Factors that Influence Global Value Chains: Evidence from the Manufacturing Sector in Kenya

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Factors that Influence Global Value Chains: Evidence from the Manufacturing Sector in Kenya

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List of abbreviations and acronyms

BETA	Bottom-Up Economic Transformation Agenda
FDI	Foreign Direct Investment
GoK	Government of Kenya
GVCs	Global Value Chains
IVs	Instrumental Variables
KAM	Kenya Association of Manufacturers
MSMEs	Micro, Small and Medium Enterprises
OECD	Organisation for Economic Co-operation and Development
PSM	Propensity Score Matching
WBES	World Bank Enterprise Survey

Abstract

This study investigates the determinants of GVCs participation among manufacturing firms in Kenya. Using the propensity matching method and firm-level cross-sectional data from the World Bank Enterprise Survey (WBES) for the period 2007–2018, the analysis identifies key determinants across the entire manufacturing sector. These determinants are labour productivity, foreign ownership, firm size, website presence, generator use, and transport costs. Additional factors depend on the specific GVC definition applied. The study also reveals that smaller and female owned firms are more susceptible to business environment factors such as security, corruption, and competition with the informal sector compared to larger and male owned counterparts. Furthermore, the study examines factors that influence GVCs participation in the food and chemical sectors, highlighting sector-specific factors which can result in tailored policy recommendations.

Key words: *Global Value Chain; Determinants; Cross-sectional data sets; Manufacturing; Kenya.*

1. Introduction

In the recent times, there has been an increased attention in global value chains[1] (GVCs) owing to factors such as innovation, globalization, and the expansion of international production networks among businesses. According to World Bank (2019), a significant proportion of the trade occurs within GVCs. The fragmentation of production across borders has allowed firms to focus on tasks where they have comparative advantage and therefore shifting solely from producing final goods to participating in various stages of the production process (Boffa et al. 2021). This dynamic allows small and large firms, both foreign and domestic, engage in the process, which can result in potential gains such as productivity, exports, knowledge and capital accumulation, improved management practices and technical assistance, as well as local firms getting spillovers effects (Banga, 2022; Tian et al., 2021; Tajoli & Felice, 2018). These elements can aid developing countries access larger markets, achieve economies of scale, and promote growth and development (Manghnani et al., 2021; Reddy et al., 2021; Boffa et al., 2021).

Developing countries are increasingly exploring strategies to harness the benefits from GVCs to facilitate industrialization, where the manufacturing sector is expected to drive economic diversification and prosperity. Kenya is one of the countries yet to fully exploit its potential within GVCs in the manufacturing sector. However, despite this, GVCs remains crucial as it aligns with the objectives of Vision 2030 and Bottom-Up Economic Transformation Agenda (BETA), which aims to elevate manufacturing sector contribution to 15% of GDP by 2030, with GVCs playing a pivotal role. Through BETA, the government hopes to create jobs and reduce poverty through the informal sector and micro, small and medium enterprises (MSMEs) (Government of Kenya [GoK], 2020).[2] Therefore, fostering MSMEs participation in GVCs will likely yield numerous benefits including increased productivity and enhanced competitiveness, consequently leading to job creation and inclusive economic growth. This paper examined the factors that influence the manufacturing sector in Kenya using firm-level data set from World Bank Enterprise Survey (WBES) for the period 2007–2018. In addition, the study examines the factors that influence both food and chemicals sub-sectors.[3]

The theoretical literature indicates that firms engaged in GVCs focus on tasks within the production process, resulting in cost savings, increased productivity, and formation of new networks of suppliers based on the fragmentation theory. Recent

trade literature further underscores that firms engaged in trade activities tend to be large and with high productivity (Masunda & Mupaso, 2019). Moreover, innovation plays pivotal role in drive shaping trade behaviour due to technology gap and product and process cycles (Reddy et al., 2021). Innovation reduces costs of product and process differentiation, and the monopolistic nature of the firms allows them to benefit from rents and entry into external markets possible.

However, there is limited literature on GVCs participation in Africa (Fernandes et al., 2022; Simone et al., 2022; Calatayud & Barrachina, 2023; Masunda & Mupaso, 2019). This is mainly because of historical limitation in participation in GVCs and policy makers not previously targeting programmes aimed at integration of small firms in to the GVCs and data limitations. A study by Ebaidalla and Ali (2023), using 22 countries in Africa, investigated the influence of GVCs on productivity, and discovered the effect on labour productivity and sale growth within the manufacturing sector. Likewise, Calatayud and Barrachina (2023) examined the determinants of GVCs participation within the manufacturing sector in 18 countries in the sub-Saharan Africa using WBES data sets, finding that good infrastructure, quality of institutions, and security drive GVC participation. In Zimbabwe, Masunda and Mupaso (2019) found that firm size and availability of credit influenced GVCs participation, and that foreign firms participated less in the GVCs compared to the local firms.

Several studies have been conducted on GVCs activities in Kenya. Most of these studies focus on the horticulture and leather sectors, such as Heher and Steenbergen (2021), Pasquali et al. (2021), Pasquali (2021), and Pasquali and Alford (2022). However, there has been limited examination of GVCs activities within the manufacturing sector. Wanjala and Abdulahi (2022) investigated the determinants of GVCs in the manufacturing sector, using the WEBS data set for the year 2018. The study constructed a GVC index and employed the Tobit model to analyse the determinants of GVCs. The results revealed a low GVC index of 18.65%, suggesting that less than two out of ten firms are involved in GVCs, with labour productivity, firm certification, firm size, and research and development emerging as significant determinants. Similarly, Moutfaucon et al. (2023) used data sets from UNCTAD-Eora, WBES, and customs level to examine factors that influence firm participation in backward GVCs in Africa, including Kenya and Uganda.[4] For Kenya, the study used both WBES and custom level data sets and employed probit and linear models for the analysis. They found that, foreign ownership, worker force skills, and capital influence backward GVCs participation in Kenya.

In previous literature, GVCs participation by firms was associated with exporting or importing, foreign technology or having international quality certificate (Del Prete et al., 2017).These measures were more suited to firms engaged in exporting than importing. In this study, GVC participation is defined as firms engaged in both exporting and importing simultaneously. Such dual/two-traders may possess foreign technology and/or international quality certificates resulting in distinct categories (Sasidaran et al., 2022). Using these definitions, the study examines the factors that influence the likelihood of firms participating in GVCs in the manufacturing sector

in Kenya. Unlike the previous studies in Kenya, the study incorporates both detailed firm-specific characteristics and firm perceptions of the business environment into the analysis. Additionally, it investigates whether the results differed based on firm size or the gender of firm owners.

This study found that both firm-specific characteristics and firm perceptions of the business environment significantly influence firms' participation in GVCs activities. Additionally, the specific factors influencing GVC participation depend on the definition of the GVCs used. The results also indicate that small firms have different requirements to engaging in GVCs activities compared to larger firms, and female owned firms are more affected by business environment factors than male owned firms. To address endogeneity issues, such as omitted variables or selection bias, the study used the propensity score matching.[5] When accounting for endogeneity, the results differed significantly from those of Wanjala and Abdulahi (2022) and Moutfaucon et al. (2023).

The study went further to examine the factors that influence GVCs participation in two sub-sectors. The food sub-sector, being the largest, holds significant importance for Kenya as it addresses challenges related to food security driven by population growth. This sub-sector processes raw materials and intermediate goods sourced from the agriculture sector. The Chemical sub-sector complements the food sector by producing chemicals essential in agriculture, including pesticides, herbicides, and fertilizers. The development of GVCs in these sub-sectors could expand markets opportunities, promoting industrialization and job creation through backward participation.[6] The results reveal heterogeneity across different sectors.

The rest of this study is organized as follows. Section 2 briefly presents the literature review, followed by the methodology elaboration in Section 3. Section 4 will give an overview of GVCs in Kenya, data sets source and present descriptive statistics. Section 5 presents the results and the discussion of the results, while Section 6 concludes the study.

2. What does the literature say about supply chain trade in Kenya?

Numerous theories have been used by scholars to discuss the drivers behind GVCs. Fragmentation theory shows how production process can be fragmented and distributed across different countries so as to achieve cost savings, reduce logistics cost, and establish networks with suppliers (Gereffi et al., 2005). Building on the transaction literature, increased transactions within a firm can lead to increased costs prompting larger firms to vertically integrate production tasks. Consequently, costs can be managed through intermediate governance structures (Mazzi et al., 2021). Additionally, engagement of a firm in the global value chains fosters knowledge transfers and opportunities for upgrading. The new trade theory, which centres on firm heterogeneity, monopolistic competition, and product differentiation based on efficiency and productivity offers insights in GVCs trade and factors driving participation (Masunda & Mupaso, 2019). Traditional trade literature also shows how comparative advantage due to factor endowment such as capital, labour, and natural resources can determine the firm's level of engagement in GVCs. Trade costs can also influence GVCs participation due to geographical distance from the target markets. Factors such as transport infrastructure (road, rails, etc.), logistics services and competitive conditions can determine if a firm will participate in downstream or upstream sectors (Amador & Cabral, 2016; Antràs, 2020).

The empirical literature exploring factors that influence GVCs have exhibited diverse characteristics. Some researchers analyse cross-country evidence, while others focus on individual countries or specific sectors depending on data sets availability. Most of the studies rely on sources such as UNCTAD EORA, customs data sets, WBES, and occasionally primary data.[7] Since this study focuses on firm-level data sets, we examined firm-level literature on GVCs participation in Africa as shown in Table 1.

Table 1: Selected empirical literature on GVCs in Africa using firm-level data sets

Authors	Data sets used	Techniques used	Results
Calatayud and Barrachina (2023)	WBES for 18 sub-Saharan African countries for the period 2005–2018 in the manufacturing sector	Probit, Tobit, linear models with IV and matching methods for robustness	Infrastructure, quality of institutions, and security increased GVC participation. However, lack of access to finance, informal sector, and high trade costs affect GVC participation negatively. GVCs has a positive effect on firm performance
Yameogo and Jammeh (2019)	Global Trade Project database. Panel data for 23 countries for 19 subsectors in the manufacturing sector	Fixed-effect gravity model	Strongest determinant of participation in backward and forward GVCs is skilled labour. Others include quality of labour force and initial human capital endowment
Ebaidalla and Ali (2023	Panel for 22 sub-Saharan African countries for 3,790 firms in the manufacturing sector	Matching and difference in difference methods	GVCs have a positive impact on labour productivity and sales growth
Mazzi et al. (2024)	Firm-level panel data set for the manufacturing sector, period 2009–2017, South Africa	Semi-log linear regression	GVCs is associated with higher productivity premium compared to traditional trade
Masunda and Mupaso(2019)	Firm-level data from the WBES for Zimbabwe	Probit and logit models	Factors that influence GVCs are access to credit, foreign ownership, and firm size
Kenya			
Montfaucon et al. (2023)	Customs level data for Kenya and Uganda, WBES 127 countries, 46 countries in Africa	Least squares between effects, Probit, Linear regressions	Factors that influence GVCs are political stability and FDI
Wanjala and Abdulahi (2022)	Firm-level data set from the WBES in 2018 for the manufacturing sector in Kenya	Tobit regression	Labour productivity, firm certification, firm size, and R&D; and they calculate the GVC participation index at 18.65%

continued next page

Table 1 Continued

Authors	Data sets used	Techniques used	Results
Others on Kenya			
Heher and Steenbergen (2021)		Survey of the existing literature on the horticultural sector in Kenya	Multinationals expose domestic firms to international markets through access to foreign expertise, technology, and capital. In addition, foreign partnership fosters development of business networks, international standards, codes of conduct and certifications, which results in technology transfer and economic upgrading among other benefits
Pasquali et al. (2021)	Kenyan customs export data for the period January 2006–December 2018 and qualitative interviews	Mixed methods: multilevel regression, propensity score matching, system-GMM	Suppliers' firms that have used multi-chain strategies to serve buyers has resulted in economic upgrading through product diversification and in turn improved returns
Pasquali (2021)	Firm-level customs export data for the period 2006–2015 and qualitative interviews	Linear generalized, ordered logistic and multilevel linear regressions	Product quality and value-added tasks are higher for exports for North than to the South, but no difference in product and functional upgrading for the two destinations. China-led value chains have similar product quality and steeper functional upgrading compared to North South value chain. Intra-Africa value chains platforms can be used by small suppliers to specialize in higher value-added tasks
Pasquali and Alford (2022)	Customs export data for the period January 2006–December 2015 and qualitative interviews	Linear probability regression	Product specifications and trust shape the private governance and heterogeneity of GVCs across North and South regions

Based on the literature reviewed, both firm characteristics (such as labour productivity, firm size, and credit) and institutional factors, such as political stability, can influence GVCs participation in the manufacturing sector. Moreover, foreign firms can support local firms to join the GVCs through different mechanism such as exports, knowledge transfer, business networks, training, adherence to international regulations and practices, product quality, and trust, among other activities. Apart from the studies mentioned earlier by Montfaucon et al. (2023) and Wanjala and Abdulahi (2022), there is limited research exploring factors that influence GVCs in the manufacturing sector in Kenya. In addition, the studies that use customs data sets lack comprehensive firm characteristics variables, limiting their scope. Using the WBES, our study examined how both firm-specific characteristics and firms' perceptions on business environment influence GVCs participation in Kenya's manufacturing sector. Moreover, the study examined the factors that influence GVCs in the subsectors in the manufacturing secto to make sectoral targeted policy recommendations.

Various techniques have been employed to investigate the determinants of GVCs, as shown in Table 1. Only a few studies have used panel data such as Mazzi et al. (2020) which makes easy to control for confounding factors. Many of the studies use WBES, and employ cross sectional techniques due to data set constraints. However, this approach can introduce bias to the results, as it becomes a challenge to disentangle causal relationships without accounting for unobserved and observed time-invariant variations and heterogeneity. Addressing endogeneity concerns, some studies use IV strategies, for example, Calatayud and Barrachinam (2023); while others such as Pasquali et al. (2021)accounted for endogeneity through propensity score matching and systems GMM methods. In this study, we employed the propensity score matching following Pasquali et al. (2021) and Calatayud and Barrachina (2023) to be able to address the endogeneity concerns.

3. Methodology

Factors that influence GVCs in the manufacturing sector

In this study, we use four categorical definitions for GVCs as shown in Table 2 in alignment with Reddy and Sasidharan. (2023), Del Prete et al. (2017)and Gopalan et al. (2022), among others, and then investigate the factors that influence GVCs participation. The study follows scholars who have examined factors that influence GVCs such as Fernandes et al. (2022) and Simone et al. (2022). The estimation model used to estimate the factors that influence GVCs is as follows.

The generalized estimation model will be estimated as follows.

$$\Pr(Y_{ist}) = 1\left[\alpha_0 + \alpha_i X_{ist} + \beta_i + \delta_j + \rho_{is} + \pi_t + \varepsilon_{ist} > 0\right] \quad (1)$$

Where: i=1,…..n are firms; s is the sectors; t= 2007, 2013, and 2018; and $1[\cdot]$ is the indicator factor which denotes 1 when the firm is involved in the GVCs activity based on different definitions as given in Table 2. X_{ist} are a set of variables on firm characteristics such as age, credit, size, employment, wages, ownership, among others based on the literature review. β_i is the unobserved time invariant characteristics such as managerial ability, foreign experience, etc.; δ_j is the dummy to control for sectors and ρ_{is} is the dummy for perceptions for firm in the sector. π_t is the time fixed effects, and ε_{ist} is the error term.

Table 2: Definition of variables used in the estimations

Variables	Description
Proxies for Global Value Chains Indicators	
GVC-1	Simultaneously exporting & importing; equal 1, 0 otherwise
GVC-2	Simultaneously exporting & importing with international quality certification; equal 1, 0 otherwise
GVC-3	Simultaneously exporting & importing and uses technology licensed by foreign own company; equal 1, 0 otherwise
GVC-4	Two-way trading firm and has quality certification and technology licensed by foreign own company; equal 1, 0 otherwise
Basic Firm Characteristics	
Labour productivity	Log of (sales/workers)
Age	Firm's age in years
Foreign	Equal to 1 if 25% and above is owned by foreign individuals, companies or organizations, 0 otherwise
Formal	Legal status of the firm; 1 if registered, 0 otherwise
Innovation	New products/services and improved process; equal 1, 0 otherwise
Website	Firm owns a website; equal 1, 0 otherwise
Credit	Firm has a line of credit or loan from a financial institution; equal 1, 0 otherwise
Firm size	Number of the employees in a firm
Formal training	Formal training programmes for permanent, full-time employees; equal 1, 0 otherwise
Trade	Log of (exports+imports)
Generator	Generator shared or owned by the firm; equal 1, 0, otherwise
Gender of ownership	Female 1, 0 otherwise
Business Environment Perceptions	
Businesses permits	Major or severe obstacle; equal 1, 0 otherwise
Transaction costs	Major or severe obstacle; equal 1, 0 otherwise
Security	Crime, theft, and disorder; equal 1, 0 otherwise
Customs and trade regulations	Major or severe obstacle; equal 1, 0 otherwise
Political instability	Major or severe obstacle; equal 1, 0 otherwise
Corruption	Major or severe obstacle; equal 1, 0 otherwise
Tax administration	Major or severe obstacle; equal 1, 0 otherwise
Labour regulations	Major or severe obstacle; equal 1, 0 otherwise
Others	
Location	Nairobi 1, 0 otherwise
Sectors	Firm in sector j; equal 1, 0 otherwise
Years	Firm in year 2007, 2013, and 2018; each year equal 1, 0 otherwise

Estimation issues

The study used the WBES data sets for the years 2007, 2013, and 2018. Given that these data sets do not have a panel structure, the study combined them, and the estimations employed cross-section techniques. Fernandes et al. (2022) find that there exists potential reverse causality between GVC participation, tariffs, and FDI inflows. This is because GVCs participation may attract FDI, enhance domestic inputs or facilitate new access to export or import markets. Furthermore, some of the variables such as labour productivity and wages are interrelated, compounded by measurement errors due to missing values in the data sets.

While instrumental variables (IVs) can be employed to mitigate some of these challenges, it might not suffice given that some of the variables are endogenous and getting good instruments can be challenging at times. Consequently, the study employs a propensity score matching method to tackle this problem. The method imputes the missing potential outcome of each observation by utilizing similar observations that receive the other treatment level. The study used the near neighbours matching technique which allows for clustering of similar observations. This method is used by Calatayud and Barrachina (2023); Pasquali et al. (2021), and Ebaidalla and Ali (2023), among others.

The pooled data set and the t-test results, presented in Table A1 (in the appendix) compare firms involved in GVCs with those that are not. The findings indicate that GVC-participating firms are superior in firm characteristics such as labour productivity, larger, older, among other indicators. In addition, GVC firms are more affected by transport costs, customs and trade regulations, tax administration and labour regulations, whereas non-GVC firms prioritize political stability and reducing competition with the informal sector. Furthermore, the majority of GVCs firms are located in Nairobi.

4. Data set sources and descriptive statistics

Overview of GVCs in Kenya

Kenya's involvement in GVCs activities has historically been limited. Between 1990 and 2005, Kenya transitioned from participating in GVCs primarily through commodity trading to focusing on the manufacturing sector mainly agribusiness and apparel (World Bank, 2020). Since 2012, the government has introduced initiatives to support the Kenya Vision 2030 agenda, with GVC participation being a pivotal aspect in the manufacturing sector as shown in Table 3.

Table 3: Initiatives to support GVCs in the manufacturing sector in Kenya

Documents	Aims
National Industrialization Policy: Framework for Kenya for the Period 2012–2030	Kenya industrialization through a globally and competitive manufacturing sector through productivity and competitiveness, market development, high value addition and diversification, regional dispersion, technology and innovation and fair trade
National Trade Policy (2017)	Expanding market, income generation and distribution, increased employment, and competitiveness. In addition, mainstreaming the Micro, Small and Medium enterprises (MSMEs)
Integrated National Export Development and Promotion Strategy plus the implementation plan (2018)	To reverse the downward trend of Kenya's export performance through targeted export growth
Kenya National Africa Growth and Opportunity Act Strategy and action (2018–2023)	Provides strategies and actions for increasing exports to the USA that is informed by an analysis of identified priority sectors
Medium Term Plan (2023–2027) "Bottom-up Economic Transformation Agenda for Inclusive Growth"	Economic turnaround through a value chain approach. A key component was the support of the MSMEs to create employment and income opportunities for the economically excluded segments of the population

For example, the Sessional Paper No. 2022 on the National Industrialization Policy outlines strategies for high value addition, prioritizing short- to medium-term goals. The priority sectors identified in alignment with Kenya's vision 2030 blueprint were labour intensive. These include agro-processing such as tea, coffee, pyrethrum, cotton, nuts, among others, as well as textile and clothing sectors in the short term, and leather and leather goods in the short to medium term. Medium to high technology sectors such as iron and steel industry, machine tools and spares, agri-machinery, farm implements, and pharmaceutical industry were also earmarked for short- to medium-term development. Advanced manufacturing sectors such as the biotechnology and nano technology industry were slated for long-term pursuits. Specific policies were outlined in this regard, such as providing incentives for investments in high value processing of agriculture products, promoting industry clustering around specific agriculture resources, revitalizing the agro-mills and enhancing branding for products and services for export.

In 2018, the government further advanced the GVCs activities strategies through the Integrated National Export Development and Promotion Strategy plus the implementation plan, employing value chain approach. This approach incorporated growth expectations and potential per priority sectors based on the National Industrialization Policy framework, strategic interventions, implementation agencies, and associated costs. Moreover, in line with medium-term budget outlined in the Vision 2030 Fourth Medium Term Plan for the period 2024–2025, the government has prioritized nine bottom-up economic transformation agenda (BETA) value chains such as leather, cotton, dairy, edible oils, tea, rice, blue economy, natural resources, and building materials.[8] However, the criteria used to identify these sectors compared to those outlined in the National Industrialization Policy of 2012 were not explicitly clarified by the government. Additionally, within the manufacturing sector, food, beverages, textiles and apparels, leather and footwear, chemical and agro-processing sectors recognized for the potential to create jobs and drive economic growth and transformation (KAM, 2023).

Data sets used and descriptive statistics

The study used the firm-level data set from the World Bank Enterprise Survey (WBES) for Kenya for the years 2007, 2013, and 2018 as shown in Table 4. This data set was used previously by Montfaucon et al. (2023) in their study, while Wanjala and Abdulahi (2022) used the 2018 data set.

Table 4: Number of firms in the WBES

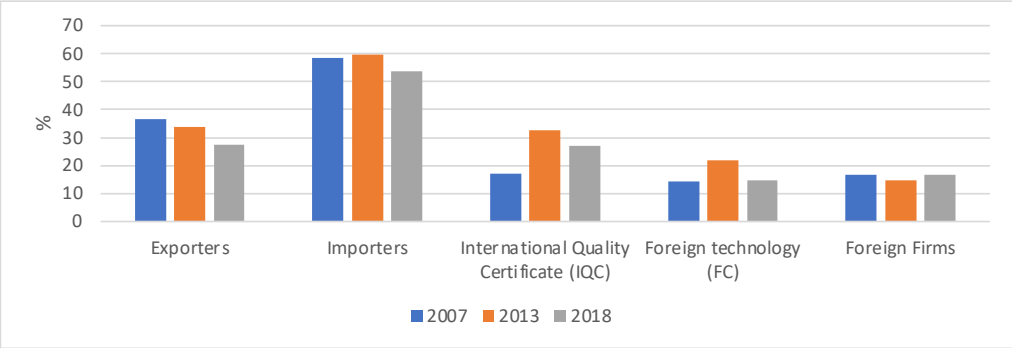
Year	2007		2013		2018	
Industry Sampling Sector	**Freq.**	**%**	**Freq.**	**%**	**Freq.**	**%**
Food (ISIC Rev 3.1 code 15)	110	16.74	163	20.87	160	15.98
Textiles and Garments (ISIC code 17, 18)	111	16.89	53	6.79	60	5.99
Chemical, Pharmaceutical, and Plastic (ISIC code 24,25)	26	3.96	55	7.04	112	11.19
Other Manufacturing (ISIC code 16, 19-23, 26-37)	149	22.68	156	19.97	188	18.78
Retail (ISIC code 52)	126	19.18	166	21.25	178	17.78
Tourism (ISIC code 55)	56	8.52	N/A	N/A	136	13.59
Other Services (ISIC code 45, 50, 51, 60-64, 72)	79	12.02	188	24.07	167	16.68
Total	657	100	781	100	1,001	100

Source: Author's calculation based on the World Bank Enterprise Survey data set.

These waves consist of cross-sectional data sets, providing information on firms in Kenya obtained through a stratified random sampling from both manufacturing and services sectors. The sample size was determined using three levels of stratification: industry, establishment size, and region. Industries were stratified into seven sub-sectors, while the establishment size was categorized as small (5 to 19 employees), medium (20 to 99 employees), and large (100 or more employees). Regional stratification was done across different regions. A standardized questionnaire was consistently used throughout the survey period, enabling construction of firm-level data set for the estimations. The manufacturing sector accounted for over 50% of the surveyed firms across all three waves. The services sectors covered in the survey included retail and tourism, although there was no information for the tourism sector in year 2013. Within the manufacturing sector, main sub-sectors are food and textile and garments. This study exclusively focused on the manufacturing sector unlike Montfaucon et al. (2023) and Wanjala and Abdulahi (2022), who focused on all the sectors. Consequently, the data set used in this study excluded the retail, tourism, and other sectors.

In Figure 1, the distribution of firms is depicted across various categories related to GVCs. Exporters constituted 36.71% of the firms surveyed in 2007 but this proportion declined in subsequent years, reaching 27.5% in 2018. Nearly 60% of the firms surveyed engaged in the importation of raw materials and supplies from other countries. Based on the survey, only 16% of the firms interviewed were foreign firms across all three waves. Furthermore, the survey data indicated that several firms possessed international quality certificates. Notably, 2013 had the highest number of the firms at 32.55% with such certifications. The survey also indicates that about 14% of the firms use foreign technology except for 2013 where the number increased to 22%.

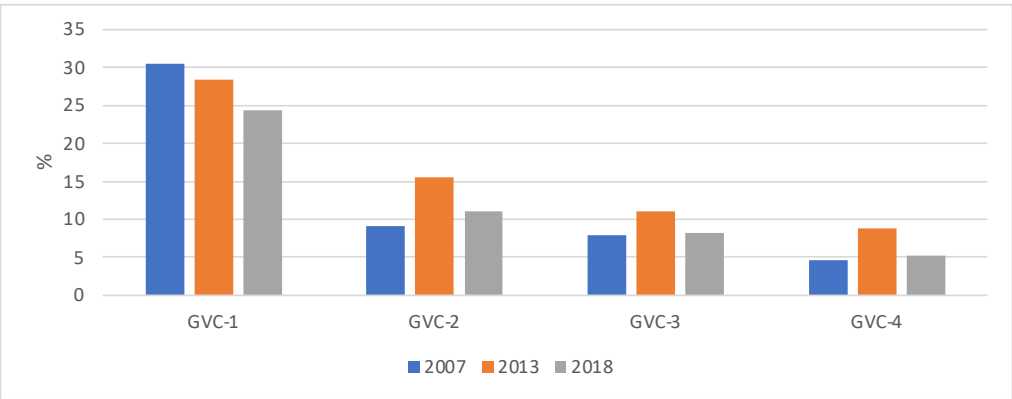
Figure 1: Percentage of the firms based trade variables in the manufacturing sector



Source: Author's construction based on the World Bank Enterprise Survey data set.

Figure 2 illustrates the GVCs participation rate of GVCs firms. The study employs two-way traders, i.e., simultaneously exporting and importing, to calculate the participation rate using the survey waves in the manufacturing sector. When considering the first definition, the participation rate of the firms involved in GVC-1 decreases from 30.63% in 2007 to 21.92% in 2018. This is mainly because of exporters who seem to have reduced their participation in the foreign market.

Figure 2: GVCs firm participation rate in the manufacturing sector



Notes: GVC-1: Simultaneously exporting and importing; GVC-2: Simultaneously exporting and importing with international quality certification; GVC-3: Simultaneously exporting and importing and uses technology licensed by foreign owned company. GVC-4: Two-way trading firm and has quality certification and technology licensed by foreign owned company.
Source: Author's construction based on the World Bank Enterprise Survey.

Based on the GVC-2 definition, approximately 9% of the firms involved in GVCs have international quality certificate in both 2007 and 2018. However, there was a jump in 2013, reaching 15.22%. Similarly, based on the GVC-3 definition, 7% of the firms involved in GVCs utilized foreign technology with a rise to 10% in 2013. In the last category where GVCs firms with both international quality certificates and foreign

technology, the survey shows that only about 5% of the firms met that criterion, although this figure increased to 8.2% in 2013.

In Table 5, the study presents the distribution of the GVCs across sub-sectors in the manufacturing sector using pooled data. The overall observation is that approximately 27% of the firms in the manufacturing sector are actively involved in the GVCs.[9]

Table 5: GVCs in the manufacturing sector in Kenya based on the pooled data set

Sector	GVC-1		GVC-2		GVC-3		GVC-4	
	No	%	No.	%	No.	%	No.	%
Food	52	15.0	28	19.18	16	14.41	10	13.16
Textiles & Garments	61	17.83	15	10.27	10	9.01	5	6.58
Chemicals	58	16.96	25	17.12	19	17.12	12	15.79
Plastics & Rubber	32	9.36	15	10.27	11	9.91	9	11.84
Fabricated metal production	22	6.43	12	8.22	12	10.81	8	10.53
Others	117	34.21	56	34.93	43	38.74	32	42.10
Total	342	100	146	100	111	100	76	100

Source: Author's calculation based on the World Bank Enterprise Survey data set.

Notably, the sub-sectors such as chemical production, food processing, textile and garments, plastic and rubber production, and fabricated metal production exhibit a higher concentration of GVC engagement. Conversely, industries with the lowest level of GVC involvement include wood and paper production, precision instruments, refined petroleum, and recycling. In tables A2–A6 (in the appendix), the study includes more detailed analysis of the sectors surveyed and GVCs participation, correlation matrix, and variables used in the study.

5. Results

In this section, the study presents the various findings based on the conducted estimations. Table 6 presents the results of the factors that influence GVCs participation based on the different definitions. Table 7 and Table 8 present the factors that influence GVC participation based on firm size and gender of firm ownership, respectively. Following this, Table 9 presents results related to the factors that influence GVC participation of the food and chemical sectors.

Factors that influence GVCs participation in the manufacturing sector in Kenya

The results presented in Table 6 are obtained from propensity score matching (PSM) estimation. This method uses propensity scores to simulate random grouping, and can be used to deal with endogeneity resulting from omitted variables or selection bias.[10] The propensity scores reduce the dimensions to one dimensional score and solve the problem of insufficient numbers of sample cases in exact matching (Guo et al. 2019). The estimations employed the near neighbour matching estimator, where the individual in the control group is matched with the closest partner in the treatment group based on their propensity score. To estimate the factors that influence the probability of firms participating vs non-participating in GVCs activities, the study used the probit model for the estimations.[11]

Across all estimations, the results consistently show that labour productivity, foreign ownership, website presence, firm size, use of generators, and perception of transport costs are the primary factors influencing GVC participation in the manufacturing sector in Kenya regardless of the GVC definition. These six factors are positive and significant at different levels.

According to the literature, labour productivity or firm productivity enables firms to overcome related sunk costs and self-select into the trade market as shown by Bernard et al. (2007) among others. Several studies on GVCs participation, such as Mazzi et al. (2021), Ebaidalla and Ali (2023),] and Yameogo and Jammeh (2019) have also showed a positive impact of labour productivity for African countries, and Wanjala and Abdulahi (2022) in Kenya specifically in the manufacturing sector. Foreign firms are inclined to engage in GVCs by trading intermediates and semi-finished products across international borders due to their affiliations with other large foreign firms in various countries. Consistent with existing literature, foreign firms are positively associated with GVCs (Fernandes et al., 2023; Sharma and Arora 2023; Montfaucon et al., 2023).

Table 6: Factors that influence GVCs participation in the manufacturing sector in Kenya based on the PSM[12]

Variables	Two-way Trader		GVC – International Quality Certification		GVC – Uses Technology Licensed by Foreign Owned Company		GVC – All	
	GVC-1		GVC-2		GVC-3		GVC-4	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Log labour productivity	0.12***	0.03	0.19***	0.04	0.15***	0.05	0.23***	0.05
Age	0.02*	0.01	0.02	0.01	0.00	0.01	0.01	0.01
Age squared	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Foreign ownership	0.65***	0.12	0.67***	0.15	0.65***	0.15	0.79***	0.17
Formal status	-0.08	0.14	-0.40**	0.20	-0.02	0.22	-0.36	0.26
Innovation	0.19*	0.11	0.08	0.16	0.25	0.17	0.20	0.21
Website use	0.51***	0.10	0.72***	0.15	0.56***	0.15	0.64***	0.19
Credit	0.19**	0.09	-0.04	0.13	0.14	0.13	0.11	0.16
Log firm size	0.35***	0.04	0.34***	0.06	0.09	0.06	0.20***	0.07
Formal training	-0.01	0.10	0.32**	0.14	0.37***	0.14	0.28*	0.17
Generator use	0.11	0.12	0.52**	0.23	0.49**	0.21	0.55*	0.31
Transport cost	0.30***	0.11	0.40***	0.14	0.29**	0.15	0.31*	0.18
Security	-0.16	0.12	-0.44***	0.17	-0.41**	0.18	-0.58***	0.23
Customs and trade regulations	0.25**	0.11	0.03	0.15	0.67***	0.16	0.42**	0.19
Business permit	-0.24**	0.13	0.14	0.16	-0.08	0.18	0.34*	0.20
Political instability	-0.19*	0.11	-0.19	0.14	-0.06	0.15	-0.12	0.18
Corruption	0.01	0.11	-0.06	0.14	-0.24	0.15	-0.27	0.18
Competition with informal	0.05	0.10	0.11	0.14	-0.46***	0.16	-0.50***	0.20
Tax rates administration	0.05	0.11	-0.07	0.16	-0.08	0.16	0.00	0.20

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Table 6 Continued

Variables	Two-way Trader		GVC – International Quality Certification		GVC – Uses Technology Licensed by Foreign Owned Company		GVC – All	
	GVC-1		GVC-2		GVC-3		GVC-4	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Labour regulation	0.03	0.14	0.02	0.19	-0.09	0.20	-0.09	0.25
Location	0.30***	0.10	0.31**	0.13	0.23*	0.14	0.09	0.16
Constant	-4.86***	0.51	-7.14***	0.77	-5.53***	0.75	-7.22***	0.94
Number of observations	1135		1135		1135		1135	
	LR Chi2(21) = 383.95		LR chi2(21) = 306.99		LR chi2(21) = 225.61		LR chi2(21) = 200.55	
	Prob>chi2=0.00		Prob > chi2 = 0.00		Prob > chi2 = 0.00		Prob > chi2 = 0.00	
Pseudo R2/R2	0.28		0.37		0.32		0.37	

Note: *, **, *** Significance at the 10%, 5%, and 1% level, respectively.
Source: Author's calculation.

Firm size is a significant factor across all the GVCs except for two-way traders utilizing technology licensed by foreign owned companies. As indicated by the correlation matrix in Table A5 (in the appendix), there is a strong correlation of 0.48 between firm size and the use of generators, which is significant for two-way traders using foreign licensed technologies.[13] Similar results were found by Masunda and Mupaso (2019), Urata and Baek (2020), and Wanjala and Abdulahi (2022).

Contrary to Wanjala and Abdulahi (2022) and Montfaucon et al. (2023) the results show that website use, generator use, and transport costs influence GVCs activities in manufacturing sector in Kenya. The use of website is associated with GVC participation. Gapalan et al. (2022)demonstrate that digitalization, in general, deepens GVC participation and enhances GVCs, particularly for financially constrained firms. The lack of steady electricity supply prompts many firms to share or own generators to ensure uninterrupted operations. Most of the firms consider generators as a good backup in case of power outages and their use is positive and significantly associated with GVCs participation. The results align with findings by Calatayud and Barrachina (2023) within the context of sub-Saharan Africa.

In Kenya, most firms perceive transport cost as facilitator in GVCs engagement and not an obstacle. Low transport costs facilitate global value chain by contributing to improved time delivery, efficiency, reliability, flexibility among other aspects enhancing customer satisfaction and service quality. Transport networks and logistics facilitate cost analysis by providing data useful in optimizing transport planning which enables firms to integrate into GVCs, expand export service and enhance connectivity, stimulating foreign trade (Kaur & Kau, 2022).

The results further show that other factors influencing GVCs participation vary depending on how GVCs are defined. Formal training and perception of security are notable factors that influence GVCs except for the two-way traders (GVC-1). These firms require formal training to equip workers with knowledge and good management practices, enabling them to understand foreign standards and trade regulations, ultimately enhancing firm productivity (Alfero-Urena et al., 2022). Similarly, firms' perception on security encompassing concerns about crime, theft and disorder is considered a major obstacle in GVCs participation in the manufacturing sector and is significant and negative. These results align with Calatayud and Barrachina (2023) based on the GVCs definitions expect for the two-way traders in sub-Saharan Africa as a whole.

Furthermore, firms indicated that customs and trade regulations were favourable across all the GVCs definitions expect for GVCs with international quality certification (GVC-2) although still positive but not significant. This observation is supported by existing literature which suggests that regulatory barriers in trade increase trade costs thereby motivating firms to engage in GVCs (Fernandes et al. 2023). Additionally, the results show that firms located in Nairobi are more likely to participate in GVCs compared to the firms located out of the main city except for the GVC-4 or the GVC-All.

Competition with the informal sector is identified as a significant obstacle based on GVCs using licensed technology by foreign firms (GVC-3) and GVC-All. For the two-

way traders (GVC-1), obtaining business permit and political instability are identified as major obstacles in the manufacturing sector. Moreover, firms with access to credit facilities can participate in GVCs compared with firms without, particularly among the two-way traders. Lastly, formal status is a major factor that influences GVC participation for the firms that are seeking international quality certification (GVC-2). Firm registration is a prerequisite for firms interested in GVCs through international product certification processes.

While the results of Calatayud et al. (2023) primarily focus on sub-Saharan Africa as a whole, they may not be directly applicable to individual African countries due to their uniqueness. This study reveals differences in results compared to theirs based on the GVCs definitions. For example, GVC participation via foreign technology or GVC with both foreign technology and international certification has more requirements compared with two-way traders with none or two-way traders using international certification. Similarly, while Montfaucon et al. (2023) and Wanjala and Abdulahi (2022) highlight the significance of variables such as FDI, political stability, labour productivity, firm size in firms' participation in GVCs, this study shows differences in the results due to several factors. These include the definitions of GVCs used, the type of variables used in the estimations, the methods for addressing endogeneity issues, and the scope of the study.

Based on our results, both firm characteristics and perceptions of the business environment determine firm engagement in GVC activities in the manufacturing sector in Kenya. Our findings indicate that labour productivity, foreign ownership, firm size, website use, generator use, and perceptions of transport costs are the main determinants of GVCs activities in Kenya's manufacturing sector. Additionally, the study shows that the definition of GVCs significantly influences the factors identified in the estimations.

Factors that influence GVCs participation based on firm size and gender of firm ownership

Table 7 presents the results regarding the factors that are influencing GVCs for both micro and small firms, as well as medium and large firms. In all the estimations, foreign ownership, website use, and firm size influence GVCs across all the firms in the manufacturing sector. However, labour productivity holds greater significance for the medium and large than for smaller ones. According to the Organisation for Economic Co-operation and Development (OECD, 2021), large firms are on average more productive compared to the small firms in the manufacturing sector. The results also show that most of the small firms are affected more by power losses which makes them acquire or share generators in case of blackouts to reduce the disruptions and losses compared to the larger firms. Moreover, small firms are affected more by the business environment factors compared to the larger firms. Conversely, large firms are more susceptible to crime, transport costs, and competition from the informal sector.

Table 7: Factors that influence GVCs participation based on firm size in the manufacturing sector in Kenya using propensity matching

Variables	Micro and Small Firms								Medium and Large Firms							
	GVC-1		GVC-2		GVC-3		GVC-All		GVC-1		GVC-2		GVC-3		GVC-All	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Log labour productivity	0.00	0.05	0.07	0.11	-0.05	0.10	-0.02	0.15	0.19***	0.04	0.25***	0.05	0.27***	0.06	0.34***	0.07
Age	0.02	0.01	0.03	0.04	0.01	0.02	0.02	0.05	0.02**	0.01	0.02*	0.01	0.01	0.01	0.02	0.02
Age squared	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Foreign ownership	0.69***	0.20	1.58***	0.40	0.82***	0.31	2.01***	0.61	0.69***	0.16	0.43***	0.17	0.57***	0.19	0.58***	0.21
Formal status	-0.01	0.20	-0.12	0.51	-0.24	0.37	-0.98	0.64	-0.19	0.22	-0.53**	0.25	-0.01	0.32	-0.31	0.33
Innovation	0.12	0.16	-0.11	0.38	0.48	0.33	0.95*	0.57	0.27*	0.16	0.18	0.20	0.01	0.23	0.03	0.26
Website use	0.56***	0.16	1.11***	0.40	1.08***	0.29	2.11***	0.70	0.56***	0.14	0.67***	0.18	0.35*	0.19	0.40*	0.23
Credit	0.17	0.15	0.26	0.32	-0.18	0.25	0.26	0.42	0.24*	0.13	-0.12	0.16	0.33*	0.18	0.18	0.20
Firm size	0.27**	0.12	0.81**	0.37	0.43*	0.23	0.99*	0.53	0.27***	0.08	0.32***	0.09	0.18*	0.09	0.29***	0.10
Formal training	0.09	0.16	0.07	0.36	0.55**	0.26	-0.05	0.45	-0.15	0.14	0.41	0.16	0.34*	0.19	0.44**	0.22
Generator	0.30*	0.16	0.63*	0.38	0.54*	0.30	0.94*	0.53	-0.24	0.20	0.54**	0.35	0.80	0.51	0.52	0.54
Transport costs	0.04	0.17	0.93**	0.43	0.27	0.30	1.33**	0.58	0.56***	0.15	0.38**	0.17	0.38*	0.20	0.19	0.22
Security	-0.04	0.19	0.00	(omitted)	-1.02**	0.50	0.00	(omitted)	-0.30**	0.15	-0.34*	0.19	-0.28	0.22	-0.44*	0.26
Customs and trade regulations	0.40**	0.18	-0.06	0.43	1.10***	0.30	-0.02	0.53	0.14	0.15	-0.02	0.18	0.58	0.21	0.52**	0.23
Business permit	-0.10	0.20	0.80**	0.40	0.23	0.32	1.19**	0.52	-0.29*	0.17	-0.11	0.20	-0.29	0.25	0.03	0.27
Political instability	-0.19	0.17	-0.95**	0.47	-0.27	0.29	-1.16**	0.57	-0.17	0.14	-0.02	0.16	0.06	0.19	0.09	0.21
Corruption	-0.02	0.17	-0.23	0.42	-0.25	0.32	-0.44	0.53	0.06	0.14	0.04	0.17	-0.29	0.20	-0.21	0.23
Competition with informal	-0.03	0.15	-0.58	0.37	-0.19	0.27	-1.02**	0.50	0.14	0.15	0.15	0.18	-0.65***	0.22	-0.63***	0.26

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Table 7 Continued

Variables	Micro and Small Firms								Medium and Large Firms							
	GVC-1		GVC-2		GVC-3		GVC-All		GVC-1		GVC-2		GVC-3		GVC-All	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Tax rates administration	-0.02	0.18	-0.33	0.42	-0.21	0.30	0.10	0.47	0.08	0.16	-0.01	0.18	-0.01	0.22	0.01	0.25
Labour regulation	-0.19	0.26	-0.81	0.81	-1.51**	0.72	-1.14	0.97	0.11	0.18	0.12	0.21	0.14	0.24	0.05	0.29
Location	0.37**	0.16	0.61	0.39	0.41	0.28	0.26	0.45	0.24*	0.13	0.36**	0.16	0.17	0.18	0.11	0.20
Constant	-3.11***	0.83	-7.53***	2.14	-4.36***	1.48	-8.06***	2.98	-5.45***	0.86	-8.03***	1.08	-8.15***	1.27	-9.60***	1.46
Number of observations	657	520	657	520	478	478	478	478								
LR chi2(21)	84.36	84.40	101.73	78.45	116.07	137.10	124.01	114.72								
Prob>chi2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00								
Pseudo R2			0.18	0.48	0.42	0.55	0.18	0.26	0.30	0.33						

Note: *, **, *** Significance at the 10%, 5%, and 1% levels, respectively.
Source: Author's calculation.

The results indicate that, while two-way traders are influenced by similar factors, differences arise based on the definitions of GVCs. Larger firms tend to be more productive, older, more innovative, and have better access to credit. They also perceive transport costs, security, and business permits as significant factors. Security and business permits are major obstacles to participating in GVCs activities. Conversely, smaller firms find the use of generators and customs and trade regulations have a greater impact on their ability to join GVC activities compared to larger firms.

Additionally, larger two-way traders with international quality certification are more productive, older, more formal, and more considered about security concerns and location compared to smaller firms. These smaller firms are more interested in political stability which they see as a major obstacle influencing GVC activities.

The results also show that larger firms with technology licensed by foreign companies exhibit higher productivity. These firms benefit from access to credit and consider transport costs and competition with the informal sector significant factors. In contrast, smaller firms prioritize access to generators, improved security and the influence of customs, trade and labour regulations on their participation in GVCs.

Moreover, larger firms engaged in GVCs, possessing both international certification and foreign-licensed technology are, not only more productive, but also invest in formal worker training.

These firms are concerned with customs and trade regulations, concerned about security issues and competition with informal sector. On the other hand, smaller firms focus more on transport costs, business permits, and political stability.

Table 8 highlights disparities in the factors that influence GVCs participation based on gender of the owners. Although the main factors are similar across genders, significant differences emerge depending on GVC definitions. Female owners have more factors to consider before participating in GVCs compared to male owners. When comparing firm characteristics based on gender, formal registration plays a more crucial role in the decision of male owners to engage in GVCs. In contrast, female owners prioritize power availability, as evidenced by their consideration of generator use.

The perception of the business environment has a greater influence of GVC participation for female owners compared to male owners. While female owners view transport costs and customs and trade regulations favourably for participating in GVCs activities, they see insecurity, corruption, and competition with the informal sector as major obstacles. In contrast, male owners identify political instability as the main obstacle.

Table 8: Factors that influence GVCs participation based on ownership gender in the manufacturing sector in Kenya using propensity matching

Variables	Male Ownership of Firms								Female Ownership of Firms							
	GVC-1		GVC-2		GVC-3		GVC-All		GVC-1		GVC-2		GVC-3		GVC-All	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Log labour productivity	0.24***	0.06	0.27***	0.07	0.16**	0.07	0.24***	0.09	0.01	0.05	0.13**	0.07	0.14**	0.07	0.30***	0.09
Age	0.01	0.01	0.01	0.02	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.02	-0.01	0.01	-0.01	0.02
Age squared	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Foreign ownership	0.59***	0.21	0.53**	0.25	0.66***	0.26	0.70**	0.30	0.67***	0.16	0.83***	0.19	0.80***	0.20	1.12***	0.25
Formal status	-0.29	0.21	-0.47*	0.29	-0.35	0.30	-0.68**	0.35	0.15	0.23	-0.40	0.34	0.32	0.42	-0.26	0.49
Innovation	0.23	0.18	0.08	0.25	0.19	0.26	0.19	0.30	0.17	0.15	0.10	0.23	0.24	0.25	0.17	0.34
Website use	0.49***	0.18	1.04***	0.30	0.40	0.27	0.75**	0.35	0.62***	0.13	0.58***	0.19	0.66***	0.20	0.61**	0.26
Credit	0.19	0.16	-0.10	0.21	0.32	0.22	0.14	0.26	0.18	0.12	0.05	0.18	0.08	0.18	0.15	0.24
Firm size	0.27***	0.07	0.26***	0.10	0.08	0.10	0.18	0.11	0.40***	0.06	0.42***	0.08	0.07	0.08	0.19**	0.10
Formal training	-0.17	0.18	0.34	0.22	0.42*	0.23	0.45*	0.27	0.13	0.13	0.32*	0.19	0.46**	0.19	0.30	0.26
Generator	-0.07	0.21	0.17	0.34	-0.06	0.32	-0.20	0.39	0.20	0.15	0.77**	0.35	1.06***	0.35	0.00	(omitted)
Transport costs	0.26	0.21	0.39	0.26	0.35	0.27	0.32	0.33	0.38***	0.13	0.46**	0.19	0.25	0.20	0.20	0.25
Security	-0.41	0.26	-0.42	0.36	-0.39	0.36	-0.31	0.43	-0.13	0.14	-0.37*	0.21	-0.46	0.23	-0.65**	0.31
Customs and trade	0.14	0.23	-0.25	0.29	0.31	0.30	0.05	0.36	0.27***	0.14	0.09	0.20	0.82***	0.21	0.73***	0.28
Business permit	-0.16	0.24	0.37	0.27	0.01	0.30	0.46	0.33	-0.39**	0.16	-0.20	0.23	-0.18	0.25	0.26	0.31
Political instability	-0.20	0.18	-0.52**	0.25	-0.11	0.25	-0.18	0.29	-0.21	0.14	-0.07	0.20	-0.12	0.21	-0.29	0.29
Corruption	0.11	0.19	0.43*	0.24	0.16	0.26	0.26	0.29	0.01	0.13	-0.44**	0.20	-0.47**	0.21	-0.82***	0.31
Competition with informal	-0.14	0.19	0.12	0.24	-0.40	0.27	-0.48	0.32	0.21	0.13	0.14	0.20	-0.51**	0.23	-0.66**	0.32
Tax administration	-0.24	0.23	-0.03	0.27	-0.45	0.33	-0.61	0.39	0.17	0.14	-0.08	0.20	0.11	0.21	0.34	0.27

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Table 8 Continued

Variables	Male Ownership of Firms								Female Ownership of Firms							
	GVC-1		GVC-2		GVC-3		GVC-All		GVC-1		GVC-2		GVC-3		GVC-All	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Labour regulation	0.04	0.27	-0.22	0.34	-0.08	0.35	0.17	0.40	0.03	0.17	0.22	0.24	-0.02	0.27	-0.27	0.39
Location	0.63***	0.17	0.61***	0.22	0.64***	0.24	0.31	0.27	0.15	0.13	0.18	0.18	0.03	0.19	0.01	0.23
Constant	-5.93***	0.85	-8.03***	1.26	-5.60***	1.16	-7.32***	1.44	-3.87***	0.72	-6.55***	1.16	-5.78***	1.17	-7.40***	1.60
Number of observations	394	394	394	394	741	741	741	466								
LR chi2(21)	151.01	130.20	82.81	76.90	264.7	194.06	169.48	112.55								
Prob>chi2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00								
Pseudo R2			0.31	0.38	0.31	0.35	0.31	0.41	0.39	0.41						

Note: *, **, *** Significance at the 10%, 5%,, and 1% levels, respectively.
Source: Author's calculation.

Factors that influence GVCs participation in different sectors

Due to data set constraints, the study concentrated on two key sectors within the manufacturing industry (as illustrated in Table 4), namely the food and chemical sectors. The analysis focused on three definitions of GVCs as presented in Table 9 because of limited number of firms in the last GVC definition. Like the entire manufacturing sector, the GVCs participation in the food sector is affected by foreign ownership, website presence, firm size and perception of transport costs. Unlike the entire manufacturing sector, the labour productivity is only significant in the two-way traders with foreign licensed technology.

Favourable labour regulations play a key role in enabling participation in GVCs as it creates employment opportunities and increase the labour demand. Guschanski and Onaran(2023) find that GVCs disrupts labour relations, diminishing the bargaining power of workers. Furthermore, many GVCs rely on contract and agency labour, which might be associated with low wages, forced overtimes, and higher production targets.

For the two-way traders adhering to international quality certification, tax administration is perceived as an obstacle for the GVCs participation in the food sector. Additionally, delayed business licencing and permits, political instability, and competition with the informal sectors are major obstacles in GVC participation.

To facilitate firms' participation in GVCs within the food sector, it is essential for the government and KAM to establish clear definitions, considering the diverse requirements of GVC types. In addition, implementing incentives targeting foreign firms operating in the sector, reducing the cost of website development, and improving infrastructure to be able to reduce transport costs, will allow firms to participate in the GVCs regardless of specific GVC definition. Furthermore, improving the business environment by reducing delays and bureaucratic hurdles in business licencing and permits, addressing issues related to crime and political instability, as well as reducing firm informality will encourage firms to engage in GVCs activities.

Similarly, Table 9 presents the factors that influence GVCs participation in the chemical sector within the manufacturing sector in Kenya. The factors that influence two-way traders (GVC-1) include labour productivity, formality of the firms, firm size, and business environment factors such as security, custom and trade regulations, competition with the informal sector, and tax rate administration. Like the two-way traders in the entire manufacturing sector, labour productivity, firm size, and custom and trade influence the two-way traders in the chemical sector. However, to encourage firms to participate in the GVCs in the chemical sector, favourable customs and trade regulations, reduction of crime, simple and predictable tax administration along with reduction of informal competition are essential factors.

In the case of the firms with international quality certification participating in GVCs (GVC-2), only significant factors influencing participation are firm size, and training based on the estimations. This contrasts with the broader results for the manufacturing sector.

Table 9: Factors that influence GVCs participation in the food and chemical sector in Kenya using propensity matching

Variables	Food Sector						Chemical Sector					
	GVC-1		GVC-2		GVC-3		GVC-1		GVC-2		GVC-3	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Log labour productivity	0.09	0.06	0.13	0.10	0.30*	0.16	0.33**	0.17	0.22	0.19	0.31	0.20
Age	0.01	0.02	0.00	0.03	-0.04	0.04	-0.02	0.03	0.00	0.04	0.10**	0.05
Age squared	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Foreign ownership	0.97***	0.29	1.55***	0.45	2.22***	0.88	0.59	0.47	0.47	0.55	0.52	0.58
Formal status	-0.27	0.32	-0.89	0.61	0.92	0.91	-1.87***	0.66	-1.04	0.79	-2.20**	1.03
Innovation	0.09	0.26	-0.13	0.42	0.79	0.83	0.43	0.41	0.49	0.62	-0.01	0.61
Website	0.80***	0.24	2.27***	0.65	1.18*	0.62	0.19	0.43	-0.42	0.60	0.46	0.67
Credit	0.30	0.21	-0.01	0.36	1.12*	0.64	0.53	0.37	-0.33	0.50	1.27**	0.63
Firm size	0.33***	0.08	0.62***	0.16	0.77***	0.25	0.51**	0.23	0.75**	0.33	-0.21	0.32
Formal training	-0.31	0.24	-0.58	0.42	0.11	0.57	-0.15	0.43	0.91*	0.54	1.36**	0.63
Transport costs	0.41*	0.24	1.18***	0.43	1.70**	0.72	0.36	0.39	-0.43	0.62	1.24*	0.66
Security	0.12	0.26	0.12	0.42	1.30***	0.67	1.13**	0.54	-0.44	0.73	0.45	0.94
Customs and trade reg.	0.07	0.28	-0.05	0.45	0.87	0.58	0.76*	0.45	0.58	0.59	2.52***	0.86
Business permit	-0.31	0.30	0.29	0.44	-1.82*	1.00	-0.30	0.50	-0.12	0.70	-1.43	0.93
Political instability	-0.10	0.24	-0.17	0.45	-1.56**	0.72	0.00	0.38	0.43	0.44	0.87	0.65
corruption	-0.11	0.25	-0.38	0.43	-0.47	0.54	-0.42	0.39	-0.46	0.52	-0.62	0.71
Competition informal	0.09	0.23	-0.05	0.36	-1.86**	0.86	1.07**	0.44	0.57	0.58	-0.33	0.69
Tax rates administration	-0.15	0.27	-0.95*	0.51	-0.70	0.71	-0.95**	0.44	-0.68	0.59	-0.70	0.66

continued next page

Table 9 Continued

Variables	Food Sector						Chemical Sector					
	GVC-1		GVC-2		GVC-3		GVC-1		GVC-2		GVC-3	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Labour regulation	0.89***	0.32	1.48**	0.63	1.07	0.80	-0.60	0.77	-0.97	1.19	-1.39	1.01
Location	0.28	0.23	0.65	0.41	-0.26	0.58	-0.19	0.47	0.50	0.59	0.07	0.61
Constant	-4.81***	1.01	-8.10***	2.03	-13.61***	3.92	-6.61**	2.83	-7.79**	3.87	-10.12**	4.30
No of observations	371		371		371		104		77		104	
	LR chi2(20) = 95.59		LRchi2(20) =110.6		LR chi2(20) = 75.11		LR Chi2(21)=59.23		LR Chi2(20)=37.40		LR Chi2(21)=44.42	
	Prob>chi2=0.00		Prob>chi2=0.00		Prob>chi2 =0.00		Prob>chi2=0.00		Prob>chi2 =0.00		Prob>chi2 =0.00	
Pseudo R2	0.33		0.57		0.60		0.41		0.40		0.46	

Note: *, **, *** Significance at the 10%, 5%, and 1% level, respectively.
Source: Author's cal culation.

Similarly, the factors that influence GVCs utilizing foreign technology (GVC-3) are consistent with the results from the entire sector such as formal training, and business environment factors such as use of generators, reduction of transport costs, and favourable customs and trade regulations. However, in the chemical sector, firms' engagement through GVCs using foreign technology tend to be older, legally registered, and have access to credit compared to the results observed for the entire manufacturing sector.

Results from the chemical sector indicate that there is need to support firms' access to the internet and websites to enable their participation in the GVC activities. In addition, providing incentives to attract foreign ownership, enhanced formal training, increasing firm formality, ensuring the availability of credit, and improving business environment through better customs and trade regulations, tax administration and addressing competition from the informal sector can all support firms interested in participating in GVCs within the chemical sector.

The results presented in the paper are summarized on (Table 10).

Table 10: Summary of the results

The Manufacturing Sector	Main Determinants
Overall	Foreign ownership, website use, generator use, firm size, labour productivity, and perceptions of transport costs
The medium and large firms	Labour productivity, foreign ownership, website use, generator use
The small firms	Foreign ownership, website use, generator use
Male owned firms	Labour productivity and foreign ownership
Female owned firms	Foreign ownership and website use
Food sector	Foreign ownership, website presence, firm size, generator use, and perception of transport cost
Chemical sector	Formal registration, firm size, formal training, and customs and trade regulations

The results further indicate that different sectors have distinct factors influencing their participation in GVCs. In addition, within each sector, definition of GVC used results in unique requirements regarding the factors that affect GVC activities.

6. Conclusion

This paper examined the factors that influence GVCs participation within the manufacturing sector in Kenya for the period 2007–2018 using firm-level data from the World Bank Enterprise Survey. Various definitions of GVCs were employed, and the results were estimated using propensity score matching method (PSM) through a probit model. The nearest neighbour matching estimator was used to group individuals based on propensity scores. PSM addresses endogeneity from omitted variables or selection bias by reducing multiple dimensions to one dimensional score, thereby resolving the issues of insufficient sample cases in exact matching. The study also examined the factors that influence GVC participation according to firm size and ownership gender. Moreover, the study examined the factors that influence GVCs participation in both food and chemical sectors.

The results show that the factors that influence GVCs participation in the manufacturing sector are labour productivity, foreign ownership, firm size, the presence of website, generator use, and transport costs, and are consistent across different GVC definitions. The other factors such as formal training and access to credit depend on the definition of the GVC used. The findings from the food and chemical sectors indicate that various factors influence GVCs participation depending on the definitions of GVCs used and the sector. In addition to the primary factors that influence the overall sector, additional determinants such as labour regulation, access to credit, firm formality, and some aspects of business environment such as business licencing and permits, security and political instability impact firm engagement in the GVCs participation in the food sector. In the chemical sector, while foreign ownership and presence of websites are not as important, labour productivity, formal training, availability of credit, and firm formality as well as elements of business environment such as customs and trade regulations, tax administration, security, and reliance of generator influence firms depending on how you define GVCs.

The paper demonstrates that both firm-level characteristics and the firm's perceptions on business environment influence GVC activities in Kenya's manufacturing sector. Additionally, the study highlights the importance of defining GVCs, as this definition influences the factors identified as impacting GVC activities. The type of variables used in the estimations and the methods used to address endogeneity issues determines the nature of results reported. Furthermore, the study indicates that smaller firms are more significantly impacted by these factors

compared to the larger firms, who are often female-owned. Lastly, the food and chemical sectors exhibit heterogeneity in the factors influencing GVCs activities within the manufacturing sector.

Based on the results presented in this paper, several policy recommendations can be proposed to enhance GVC participation in the manufacturing sector in Kenya. These include; implementation of training programmes and skill development initiatives to enhance labour productivity, developing incentives such as tax breaks, and developing regulatory frameworks to attract foreign investors in chemical sectors, among others. Additionally, to support the small and medium enterprises by developing policies to address specific needs and challenges facing these firms, particularly those female-owned that are affected more by the business environment such as insecurity, corruption, and competition from the informal sector, and providing targeted capacity-building and mentorship programmes for these firms. Moreover, ensuring access to affordable credit for firms seeking to participate in GVCs, and supporting digital infrastructure and connectivity to enable the firms access global markets. Furthermore, streamline business regulations such as customs and trade, tax administration, and labour, among others, to enable the firms engage in GVCs activities and recognizing the heterogeneity across different sectors to ensure that they address sector specific challenges. Implementing these policies, among others, can enhance Kenya's manufacturing sector competitiveness and integration into the GVCs; consequently fostering economic growth, development, and job creation.

Notes

1. Global value chains refer to international production sharing where production is broken down into different activities and tasks (design, production, marketing, distribution, and customer support) which can be conducted in different countries (see https://iap.unido.org/articles/what-are-global-value-chains-and-why-do-they-matter).

2. The MSMEs account for 24% of GDP, encompass 90% of the private sector enterprises, and employ about 93% of the total labour force in the nation, and most are in the informal sector (GoK, 2020).

3. To support government GVCs approach, Kenya Association of Manufacturers (KAM) is working with its members in the agriculture processing sectors such as food and beverages, textiles and apparels, leather and foot wears, and processing and chemicals, to address the challenges in the agro-processing value chains (see https://www.capitalfm.co.ke/news/2023/07/strengthening-local-value-chains-key-to-kenyas-transformation/)

4. The study defined GVC as firms exporting either directly or indirectly, and firms directly importing inputs and supplies for their production process.

5. This method cannot be used to deal with simultaneous causality and measurement errors (see Zhang et al., 2021).

6. https://kam.co.ke/sectors/

7. Despite limited empirical literature on GVCs on Africa, most of the studies use the UNCTAD EORA data sets and customs data sets, which may suffer from missing important variables related to the firms or distorted statistics affecting the estimations (Fernandes et al., 2023; Calatayud & Barrachina, 2023).

8. https://www.treasury.go.ke/wp-content/uploads/2023/08/CS_NT.P_Keynote-Address_SWG_Launch-2024-25Revised.pdf

9. 342 of the 1,235 firms in the manufacturing sector, i.e., 27.69%.

10. There is a debate on whether the propensity scores matching addresses selection bias or not (see Guo et al., 2019).

11. The objective is to identify objects or individuals in a large group of non-participants who have similar characteristics with the treatment participants before the treatment was administered. Consequently, any differences in outcomes between this control group and the participants can be attributed to the programme. The logit and probit models produce comparable results in the PSM estimations (see Caliendo & Kopeinig, 2008).

12. "psmatch2 implements full Mahalanobis matching along with a range of propensity score matching methods to account for pre-treatment observable differences between a group of treated and a group of untreated individuals. It computes approximate standard errors on the treatment effects, assuming independent observations, fixed weights, homoscedasticity of the outcome variable within the treated and within the control groups, and that the variance of the outcome does not depend on the propensity score" (see http://repec.org/bocode/p/psmatch2.html).

13. When the generator variable is removed from the estimation, the firm size becomes a positive and significant factor for two-way traders with foreign licensed technology. Similarly, when firm size is removed from the estimation, the generator becomes a positive and significant factor for two-way traders.

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Appendix

Table A1: T-test based on the pooled data set

Variable(s)	Non-GVC1 Mean Control	GVC1 Mean Treated	Diff.	t	Pr(T>t)
Basic Firm Characteristics					
lnLabour productivity	14.18	14.98	0.80	7.82	0.00***
Age	28.60	35.76	7.16	6.22	0.00***
Foreign firms	0.10	0.29	0.19	8.81	0.00***
Formal firms	0.77	0.90	0.13	5.07	0.00***
Innovation	0.66	0.80	0.14	4.93	0.00***
Website	0.34	0.66	0.32	10.86	0.00***
Credit	0.41	0.59	0.18	5.61	0.00***
Firm size	70.15	252.94	182.79	8.10	0.00***
Formal training	0.36	0.57	0.21	6.78	0.00***
lnTrade	7.06	19.43	12.37	21.30	0.00***
Generator	0.57	0.85	0.28	9.50	0.00***
Gender of ownership	0.65	0.60	-0.05	-1.73	0.04**
Location	0.45	0.61	0.16	5.35	0.00***
Business Environment Perceptions					
Business permit	0.19	0.20	0.01	0.31	0.76
Transport costs	0.28	0.39	0.11	4.00	0.00***
Security	0.23	0.25	0.02	0.83	0.41
Customs and trade regulations	0.20	0.33	0.13	4.81	0.00***
Political stability	0.33	0.29	-0.04	-1.34	0.09*
Corruption	0.35	0.39	0.04	1.20	0.23
Competition informality	0.39	0.35	-0.04	-1.56	0.06*
Taxes administration	0.25	0.30	0.05	1.75	0.04**
Labour regulation	0.11	0.16	0.05	2.49	0.01***

Note: *** p<0.01; ** p<0.05; * p<0.1

Table A2: GVCs in the manufacturing sector in Kenya based on the pooled data set

Sector	GVC1		GVC2		GVC3		GVC-4	
	No.	% of total firms	No.	% of total firms	No.	% of total firms	No.	% of total firms
Food	52	12.9	28	6.9	16	4	10	5
Textiles	34	36.6	10	10.8	8	8.6	4	8.6
Garments	27	21.6	5	4	2	1.6	1	1.6
Leather	11	45.8	3	12.5	3	12.5	2	16.7
Wood	1	3.8	1	3.8	1	3.8	1	7.7
Paper	9	34.6	5	19.2	3	11.5	3	23.1
Publishing, printing,	10	22.7	3	6.8	3	6.8	1	4.5
Refined petroleum prod.	3	60	1	20	0	0	0	0
Chemicals	58	51.8	25	22.3	19	17	12	21.4
Plastics & rubber	32	45.7	15	21.4	11	15.7	9	25.7
Non-metallic mineral	10	22.7	4	9.1	2	4.5	2	9.1
Basic metals	10	52.6	7	36.8	4	21.1	4	42.1
Fabricated metal prod.	22	34.9	12	19	12	19	8	25.4
Machinery and equip.	16	42.1	8	21.1	6	15.8	5	26.3
Electronics	11	50	5	22.7	8	36.4	5	45.5
Precision instruments	1	100	0	0	1	100	0	0
Transport machines	14	33.3	8	19	6	14.3	6	28.6
Furniture	19	25.3	5	6.7	4	5.3	2	5.3
Recycling	2	66.7	1	33.3	2	66.7	1	66.7
Total	342	27.7	146	11.8	111	9	76	12.3

Source: Author's calculation.

Table A3: Measurement of the variables used in the study

Variable	Obs	Mean	Std. Dev.	Min	Max
Global Value Chains					
GVC1	1,235	0.28	0.45	0	1
GVC2	1,235	0.12	0.32	0	1
GVC3	1,235	0.09	0.29	0	1
GVC4	1,235	0.06	0.24	0	1
Basic Firm Characteristics					
lnLabour productivity	1,135	14.40	1.60	8.01	21.27
Age	1,235	30.58	18.39	0	112
Foreign firms	1,235	0.15	0.36	0	1
Formal firms	1,235	0.81	0.40	0	1
Innovation	1,235	0.69	0.46	0	1
Website	1,235	0.43	0.49	0	1
Credit	1,235	0.46	0.50	0	1
Firm size	1,221	3.68	1.41	0	8.99
Formal training	1,235	0.42	0.49	0	1
lnTrade	1,235	10.49	10.67	0	27.63
Generator	1,235	0.65	0.48	0	1
Gender of ownership	1,235	0.63	0.48	0	1
Location	1,235	0.49	0.50	0	1
Business Environment Perceptions					
Business permit	1,235	0.19	0.39	0	1
Transport costs	1,235	0.31	0.46	0	1
Security	1,235	0.23	0.42	0	1
Customs and trade regulations	1,235	0.24	0.43	0	1
Political stability	1,235	0.32	0.47	0	1
Corruption	1,235	0.37	0.48	0	1
Competition informality	1,235	0.38	0.49	0	1
Taxes administration	1,235	0.27	0.44	0	1
Labour regulation	1,235	0.12	0.33	0	1

Table A4: Female ownership based on the firm size based on the pooled data

Sector	Small		Medium		Large	
	%	Total	%	Total	%	Total
Food	76.0	221	75.9	58	61.2	85
Textiles	65.1	43	66.7	12	61.3	31
Garments	84.4	77	87.5	16	72.7	22
Leather	37.5	8	40.0	10	60.0	5
Wood	60.0	15	75.0	4	100.0	3
Paper	61.5	13	40.0	5	85.7	7
Publishing, printing,	67.7	31	50.0	6	66.7	6
Refined petroleum prod.	N/A	N/A	50.0	2	0.0	2
Chemicals	49.0	49	69.2	26	63.9	36
Plastics & rubber	40.0	30	50.0	8	48.4	31
Non-metallic mineral	60.0	20	55.6	9	30.8	13
Basic metals	50.0	6	0.0	2	40.0	10
Fabricated metal prod.	58.6	29	55.6	9	55.6	18
Machinery and equipment	54.5	22	37.5	8	14.3	7
Electronics	36.4	11	80.0	5	0.0	5
Precision instruments	N/A	N/A	N/A	N/A	0.0	1
Transport machines	54.2	24	25.0	4	50.0	12
Furniture	69.0	42	66.7	9	53.8	13
Recycling	100.0	1	N/A	N/A	0.0	2
Total	66.8	642	64.8	193	56.0	309

Table A5: Correlation matrix (using the firm characteristics)

Variables	GVC1	GVC2	GVC3	GVC4	lnlabo~y	Age	Foreign	Formal	Innova ~n	Website	Credit	Firm size	Fortra ~g	lntrade	Genera ~r	Owners ~r	Loca-tion
GVC1	1																
GVC2	0.58	1															
GVC3	0.51	0.56	1														
GVC4	0.42	0.71	0.81	1													
lnLabour productivity	0.23	0.25	0.23	0.24	1												
Age	0.18	0.21	0.18	0.19	0.15	1											
Foreign firms	0.26	0.23	0.22	0.23	0.17	0.06	1										
Formal firms	0.14	0.06	0.09	0.06	0.20	0.18	0.17	1									
Innovation	0.15	0.09	0.11	0.08	0.07	0.07	0.01	0.09	1								
Website	0.30	0.29	0.23	0.22	0.21	0.11	0.14	0.13	0.08	1							
Credit	0.16	0.07	0.10	0.08	0.09	0.08	0.01	0.11	0.14	0.08	1						
Firm size	0.45	0.36	0.23	0.24	0.14	0.22	0.21	0.26	0.16	0.34	0.22	1					
Formal training	0.18	0.21	0.20	0.16	0.18	0.13	0.08	0.17	0.19	0.24	0.14	0.28	1				
lnTrade	0.55	0.31	0.27	0.20	0.22	0.12	0.21	0.18	0.11	0.23	0.16	0.41	0.18	1			
Generator	0.27	0.23	0.19	0.17	0.24	0.18	0.12	0.20	0.12	0.24	0.10	0.48	0.18	0.22	1		
Gender of ownership	-0.05	-0.09	-0.03	-0.05	-0.07	0.07	-0.04	0.16	0.08	-0.18	0.10	-0.11	0.02	-0.03	-0.06	1	
Location	0.16	0.11	0.07	0.04	0.00	0.03	-0.04	0.00	0.19	0.08	0.07	0.20	-0.01	0.14	0.07	0.10	1

Table A6: Correlation matrix (using the business environment perceptions)

	gvc1	gvc2	gvc3	gvc4	busine~t	transp~t	security	custom~e	politi~l	corrup~n	compet~l	obstab~s	labouri~
GVC1	1												
GVC2	0.59	1											
GVC3	0.51	0.55	1										
GVC4	0.41	0.70	0.81	1									
Business permit	0.01	0.03	-0.02	0.01	1								
Transport costs	0.11	0.07	0.08	0.05	0.20	1							
Security	0.02	-0.02	-0.05	-0.05	0.15	0.23	1						
Customs and trade regulations	0.14	0.06	0.14	0.09	0.20	0.29	0.16	1					
Political stability	-0.04	-0.03	0.01	0.00	0.09	0.01	0.02	0.09	1				
Corruption	0.03	-0.01	-0.04	-0.05	0.21	0.16	0.28	0.24	0.24	1			
Competition informality	-0.04	-0.05	-0.12	-0.11	0.22	0.11	0.18	0.17	0.09	0.20	1		
Taxes administration	0.05	0.00	0.00	-0.01	0.26	0.20	0.22	0.32	0.12	0.24	0.24	1	
Labour regulation	0.07	0.03	0.01	0.00	0.17	0.20	0.17	0.18	0.09	0.17	0.13	0.22	1

Mission

To strengthen local capacity for conducting independent,
rigorous inquiry into the problems facing the management of economies in sub-Saharan Africa.

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