outcomes. The empirical specification is as follows:

$$L_i = \beta_0 + \beta_1 \text{Digitalization}_i + \beta_2 \text{Firmage}_i + \beta_3 \text{Cost of labour}_i + \beta_4 \text{Sales}_i + \beta_5 \text{Experience}_i + \beta_6 \text{Manufacturing}_i + \varepsilon_i \quad (2)$$

This model examines the level of employment within firm i , with β_0 representing the intercept, which captures the baseline employment, level when all predictor variables are zero. The coefficient β_1 quantifies the impact of digitalisation on employment. Other control variables include sales revenue, managerial experience of a top manager, and the sector of the firm (manufacturing). The error term (ε) captures unobserved factors that influence employment at the firm level.

A positive coefficient for β_1 indicates that an increase in digitalisation is associated with higher employment levels, suggesting a positive relationship between digitalisation and employment. Conversely, a negative coefficient would imply that higher digitalisation levels results in low levels of employment, indicating a negative relationship. This model facilitates a nuanced understanding of how digitalisation influences employment outcomes, considering sector-specific differences and controlling for relevant firm characteristics.

The empirical model further investigates the relationship between digitalisation and skilled labour among SMEs in Ghana. The evolving landscape of digital technologies has significant implications on the composition of the labour force, particularly in terms of skill requirements and job roles. Understanding how digitalisation influences the demand for skilled labour is crucial for addressing labour market challenges and informing strategic workforce planning initiatives. The model considers various factors, including

digitalisation, sector type, firm age, manager experience, sales revenue, and cost of labour, to examine the link between digitalization and the demand for skilled labour. Here the dependent variable is the proportion of skilled to unskilled labour in a firm, and given the focus of the study, skilled labour is defined to be worker with digital or computer skills.

$$\begin{aligned} \text{Ratio of skilled – to – unskilled Labour}_i &= \beta_0 + \beta_1 \text{Digitalization}_i + \beta_2 \text{Firmage}_i \\ &+ \beta_3 \text{Cost of labour}_i + \beta_4 \text{Sales}_i + \beta_5 \text{Experience}_i + \beta_6 \text{Manufacturing}_i \\ &+ \varepsilon_i \end{aligned} \quad (3)$$

This model estimates a number of covariates on the ratio of skilled to unskilled labour within firm i , β_0 represents the intercept, which captures the baseline level of the skilled-to-unskilled labour ratio when all predictor variables are zero. The coefficient β_1 quantifies the impact of digitalization on skilled labour. A positive coefficient for β_1 indicates that increased digitalisation is associated with a higher level of skilled labour versus unskilled labour, suggesting a positive relationship between digitalization and the demand for skilled labour. Conversely, a negative coefficient would imply that higher digitalisation levels leads to a decrease in skilled labour, indicating a negative relationship. This model facilitates a nuanced understanding of how digitalization influences the demand for skilled labour, considering sector-specific differences and controlling for relevant firm characteristics.

3.2. Data description

The study uses secondary data obtained from the World Bank Enterprise Survey (2022) on small and medium scale enterprises in Ghana. Employment is measured as the number of workers employed by a firm, reflecting the overall level of workforce participation within the firm. Skilled labour is a dummy variable that takes the value one for number of workers within a firm with computer skills and zero otherwise. It captures the extent of digital skills and digital capabilities within the workforce. Digitalisation is a dummy variable that takes the value one if a firm uses computers or tablets and zero otherwise. It indicates the adoption and integration of digital technologies within firms' operations.

Sales is proxied as the sales per month for firms, providing a measure of the firm's revenue generation and economic activity. Cost of labour is measured in terms of the salary paid to labour per month, this reflects the financial resources allocated to compensating employees. Firm age is the age of the firm in years; this is the difference between the current year and the year of establishment of the firm. Experience is measured as the number of years of managerial experience of a top manager. The variable sector refers to the specific sector in which the firm operates (manufacturing and service). This variable provides insights into sector-specific characteristics in the area of employment and the skilled labour utilization.

Table 1. Summary Statistics of Main Variables

Variables	Obs	Mean	SD
Employment	2511	1.917	2.134
Digitalization	2510	0.056	0.230
Skilled	2511	0.590	0.491
Cost of labour	2511	1053.32	5503.49
Firm age	2511	7.13	6.49
Sales	2511	50,667.04	22,967.12
Experience (years)	2511	8.283	7.122
Manufacturing	2511	0.156	0.363

Source: Results based on World Bank Enterprise Survey (2022)

Table 1 provides summary statistics of all variables in the empirical specification, this give us a better perspective on the characteristics of sampled firms and the variables of interest. Overall, average level of employment of firms in the sample is approximately 2 with some level of variability as shown in the standard deviation. Digitalization that is measured as whether a firm uses computer(s) or tablet(s), has a mean of 0.056, this indicates that digitalization is relatively low among the sample firms. This indicates that, suggests that majority of the firms in the sample have not fully embraced digital technologies in their operations.

Skilled labour, measured as the presence of individuals who can use computers within firms, demonstrates a higher mean value of 0.590. This indicates that a significant proportion of the workforce within the sample firms possesses digital skills and capabilities, highlighting the importance of digital literacy in today's labour market.

Average cost of labour is 1,053.32 Ghana cedis, this is equivalent to 81 US dollars and reflects the average salary paid to labour per month by SMEs in the sample. This provides insights into the financial resources allocated to compensating employees, which can vary across firms depending on their financial capacity and labour market conditions. Firm Age, measured in years, has a mean value of 7.1, indicating that, on average, firms in the sample have been in operation for a little over seven years. This suggests that the sample includes both relatively new and established firms, reflecting the diversity of firm age within the dataset. Sales which is measured as the total value of sales per month for a firm, has a mean value of 50667.04 Gh cedis which is equivalent to 3,900 US dollars, indicates the average revenue generation of the sample firms. This provides insights into the economic activity and performance of the firms, with higher sales indicating greater business activity and potential growth opportunities. The manufacturing available indicates firms that operate within the manufacturing sector, overall, 15% of the sampled firms are manufacturing firms, an indication that relatively small proportion of firms in the sample operate within the manufacturing sector.

4. Empirical Findings

Table 2 presents the regression results of our empirical model that examines the effect of digitalization on employment among SMEs in Ghana. Here, the level of employment is regressed on digitalization, age of the firm, sales, experience of the top manager and sector dummy. The findings point to a positive significant effect of digitalization on employment in small and medium sized enterprises in Ghana, this is consistent across all models (models 1 to 3), indicating the robustness of the finding. Essentially, this finding emphasizes the employment generation potential of digital technologies inherent in the utilization of digitalization by small and medium-size enterprises as their levels of employment increase with the use of digital technology.

Table 2. Regression Result – Effects of Digitalization on Employment

Dependent variable: Employment	(1)	(2)	(3)
Digitalization	0.196*** (0.059)	0.180** (0.060)	0.168** (0.058)
Log of firm age	0.115*** (0.021)	0.106*** (0.021)	-0.004 (0.034)
Log of cost of labour	0.114*** (0.013)	0.100*** (0.014)	0.098*** (0.013)
Log of sales		0.038** (0.014)	0.034** (0.013)
Experience			0.115*** (0.034)
Manufacturing dummy			0.378*** (0.042)
Constant	-0.438*** (0.083)	-0.603*** (0.103)	-0.661*** (0.100)
Observations	1264	1261	1261
F (5, 2391)	57.22		
Prob > F	0.000		
R-squared	0.120		
Adj. R-squared	0.118		

Notes: Standard errors in parentheses. ***p<0.001, ** p<0.01, * p<0.1

Other variables that are found to have a positive relationship with employment levels in SMEs in the country include the age of the firm (older firms employ more workers); log of sales (firms with higher monthly turnover have higher levels of employment); and years of experience of the manager of the firm. In addition, firms in the manufacturing sector relative to those in service employ more workers. These results are generally consistent in all models.

In addition to the effect of digitalization on employment, the study further investigates the relationship between the use of digital technology and skilled labour in SMEs in Ghana using the proportion of skilled to unskilled labour in the firm. Results are presented in Table 3.

Table 3. Regression Results – Effect of Digitalisation on Skilled Labour

Dependent variable:	(1)	(2)	(3)
Ratio of skilled-to-unskilled labour			
Digitalization	-0.543*** (0.048)	-0.523*** (0.048)	-0.516*** (0.048)
Log of cost of labour	-0.033*** (0.010)	-0.014 (0.011)	-0.015 (0.011)
Log of firm age	0.016 0.017	0.030* (0.017)	0.078** (0.029)
Log of sales		-0.051*** (0.011)	-0.049*** (0.011)
Experience			-0.059* (0.028)
Manufacturing			-0.007 (0.035)
Constant	0.810*** (0.067)	1.030*** (0.082)	1.057*** (0.083)
Observations	1271	1268	1268
F (5, 2391)	30.79		
Prob > F	0.000		
R-squared	0.1278		
Adj. R-squared	0.1236		

Notes: Standard errors in parentheses. ***p<0.001, ** p<0.01, * p<0.1

Interestingly, the result indicates that, the use of digital technology is negatively related to the proportion of skilled workers (workers with digital skills) to unskilled workers (workers without digital skills) employed by SMEs in Ghana, this finding is consistent across all models. Although this result appears counterintuitive, it indicates a nuanced and important finding at the micro level in the usage of digital technology. Essentially, this finding connotes that, although SMEs are using digital skills in some areas of operation such as sales and marketing, these activities are not at the core of their operations, as a result, they demand other forms of skills instead of digital skills as captured in the data. Therefore, the use of digitalization rather inversely affects the proportion of skilled labour in digital skills relative to unskilled labour in these small and medium sized enterprises.

5. Discussion and Policy Recommendations

Findings from the study generally emphasize the employment generation potential of digital technologies inherent in the utilization of digitalization by small and medium-sized enterprises as employment levels are found to increase with the use of digital technology. This result is robust and consistent in all models.

The findings corroborate with previous studies, for instance, Fernández-Macías (2018), emphasized the potential of digital technologies to create new job opportunities and stimulate employment growth. Thus, rapid advancements in digital technology leads to increased efficiency, productivity, and innovation within firms, which essentially drives demand for labour. Moreover, as highlighted by Baffour et al. (2022), technological innovation including digitalization, is a key driver of economic growth and employment creation, particularly in emerging economies such as Ghana.

Interestingly, our findings indicate that the use of digitalization is inversely related to the demand for skilled labour, specifically, the proportion of skilled workers (workers with digital skills) to unskilled workers employed by SMEs is negatively associated with the usage of digital technology. Although this result appears counterintuitive, it indicates a nuanced and important finding at the micro level in the usage of digital technology. This finding points to the fact that, although SMEs are using digital skills in some areas of operations such as sales and marketing, these activities are not at the core of their operations; as a result, they demand other forms of skills instead of digital skills as captured in the data.

Another important factor in gauging the demand for digital skills is the extent or intensity of the use of digital technology, unfortunately, the data available does not capture intensity of digital technology use by SMEs. Although this finding is contrary to studies such as Aboal et al. (2015) and Crespi et al. (2019) who found innovation including digitalization to be complementary to employment of skilled workers relative to unskilled workers. Dou et al. (2023), similarly indicates that, corporate digital transformation tends to promote the upgrade of the labour structure, favouring highly educated and skilled workers who possess expertise in digital hardware and software. This is known to have important implications for the employment prospects of workers with traditional (hard) skills, potentially leading to job displacement skill mismatches and labour market polarization if opportunities are not created for lifelong learning in the labour market.

Other studies which similarly corroborate the findings in this study include Smaldone et al. (2022), who highlights the evolving nature of jobs, particularly in the context of rapid technological advancements and digitalisation. These results underscore the challenges posed by digitalisation for skilled workers, as technological advancements reshape job requirements and skill sets. In addition, consistent with the findings of Baffour et al. (2022), this study fails to align with the theory of skill-biased technological change, which posits that technological advancements tend to complement and amplify

the skills of high-skilled workers while substituting for the tasks performed by low-skilled workers (Acemoglu, 2022).

Several recommendations emerge from the study that are relevant for stakeholders in education and the labour market. First, firms should prioritize investment in training and upskilling programs to equip employees with the digital skills needed to succeed in a digitalized work environment. Second, governments and educational institutions should collaborate to promote digital literacy initiatives and integrate digital skills training into school curricula, as it is a panacea to employment generation in SMEs in developing countries. Third, policymakers must formulate and implement policies that support lifelong learning and provide incentives for workers to acquire new skills throughout their career trajectory. Additionally, efforts to promote digitalisation should accompany measures to ensure that benefits are shared equitably, including targeted support for marginalized groups. Finally, continuous monitoring and evaluation of the impact of digitalisation on the labour market are essential to identify emerging trends, challenges, and opportunities to adapt policies accordingly to ensure a resilient and adaptable workforce in the face of technological change.

6. Conclusion

Digitalization is transforming the world of work in major ways that are yet to be investigated empirically. Indeed, the rapid proliferation of digital technologies is reshaping industries and altering traditional modes of production and service delivery with important implications for employment, particularly among small and medium sized enterprises who are at the core of employment generation in developing countries.

Using the latest round of the World Bank Enterprise Survey (2022) on Ghana, this study draws on the theoretical frameworks of labour market matching theory and skill-biased technological change to investigate the relationship between digitalization and employment, and the demand for skilled labour among small and medium scale enterprises (SMEs) in Ghana, a typical emerging economy in the global south.

Results indicate that, digitalization is positively associated with overall level of employment in SMEs in Ghana while a negative relationship is observed between digitalization and the demand for skilled labour as digitalization is observed to be negatively related to the proportion of skilled to unskilled workers that are employed by SMEs in Ghana. Although digitalization is proven to be a source of employment generation in small and medium enterprises in the country, our findings however, fail to align with the theory of skill-biased technological change, where the demand for skilled workers increases relative to unskilled workers.

This suggests that labour market proliferation which is fast occurring in developing countries with the disappearance of mid-level repetitive skills due to technology may not yet be a major source of concern within the informal sector in Ghana

and to an extent developing countries in the global south, particularly sub-Saharan Africa.

Conflict of interest

The authors declares that there are no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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ORCID

^a Esther Azigi, <https://orcid.org/0009-0008-7743-0902>

^b Priscilla Twumasi Baffour, <https://orcid.org/0000-0001-8792-5265>

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