The patterns of value chain integration and capacity utilization across firms in Africa

Master Thesis

M.Sc. Management of Technology

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TU Delft

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by

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TU Delft

Preface

In a twist of irony befitting the journey itself, this is the first page of the document and also the last one I wrote.

This thesis represents the culmination of six months of research, analysis, and reflection, driven by a profound curiosity about the growing economy of Africa and its future potential. My interest originated as a retail investor seeking opportunities to diversify my portfolio. With Africa hosting the world's youngest and fastest-growing population, projected to nearly double to 2.5 billion by 2050, along with thriving urban centers and pioneering innovations in fintech and clean energy, the continent offers vast opportunities for robust and inclusive growth. By leveraging its abundant natural resources and human potential, Africa has the potential to enhance prosperity both within the continent and globally. This thesis provided me the opportunity to build upon the foundation of economic principles I learned during my specialization in Finance and Economics.

My journey through the M.Sc. MOT program at Delft University of Technology has been fueled by a passion for understanding how technological and managerial practices can be leveraged to address real-world challenges. The focus on capacity utilization among firms in Africa was inspired by the significant disparities in production efficiency observed across the emerging economies, like Africa. This research aims to explore how different modalities of value chain integration: domestic, foreign, and hybrid, can influence capacity utilization and enhance firm performance. This investigation transcends academic exercise, striving to provide practical insights that can assist firms in navigating the complexities of global and local market integration.

I am deeply grateful to my supervisors, Dr. G.O. Ndubuisi, Dr. M. Ludema, and Dr. R.M. Verburg, whose guidance and support have been instrumental in shaping this work. Their expertise and constructive feedback have been invaluable throughout this journey. I also extend my heartfelt thanks to my family, friends, and colleagues for their support and encouragement. Lastly, I would like to acknowledge the use of Generative AI tools, specifically OpenAI's ChatGPT, which assisted in addressing errors in the data analysis code, paraphrasing, and refining some portions of the text in this thesis. I hope the findings and insights presented in this thesis will contribute meaningfully to the discourse on value chain integration and capacity utilization, offering valuable implications for business leaders, policymakers, and fellow researchers interested in the economic development of Africa.

Vishesh Bajpai
Delft, August 2024

Summary

This thesis addresses the critical challenge of low capacity utilization among firms in Africa, a key indicator of firm performance that remains significantly underdeveloped among firms across the continent. By focusing on value chain integration: domestic (DVC), foreign (FVC), and hybrid (HVC) forms, this research seeks to bridge a crucial gap in understanding how different integration strategies affect the overall performance of firms in Africa. The motivation for focusing on Africa stems from the continent's promising position on the global stage. With Africa hosting the world's youngest and fastest-growing population, projected to nearly double to 2.5 billion by 2050, along with pioneering innovations, the continent offers vast opportunities for robust and inclusive growth. By leveraging its abundant natural and human resources, Africa has the potential to enhance prosperity both within the continent and globally. However, achieving this potential requires addressing persistent inefficiencies in production, such as low capacity utilization, which this research aims to tackle. While existing literature has extensively explored the benefits of value chain integration on firm performance metrics such as productivity and innovation, there is a lack of focused research on how these benefits translate into improved capacity utilization levels, particularly among firms in Africa. This thesis contributes to the field by introducing the concept of hybrid value chain (HVC) integration, a novel approach that combines elements of both domestic and foreign integration, to examine its impact on capacity utilization. Using data from the World Bank Enterprise Surveys, covering 14,823 firms across 36 industries in Africa, the research employs a linear regression model to reveal that DVC integration significantly enhances capacity utilization. In contrast, FVC integration presents challenges that can reduce capacity utilization unless firms bolster their technological capabilities. The findings highlight that firms in Africa can overcome the barriers of foreign integration through technological advancements, which is crucial for improving their competitiveness in global markets. Moreover, the research identifies the detrimental impact of informal competition on capacity utilization, emphasizing the need for strategies that mitigate these pressures. While the study also explores the effects of HVC integration, it acknowledges limitations in its conceptualization, as this form of integration shows a negative impact on capacity utilization, indicating a need for further investigation. Overall, this research fills a gap in the literature by establishing a direct link between value chain integration and capacity utilization in Africa, offering insights that could guide business leaders and policymakers in enhancing overall firm performance across the continent. With Africa's potential for growth and development, improving capacity utilization through effective value chain integration strategies is crucial for unlocking the continent's full economic potential.

Abbreviations

AU African Union

CU Capacity Utilization

CSR Corporate Social Responsibility

DVC Domestic Value Chain

EU European Union

FDI Foreign Direct Investment

FVC Foreign Value Chain

GDP Gross Domestic Product

GVC Global Value Chain

HVC Hybrid Value Chain

ICT Information and Communication Technology

IMF International Monetary Fund

NFPMS Non-Financial Performance Measurement Systems

OECD Organisation for Economic Co-operation and Development

OLS Ordinary Least Squares

PCA Principal Component Analysis

R&D Research and Development

SME Small and Medium Enterprises

UNIDO United Nations Industrial Development Organization

VC Value Chain

VCI Value Chain Integration

VIF Variance Inflation Factor

WBES World Bank Enterprise Survey

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Introduction

The importance of capacity utilization (CU) spans several facets of economic and management theory, offering insights into how firms can navigate the challenges and opportunities within their operational environments to maximize productivity and profitability. Ultimately, the optimization of CU remains central to enhancing firm competitiveness and economic stability. Knitted closely to this view, several studies have argued and found empirical evidence linking CU to firm's operational efficiency, competitiveness, and overall performance. For instance, Afroz and Roy (1976) established earlier on, that higher CU correlates with reduced average costs of production, signifying the potential for improved operational efficiency and competitive advantage. More recently, Zheng et al. (2024), found a significant positive association between CU and multiple dimensions of firm performance, including profitability, market value, and investment efficiency.

Focusing on Africa as the context for this research is driven by the continent's unique economic dynamics and enormous potential. Africa hosts the world's youngest and fastest-growing population, projected to nearly double to 2.5 billion by 2050 (Phillips, 2019), and is home to thriving urban centers and pioneering innovations in fintech and clean energy. These factors present vast opportunities for robust and inclusive growth, making Africa a critical region for examining how firms can enhance their production capabilities through effective value chain integration. By leveraging its abundant natural resources and human potential, Africa has the potential to drive substantial economic development both within the continent and globally. However, this potential can only be fully realized if key inefficiencies, such as low CU, are addressed.

1.1. Problem Statement

Despite the critical role of CU in enhancing firm performance, CU in Africa show a wide disparity within the continent and on average remains low. The latest data from Economics (2023) for instance, indicates varying levels of capacity utilization across Africa, with Senegal leading at 82.8% while, Nigeria is at the lower end with 54.9%. This suggests that while some African countries like Senegal are optimizing their productive capacities, others (for instance, Nigeria) are not. There is also a big difference between CU in Africa and CU in more industrialized regions like Asia. For instance, in China, CU rates are reported to be between 80-90%, while in Africa, they are often 60% or less (UNECA, 2023). This discrepancy suggests there is significant room for improvement in the utilization of capacity within and across firms in Africa. In this case, understanding the drivers of CU is of utmost importance from a public policy and corporate strategy perspective.

Several studies have indeed examined the drivers of and barriers to CU across firms in Africa, identifying several factors. For instance, AfDB (2014) and Okurebia (2014) have shown that CU in Africa face challenges due to factors like inadequate infrastructure, limited access to finance, and technological gaps. Goel and Nelson (2021) identify financial challenges, joint effect of corruption and transportation challenges, as well as the joint effect of informal competition and transportation challenges as barriers to optimal CU in a study focused on firms in Kenya. The World Bank (2019) [1] points to the need for enhanced research infrastructure to tackle continent-specific challenges, including those impacting capacity utilization, despite a rise in STEM contributions from African scholars. Cirera et al. (2023) explore the interconnected barriers like financial constraints, regulatory issues, infrastructure gaps, and skill shortages to technology adoption across firms in Ethiopia. This calls for comprehensive solution(s) that includes financial support, regulatory reforms, infrastructure development, capacity building, and effective information dissemination, which could potentially increase CU, thereby enhancing overall firm performance and contributing to the regional economy's growth.

1.2. Research Gap

Although the preceding studies shed light on various factors affecting CU, another important factor affecting CU is value chain integration (VCI). VCI refers to the deliberate coordination and alignment of activities undertaken by various entities within a vertically integrated system. Such vertically integrated systems could be local in the case of domestic value chain or global in the case of foreign value chain[2]. Belderbos and Grimpe (2020) introduced a new typology of Foreign Value Chains (FVC) within the Global Value Chain (GVC) space. This research adopts FVC due to its broader definition, which encompasses the concept of GVC. In either case, in

[1] All the data that will be used for the data analysis in the thesis will be drawn from the World Bank Enterprise Surveys Database, a publicly available database. For more information, visit WBES website.

[2] In this thesis, the literature on both Global Value Chains (GVC) and Foreign Value Chain (FVC) are reviewed, and GVC and FVC are used interchangeably. For consistency, the term FVC is used in chapters 3, 4, and 5.

today's globalized world, businesses are increasingly recognizing the importance of VCI to enhance operational efficiency, reduce costs, and improve overall competitiveness. In principle, VCI can also enhance CU and overall firm performance by streamlining operations, fostering innovation through closer supplier relationships, and creating more responsive production processes to meet consumer demand (Hautala-Kankaanpaa, 2022).

Despite these plausible conceptual linkage between VCI and CU, the nature of this relationship remain underexplored, especially in context of Africa. Even more, whether the potential CU gains of VCI vary with the modality of value integration (i.e. domestic, foreign or both) remain unexplored. Domestic VCI can boost operational efficiency and lower costs through supplier collaboration, as supported by Porter (2023a)'s cluster theory. On the contrary, dependency on local suppliers constrains access to market and hence reduces economies of scale and scope levels (Krugman, 1980). Gereffi et al. (2005) highlights how firms integrated into GVC can achieve higher efficiency and productivity by leveraging international best practices and technologies. Pahl and Timmer (2019) analyzes the long term effects of GVC integration for firms in emerging economies, and found strong evidence for the positive effects on productivity growth. Mircheva et al. (2019) investigates the determinants of GVC participation across firms, highlighting its positive impact on productivity. However, there is significant heterogeneity, with greater benefits observed in upper-middle and high-income countries. These studies emphasize the positive relationship between VC participation and productivity gains. Increase in productivity growth enhances capacity utilization of firms (Gu & Wang, 2013). Moreover, Ndubuisi and Owusu (2021) demonstrate how GVC participation across firms impacts positively on the quality of exported products. Export participation enhances firms' CU (Tian, 2016). These studies suggest that participation in GVC indirectly enhances CU. Therefore, research is needed to analyze the direct relationship between VC participation and CU. Moving ahead, Andersen and Martinsen (2018) highlights the strategic importance of maintaining dual engagement in both DVC and FVC for optimizing CU and achieving competitive advantage. These studies collectively indicate that integrating into VC provides firms with significant benefits, including improved capacity utilization. However, market volatility risks potentially threaten CU in the GVC space (Prebisch, 1950).

A blend of domestic and foreign VCI could theoretically optimize CU by combining local efficiency and global market access, addressing the limitations of each approach independently. This mixed modality suggests a potential heterogeneous impact on CU that remains unexplored in existing literature, indicating a fertile area for future research to examine how firms can strategically navigate the balance between domestic and foreign value chains for optimal performance. This research gap was identified by drawing motivation from Meyer et al. (2011)'s concept of dual-embeddedness, which suggests that firms embedding in both local and global networks achieve superior outcomes.

Further, several studies, specially focused on global value chain (GVC) highlight that the gains of value chain is not automatic. Extant studies have particularly shown that these gains are contingent on several country, sector, and firm characteristics (Ndubuisi & Owusu, 2023). Mazzi et al. (2024) explores the heterogeneity that arises from technological capabilities in value chain integration. They found that learning and productivity gains in value chains are significantly influenced by the firm's technological capabilities. Winkler and Farole (2015) also find evidence of firm-level productivity gains from GVC integration through exporting or supplying to a multi-national corporation (MNC) in the country. These gains, however, are not uniformly distributed across all firms, indicating significant heterogeneity in outcomes. Moreover, Ali and Mahmood (2023) reveal notable heterogeneity in their study, in Sub-Saharan Africa, suggesting that the impact of supply chain integration on product innovation capability and operational performance may vary significantly based on factors such as firm size, industry sector, and the firm's existing internal and external integration levels.

Studies conducted outside of Africa also discuss firm heterogeneity in the context of analyzing the impact of VCI on overall firm performance, utilizing firm-level data. For instance, Elshaarawy and Ezzat (2022) discusses heterogeneity in the impact of GVC participation on innovation, conditional upon the firm's financial situation. Financial constraints are shown to significantly dampen the positive effects of GVC on innovation, indicating that the benefits of GVC participation on firm-level innovation are not uniformly experienced across all firms. Ge et al. (2018) on the other hand, discusses the impact of GVC integration on the productivity of Chinese manufacturing firms. It reveals heterogeneity in the benefits derived from GVC participation, demonstrating that R&D intensity amplifies the productivity gains for foreign owned, general trade, and technology-intensive enterprises. Similarly, government subsidy intensity strengthens the productivity effect for private and technology-intensive enterprises.

1.3. Research Objectives

In line with the preceding discussion, the objective of this master's thesis is to uncover how different modalities of value chain integration affect firms' capacity utilization and how firm heterogeneity plays a role in shaping the nature of this relationship. Ultimately, the overarching objective of this thesis is:

How does VC integration impact firm capacity utilization in Africa and to what extent does firm heterogeneity affect this relationship?

Building upon this proposal and the main research question, this thesis will explore the following sub-research questions:

1. **How do different modalities of value chain integration (domestic VC, foreign VC & hybrid VC) influence capacity utilization of firms in Africa?**

   This question breaks down the main question into specific types of value chain integration. It seeks to explore whether firms that are part of domestic, foreign, or hybrid value chains experience different levels of capacity utilization. The assumption is that the type of value chain a firm is integrated into might have distinct effects on how well it can utilize its production capacity.

2. **How does productive (technological and production) capability influence the relationship between value chain integration and the capacity utilization of firms in Africa?**

   Here, the focus is on the interaction between a firm's productive capabilities (technological and production capacities) and how this affects the relationship between value chain integration and capacity utilization. This question aims to identify whether firms with higher technological and production capabilities benefit more (or less) from VC integration in terms of capacity utilization.

3. **How does the presence of informal competition influence the relationship between value chain integration and capacity utilization of firms in Africa**

   This question introduces an external factor of informal competition as a potential moderating variable in the relationship between VCI and CU. It investigates whether the competitive pressure from informal markets alters the effectiveness of VCI for firms in Africa.

1.4. Scope

This research aims to investigate the implications of value chain integration on firm performance. The primary focus is to understand how the integration of a firm into a value chain affects its overall performance. This involves examining the extent to which integration into the value chain network enhances a firm's ability to utilize its capacity effectively. Additionally, the thesis explores other factors that influences the relationship between value chain integration and firm performance, using econometric analysis. Econometric analysis is a quantitative method that applies statistical and mathematical theories to economics for the purpose of testing hypotheses and forecasting future trends. It involves the use of data, statistical models, and computational techniques to examine economic phenomena and relationships among economic variables (Tinbergen, 1940).

This research is crucial as it seeks to bridge a gap in understanding how value chains, both within the national boundary and involving foreign partners, affect operational efficiency of the firms in Africa. It also acknowledges that not all firms are the same; different characteristics might lead to different outcomes in how value chain integration influences capacity utilization. Hence, to construct value chain integration indexes, comprehensive data on imports, exports, and specific value-added metrics (customer satisfaction, contract renewal rates, NPS, churn rate, economic impact) are necessary. With the availability of such comprehensive data, it would have been possible to create detailed and nuanced value chain integration indexes. These indexes could provide a more accurate measure of how deeply firms are integrated into both domestic and international value chains. Data on imports and exports could offer insights into the extent of a firm's engagement with global markets, while value-added metrics like customer satisfaction, contract renewal rates, Net Promoter Score (NPS), and churn rate could help in assessing the quality and sustainability of these value chain relationships. Such metrics could allow for a deeper analysis of how different dimensions of value chain integration (both quantitative like trade volumes, and qualitative like customer relationships) influence capacity utilization. Moreover, economic impact metrics would have been instrumental in evaluating the broader effects of value chain integration on firm performance and competitiveness.

However, the WBES database only provide sourcing[3] and sales[4] data. Given the limitation of available data, specifically the WBES data from 2006-2018—the research adapts by focusing on the available sourcing and sales information to create proxy variables[5]. These variables, Domestic Value Chain (DVC), Foreign Value Chain (FVC), and Hybrid Value Chain (HVC) dummy variables, are inspired by previous research by Beverelli et al. (2016, 2019). These indicators rely on sourced intermediate inputs and sales, given the data limitations. Detailed conceptualization is in subsection 3.1.2. This approach allows the study to still investigate the impact of different VCI types on CU, albeit with a narrower scope compared to what might have been possible with more comprehensive data. The creation of these dummy variables is a practical solution that allows the study to proceed despite data constraints, though it also means the analysis might not capture all dimensions of VCI and its impact.

Hence, the scope of this research includes:

- **Implications of Value Chain Integration**: Analyzing how integration into the value chain network impacts firm performance. This involves investigating how value chain integration enhances a firm's ability to utilize its production capacity and the resultant economic benefits, drawing motivation from Xie and Yu (2023). Additionally, it involves identifying the factors that mediate and moderate this relationship, as explored in studies by Lwesya (2022), Mircheva et al. (2019), and Ndubuisi and Owusu (2021).
- **Econometric Analysis**: Econometric analysis is employed in this research as it aligns with the prevalent methodologies used in existing literature within the value chain integration domain. Drawing inspiration from the foundational works of Xie and Yu (2023), Beverelli et al. (2016), Avenyo et al. (2021), and Ndubuisi and Owusu (2023), which extensively utilize regression modeling, this study adopts a quantitative approach to assess the economic impacts of value chain integration at the firm level. This methodological choice enables a focus on broader economic indicators and performance metrics, offering insights beyond the micro-level operational details of the value chain. The application of econometric techniques is further reinforced by the principles taught in Research Methods (MOT2313) during M.Sc. MOT program in Delft

[3]Sourcing from outside the national boundary refers to imports.
[4]Selling outside the national boundary refers to exports.
[5]Proxy variables are easily measurable variables that analysts include in a model in place of a variable that cannot be directly measured or is difficult to measure.

University of Technology, ensuring that the research is grounded in a rigorous academic framework. Additionally, the author's motivation to enhance their data analytical skills, particularly in quantitative analysis, stems from the specialization in finance and economics, as well as prior experience in qualitative data analysis. This research, therefore, represents a deliberate effort to broaden analytical capabilities and contribute to the existing body of knowledge with robust quantitative insights.

While the thesis addresses the gains from value chain integration, several areas are explicitly excluded from the scope to maintain a focused analysis:

- **Value Chain/Supply Chain Indications**: The thesis does not delve into the detailed aspects of production, inventory management, or transportation means within the supply chain. Additionally, comprehensive analysis of logistics chains, including the detailed analysis of the roles of various actors, organizational involvement, and geographic distribution of inventories and transportation modes are excluded.
- **Porter's Value Chain Model**: While the thesis addresses the value chain model designed by Michael E. Porter later in section 2.2, as it assumes the interaction of primary and support activities within the firm, it does not undertake a detailed analysis of this model. This research utilizes sourcing and sales data from the World Bank Enterprise Survey (WBES), which is relevant to the outbound and inbound logistics components of the value chain model. While conducting a detailed analysis of logistics based on industry type would be beneficial prior to exploring the relationship between firms' integration into value chains and performance metrics such as capacity utilization, the primary focus of this study is grounded in the field of economics rather than supply chain management. Consequently, the author has not extensively examined Porter's value chain model. The focus remains on the economic implication of VCI rather than dissecting the model's individual components.
- **Product Characteristics**: Building upon the previous discussion on Porter's VC model, from the outbound and inbound logistics perspective, detailed examination of product characteristics from both the sender and receiver perspectives is not covered. This includes logistical trade-offs related to product attributes, such as value-weight factors, packaging size, due dates, safety, special care requirements, product life cycle, estimation levels, seasonal issues, mode dependability, and order size scaling issues.

By delineating these boundaries, the thesis ensures a concentrated exploration of the economic implications of value chain integration, providing valuable insights into how firms can leverage such integration to enhance performance. For instance, the study by Xie and Yu (2023) employs econometric analysis to measure capacity utilization of firms in China, utilizing firm-level and customs transaction-level data spanning from 2000 to 2006. In addition, there are studies not directly focusing on CU but related to value chain integration and firm performance. For example, Ndubuisi and Owusu (2023) investigates how firms' integration into GVC facilitates countries in becoming productively efficient and catching up to the global efficiency frontier through international trade. This research draws motivation from these studies to investigate the implications of firms integrating into value chains. Moreover, a detailed analysis of the parameters essential for addressing all the research questions is presented in Figure 1.1. The parameters highlighted in the *shade of green* are within the scope of this thesis, while those in the *shade of yellow* are partially covered. Although other parameters are also important, they are excluded from this research due to data limitations, time constraints, and the author's academic motivation.

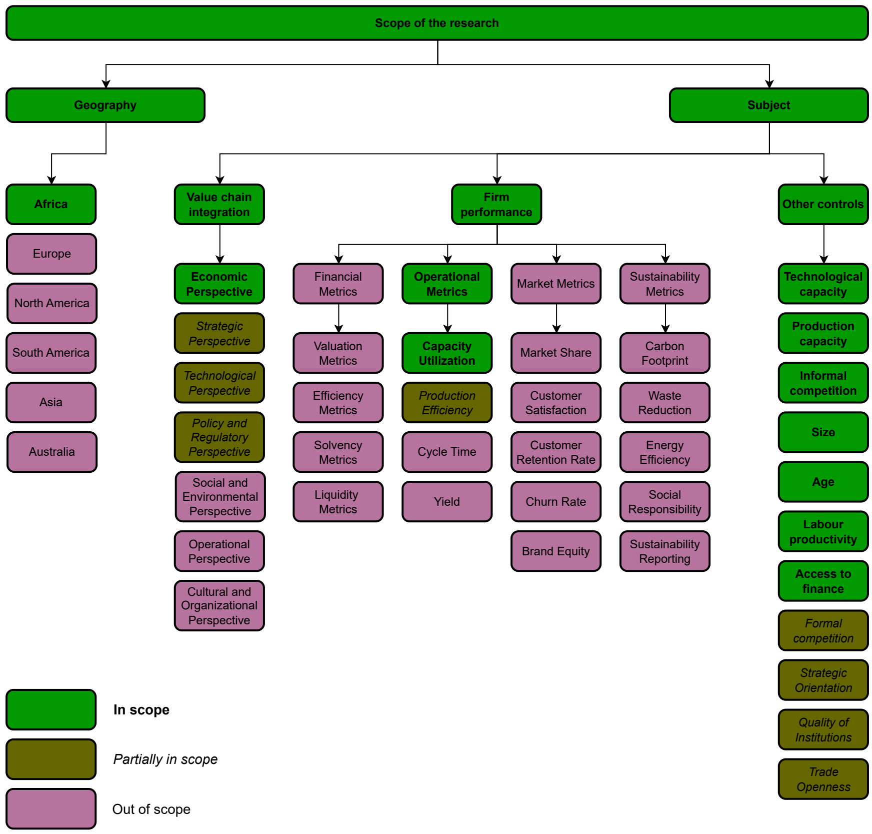

Figure 1.1: Scope of this research *Source: Author's illustration*

1.5. Management of Technology relevance

The M.Sc. Management of Technology (MOT) program at TU Delft emphasizes the integration of technology and management practices to improve organizational performance. This thesis aligns with the MOT curriculum by exploring how productive capabilities and value chain strategies can enhance CU in firms. It contributes to the understanding of how technological advancements and strategic management can drive operational efficiency, which is a core focus of the MOT program.

The objective of this research is to examine the implications of firms integrating into value chains by evaluating their capacity utilization rates, which reflect the learnings from the specialization in finance and economics

(TPM022A, TPM021A, TPM023B). This specialization builds on the foundational knowledge provided by Economic Foundations (MOT1421) and Financial Management (MOT1461). A thorough literature review, extending from Technology Dynamics (MOT1421) and Preparation Masters Thesis (MOT2004), is integral to this study. The methodology and econometric analysis techniques applied in this research are grounded in the principles taught in Research Methods (MOT2313). Additionally, courses such as Technology, Strategy and Entrepreneurship (1435), Leadership and Technology Management (MOT1524), and Emerging and Breakthrough Technologies (MOT2421) emphasize the significance of firms' productive capabilities and the expansion of technological and production capacities through investments in research and development, as well as product and process innovation.

Lastly, the findings of this thesis underscore the significant emphasis placed on innovation throughout the M.Sc. in Management of Technology (MOT) program from its inception. This consistent focus on innovation is evident in the curriculum and pedagogical approach adopted by the program, which has equipped students with the necessary skills and knowledge to critically analyze and contribute to advancements in technology and management. The integration of innovative thinking in various courses, as previously mentioned, and in research methodologies highlights both the findings of this research and the program's commitment to fostering an environment conducive to innovative activities, strategic problem-solving, and the development of cutting-edge technological solutions.

1.6. Research Outline

Chapter 2 delves deeply into the concepts of capacity utilization and value chain integration, with an emphasis on the pressing need for these firms to integrate into value chains. Drawing upon a wealth of published literature, this chapter provides a comprehensive examination of how capacity utilization fluctuates across firms in Africa and underscores the importance of value chain integration as a strategic approach to stabilizing and enhancing capacity utilization. The chapter progresses to an analysis of integration patterns, defining and differentiating between domestic, foreign, and hybrid value chain networks. This classification helps to illustrate the various pathways through which firms can engage in value chain activities, highlighting the benefits and challenges associated with each type. In its concluding sections, the chapter shifts focus to the characteristics of firms, particularly their productive capabilities. It discusses the critical investments in technological and production capacities that firms must make to enhance their performance within value chains. Furthermore, it addresses the role of informal competition, which adds a layer of complexity to the relationship between value chain integration and capacity utilization. Chapter 3 details the concepts and operationalization of value chain integration variables used in this research, alongside the econometric analysis involving model specification and estimation strategies. Chapter 4 provides a discussion of the results from the econometric analysis. This chapter delves into the empirical results, highlighting key patterns, trends, and relationships uncovered in the data. It presents detailed statistical evidence, including regression outputs, coefficients, and significance levels. The chapter also explores the robustness of the results through model specifications, offering insights to the next chapter, where the implications of the findings are examined. Chapter 5 compares the results with existing literature, discussing consistencies and discrepancies, and provides a nuanced interpretation of the econometric evidence in the context of the study's hypotheses and research questions. Then, it provides strategic recommendations for firms, advising them on how to effectively integrate into value chains to enhance their capacity and utilization rates. Furthermore, the thesis offers policy recommendations for entities like the African Union (AU) and financial institutions within the AU, emphasizing the need for policies that facilitate the integration of firms into the value chain network. These policy recommendations aim to support the growth and development of the entire continent by fostering a more interconnected and efficient value chain system.

This thesis will evaluate overall firm performance from a capacity utilization perspective, using the World Bank Enterprise Survey (WBES) database as the primary data source. The dependent variable, capacity utilization, will be analyzed across the entire continent of Africa, rather than focusing on a single country. This cross-sectoral and cross-country approach aims to enhance external validity and generalizability. By studying diverse economies within the continent, which collectively represent significant development potential, the findings will offer broader applicability and insights into the patterns of value chain integration and capacity utilization. A theoretical framework for this graduation thesis is constructed, as illustrated in Figure 1.2, which takes into account the influence of different modalities of VCI on capacity utilization of firms, moderated by the impacts of productive capability and competition.

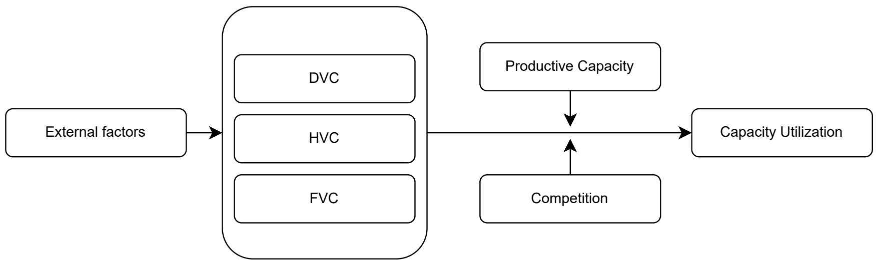

Figure 1.2: Graduation thesis framework *Source: Author's illustration*

2

Theoretical Background

2.1. Capacity Utilization

Capacity utilization reflects a firm's efficiency in using available resources to produce goods or services. High capacity utilization indicates efficient use of the capital, which often correlates with higher profitability and competitive advantage. It serves as a crucial metric for assessing the operational efficacy and economic health of firms (Xie & Yu, 2023). According to WBES, capacity utilization is the output or production level compared to the full-production capacity, that is, the maximum level of production that could reasonably be expected under normal conditions fully utilizing the machinery and equipment in place. It only refers to the production facility and not the administrative offices.

Existing research indicates that firms in or outside Africa often suffer from low capacity utilization, primarily due to several barriers like infrastructural deficiencies (Emeka et al., 2016; World Bank, 2020; Xie & Yu, 2023), outdated technology (AfDB, 2014), limited market access (UNCTAD, 2016), limited access to finance (Beck et al., 2005; Damijan & Kostevc, 2006), regulatory burdens (The World Bank, 2019), political instability (Collier & Hoeffler, 2004), labour productivity & skill mismatches (AfDB, 2023), and silo-culture[1] (Gamme et al., 2020). Such constraints hinder optimal operational performance and growth. Conversely, enablers such as technological advancement, integration into local and global value chains, and stable macro-economic policies can significantly

[1] Silo culture refers to a situation within an organization where different departments or groups or individuals do not share information or collaborate effectively with each other. This can lead to inefficiencies, duplication of work, and a lack of cohesion in achieving the organization's goals.

enhance capacity utilization (Damijan & Kostevc, 2006).

Integrating into FVC along with DVC can significantly influence CU by enabling access to larger markets, advanced technologies, and higher investment flows. FVC provide platforms for learning and innovation, which are critical for improving operational efficiencies and expanding production capacities. This integration not only helps in overcoming traditional barriers but also leverages global partnerships and networks to foster growth and sustainability in firms. In the following two sections, value chains from both foreign and domestic perspectives will be explored to offer a comprehensive analysis of potential solutions aimed at addressing the challenges of capacity utilization, particularly across firms in Africa. This analysis will serve as a foundation for understanding how integration into these value chains could represent a viable strategy for overcoming the identified barriers.

2.2. What is Value Chain?

A value chain is a sequence of activities involved in creating, producing, and delivering a product or service, from initial design and raw materials sourcing to manufacturing, distribution, marketing, and reaching the end customer (Tardi, 2024). Analyzing the value chain helps identify where value is added at each step to optimize efficiency and maximize value at minimal cost. Introduced by Michael E. Porter, this concept categorizes business activities into ”primary” and ”support” categories to enhance competitive advantage, as shown in Figure 2.1. An example of a firm integrated into the value chain is Starbucks Corporation (Bajpai, 2023).

Accoring to Tardi (2024), Porter’s Value Chain Model, introduced by Michael Porter in 1985, is a strategic framework used to analyze a firm’s internal activities and identify areas for value addition to gain a competitive edge. The model divides a company’s operations into primary and support activities. Primary activities include inbound logistics (receiving and storing inputs), operations (transforming inputs into outputs), outbound logistics (distributing finished products), marketing and sales (promoting and selling products), and service (post-sale support). Support activities encompass firm infrastructure (organizational structure and management), human resource management (recruitment and training), technology development (innovation and process improvement), and procurement (acquiring necessary inputs).

This clearly suggests that the integration of these components is crucial for creating a seamless flow of activities that add value at every stage. Effective coordination and information sharing across departments ensure alignment of activities (Willem & Buelens, 2006). This implies that effective coordination and information sharing facilitate ”knowledge sharing” across organizations, aligning with the definition of VCI used in this research (see subsection 2.2.1). Moreover, cross-functional teams foster innovation and efficiency, while continuous improvement practices help eliminate inefficiencies (Santa et al., 2011). Lastly, technology integration streamlines processes and enhances data analytics capabilities. Hence, strategically aligning a firm’s activities with value chain integration ensures coherence in value creation efforts.

All elements of the primary and support activities within Porter's Value Chain Model, as shown in Figure 2.1 contribute to the integration of the value chain network by firms. This research focuses on understanding why firms should integrate into value chains and whether this integration enhances their capacity utilization, rather than delving into the detailed analysis of the value chain model itself. Here's a comprehensive analysis of each component and their interactions:

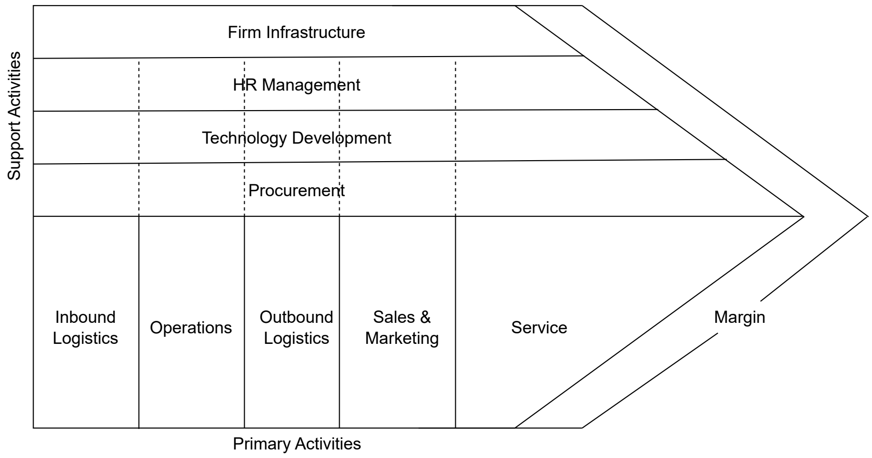

Figure 2.1: VC Model developed by Michael Porter *Source: Author's illustration*

Primary activities within a firm involve several key components. Inbound logistics refers to the processes of receiving, storing, and disseminating inputs used in the production process, such as materials handling, warehousing, inventory control, transportation scheduling, and returns to suppliers. Efficient inbound logistics ensure the timely availability of inputs for production, thereby reducing lead times and costs and improving overall supply chain efficiency. Operations encompass the activities that transform inputs into finished products or services, including machining, packaging, assembly, equipment maintenance, testing, printing, and facility operations. These operations are central to the creation of the product or service, directly impacting quality, production speed, and cost efficiency. Improvements in operations can lead to significant value addition and operational excellence. Outbound logistics involve the activities required to deliver the finished product to the customer, such as warehousing, order fulfillment, transportation, distribution management, and delivery. Effective outbound logistics ensure that products reach customers efficiently and in good condition, which enhances customer satisfaction and reduces logistics costs. Marketing and sales activities are associated with attracting buyers and persuading them to choose the product over competitors. This includes advertising, sales force management, promotion, pricing, channel selection, and pricing strategy. Strong marketing and sales strategies increase demand and brand recognition, directly influencing revenue and interacting with product development to ensure market needs are met. Service activities maintain and enhance the product's value after it has been sold. These include installation, repair, training, parts supply, and product adjustments. Effective service activities build customer loyalty and enhance the brand's reputation, leading to repeat business and positive word-of-mouth referrals. Support activities are equally critical in enabling these primary activities. Firm infrastructure encompasses the company's organizational structure, management, planning, finance, legal, and quality management functions. This infrastructure supports the entire value chain by providing a foundation for efficient and effective operations, aligning company activities with its overall strategy through good governance and strategic planning. Human resource management involves recruiting, hiring, training, development, and compensation of all personnel. Effective HR management ensures that the firm has skilled, motivated employees across all areas, thereby enhancing productivity and innovation throughout the value chain. Technology development pertains to the activities related to the development and application of technology to improve products and processes, including R&D, process automation, and product design. Advances in technology lead to new products, improved production processes, and more efficient operations, adding value across the value chain. Procurement involves acquiring the goods and services necessary for the company's operations, such as raw materials, components, machinery, and office supplies. Efficient procurement practices ensure that the firm secures high-quality inputs at the best prices, which directly impacts cost structure and overall profitability. (Porter, 1985)

The components of Porter's Value Chain do not operate in isolation; their integration is crucial for creating a seamless flow of activities that add value at every stage. Coordination and information sharing across departments ensure that all activities are aligned; for example, marketing insights can inform operations about potential increases in demand, enabling better inventory planning. Cross-functional teams that span multiple value chain activities can foster innovation and efficiency; for instance, involving logistics and procurement in product development can lead to designs that are easier and cheaper to produce and distribute. A culture of continuous improvement, where feedback loops are established, helps identify and eliminate inefficiencies. Regular interactions between operations, quality control, and service ensure product excellence. Technology integration, such as leveraging an integrated ERP system, can streamline processes and enhance data analytics capabilities across inbound logistics, operations, and outbound logistics. (Zamora, 2016)

Strategic alignment of all activities with the firm's goals ensures coherence in value creation. For example, aligning procurement strategies with overall cost leadership or differentiation strategies can reinforce competitive advantages (Bhargava et al., 2018). In conclusion, Porter's Value Chain Model provides a framework for dissecting a firm's activities to uncover potential for adding value. By understanding and optimizing each primary and support activity and ensuring their integration, a firm can enhance its efficiency, reduce costs, and improve its competitive positioning. The key lies in recognizing the inter-dependencies and fostering a culture of collaboration and continuous improvement across the entire value chain.

2.2.1. Value chain integration

According to Hautala-Kankaanpaa (2022), VCI refers to the deliberate coordination and alignment of activities undertaken by various entities within a vertically integrated system. This integration can be either local, in the form of domestic value chains (DVC), or global, in the form of foreign value chains (FVC). Flynn et al. (2009) defines VCI as seamless integration of internal and external processes to create a cohesive system that spans the entire supply chain. Additionally Gereffi et al. (2005) defines VCI as the process of coordinating the various stages of production, from raw material sourcing to final product delivery, to ensure that all activities are aligned and efficient. It involves both vertical and horizontal integration, where firms may integrate with suppliers and customers or merge with competitors to streamline operations and enhance market power. Lastly, Meyer et al. (2011) discusses the elements of both domestic and foreign value chains. It aims to balance the benefits of local responsiveness and global efficiency by integrating operations across local and international networks.

Taking motivation from the literature on VC, in this research **VCI is defined by the benefits that firms, whether as suppliers, customers, or anywhere in the value chain cycle, derive from integrating into a value chain network with a tier 1 or elite company.** For example, a firm in Egypt supplying services, such as labor or materials, to Apple benefits from knowledge spillovers. These spillovers provide the firm with valuable insights and expertise, enabling it to upskill its workforce, improve overall performance, and optimize capacity utilization rates. This integration not only enhances the firm's capabilities but also strengthens its position within the value chain. In this research, the terms integration, participation, and alignment are used interchangeably when discussing value chains. The distinctions and commonalities between these terms are explored briefly in the next section (see 2.2.2).

This integration can take three forms (refer to chapter 3.1.2 for detailed conceptualization):

- DVC: emphasizing local sourcing, production, and sales within national boundaries.
- FVC: engagement in international markets through exporting products (directly or indirectly) and importing (sourcing) intermediate inputs.
- HVC: combines elements of both domestic and foreign value chains, integrating local and international resources and markets.

The strategic positioning of a firm within the value chain can significantly influence its competitive advantage and operational efficiency (Shank et al., 1998). Firms positioned at stages with higher value addition, such as design and marketing, leverage greater profitability and differentiation opportunities. Conversely, firms at stages with lower value addition may face intense cost competition and thinner margins. This concept is explored in business management theory as the *"smile curve"* introduced by Stan Shih in 1992. Figure 2.2 shows the smile curve which illustrates the highest value-added activities are at the ends of the value chain— R&D and design at the beginning, and marketing and sales at the end; while the middle stages, like manufacturing and production stages, add less value. This curve emphasizes the importance of strategic positioning within the value chain, as firms focusing on high value-added stages can achieve greater profitability and differentiation. Mudambi (2008) discusses how knowledge-intensive industries benefit from strategic positioning along the smile curve, enhancing competitive advantage and innovation. Similarly, Reddy et al. (2020) highlight that firms participating in FVC, particularly in high-value activities, experience improved innovation and performance. Rungi and Del Prete (2018) found robust empirical evidence for the existence of smile curve, even after controlling for several functional forms, firm-level heterogeneity, and country characteristics.

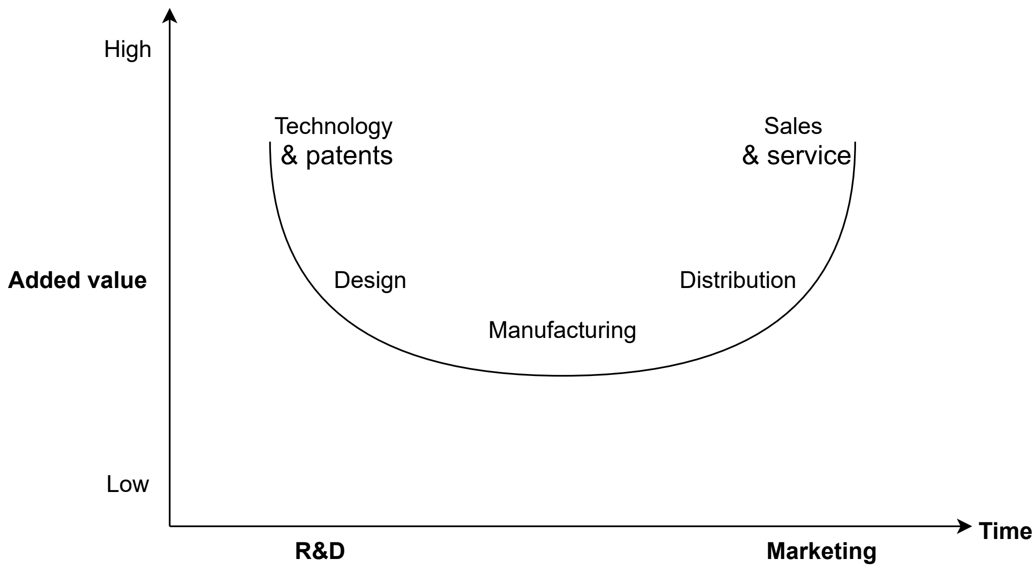

Figure 2.2: Visual of a smile curve by business functions *Source: Author's illustration*

Smile curve indicates a change in the share of value added, moving away from the manufacturing sector itself to the pre- and post-fabrication stages. Baldwin and Ito (2021) provides new evidence quantifying the magnitude of the smile curve phenomenon. Utilizing international input–output databases, Baldwin and Ito (2021) find substantial support for the smile curve at an aggregate level. Specifically, it is observed that for nearly all exporting sectors and countries, the value added to exports has markedly shifted from the manufacturing sector to the service sectors. Additionally, the findings reveal that while developing countries have reduced their own-sourcing service value-added share, developed countries have maintained relatively high levels of own-sourcing service value-added share. Hence, in the context of firms in Africa, there is an urgent need to enhance capabilities in the pre and post fabrication stages of production. These stages, including R&D, design, marketing, and after-sales services, capture a larger share of value added in VCI. By investing in education, training, innovation, and technology, firms in Africa can increase participation in these high-value stages. Secondly, the observed reduction in own-sourcing service value-added share underscores the importance of developing a domestic service sector. Firms in Africa should prioritize policies that support the growth of domestic services, such as finance, logistics, and information technology. To conclude, firms experience significant knowledge spillovers during the pre and post fabrication stages while integrating into value chains, as outlined in the definition of VCI earlier. These spillovers enhance the firms' overall capabilities and innovation potential, which is further supported by the findings of Audretsch and Belitski (2020).

2.2.2. How is value chain different from supply chain?

The supply chain focuses on the operational logistics of moving goods and materials, emphasizing efficiency and cost-effectiveness. Value chain includes not only the steps involved in operational logistics like production and delivery process but also other elements such as design, marketing, and after-sales services. The value chain is focused on maximizing the value created for customers (Porter, 1985). For instance, a coffee shop's supply chain includes growing coffee beans, harvesting, transporting them to a processor, roasting, packaging, shipping to the shop, and finally brewing the coffee. The supply chain focuses on the operational logistics of moving goods and materials, emphasizing efficiency and cost-effectiveness. At the same time, the coffee shop's value chain includes the same steps but also encompasses the shop's development of a unique blend, the ambiance of the shop which enhances customer experience, and excellent customer service that increases the perceived value of the coffee.

Three key aspects emerge when discussing value chain integration and supply chain integration: alignment, integration, and coordination. Alignment refers to the fit between an organization's supply strategy and its overall corporate and business strategies and policies (Cousins & Matthews, 2015). Integration encompasses both intra-organizational process integration and inter-organizational collaborative integration (Morash & Clinton, 1998). Coordination involves synchronizing interdependent processes, integrating information systems, and managing distributed learning (Simatupang et al., 2002). These elements are crucial for effective supply chain management, addressing issues such as order fluctuations, inventory management, and lead times (Moharana et al., 2010). Simatupang et al. (2002) identify four coordination modes: logistics synchronization, information sharing, incentive alignment, and collective learning. Successful implementation of these concepts can lead to improved efficiency, effectiveness, and value creation in the supply chain (Morash & Clinton, 1998); Moharana et al. (2010). Table 2.1 provides an explanation of the definitions, key elements, differences, and commonalities of these terms. However, as mentioned earlier, these three terms are used interchangeably in this research. If research is conducted from a supply chain perspective, it is important to understand the differences and commonalities between these terms before starting the research.

Table 2.1: Differences and commonalities between the terms: alignment, integration, and coordination

Aspect	Definition	Key Elements	Commonalities	Differences
Alignment	The fit between an organization's supply strategy and its overall corporate and business strategies and policies.	Ensures consistency between supply chain strategies and corporate goals.	All three aspects are critical for effective supply chain management, addressing issues such as order fluctuations, inventory management, and lead times. Successful implementation of these concepts can lead to improved efficiency, effectiveness, and value creation in the supply chain.	Alignment focuses on strategic fit and consistency, ensuring supply chain activities align with broader organizational objectives.
Integration	Encompasses both intra-organizational process integration and inter-organizational collaborative integration.	Involves seamless integration of processes within the organization. Facilitates collaboration between different organizations.		Integration emphasizes the merging of processes and systems both within and between organizations to enhance collaboration.
Coordination	Involves synchronizing interdependent processes, integrating information systems, and managing distributed learning.	Logistics synchronization: aligning logistics activities across the supply chain. Information sharing: exchanging critical data among partners. Incentive alignment: ensuring all parties have shared goals and benefits. Collective learning: fostering joint problem-solving and innovation.		Coordination focuses on synchronizing activities and processes across organizations, managing dependencies and learning.

Research suggests that DVC play a crucial role in facilitating GVC integration. DVC can serve as stepping stones for GVC entry (Beverelli et al., 2019). This positive relationship between DVC and GVC integration is particularly evident in backward linkages, where intermediates sourced from abroad are used as a proxy for GVC integration (Beverelli et al., 2016). The integration of global value chains and supply chains is essential for industrial clusters to gain competitive advantages and achieve upgrading (Ji-Zi, 2005). Different models of integration exist, with variations observed across industrial clusters. Supply chain relationships and processes must be continuously integrated and aligned with strategy to improve efficiency and effectiveness, creating value for final consumers. Additionally, Porter's Value Chain model (see Figure 2.1), when applied to supply chain perspective, reveals various forms of integration among parallel supply chains of different firms. Three major forms of supply chain integration include intra-organizational process integration, inter-organizational collaborative integration, and operational excellence (Morash & Clinton, 1998). The extent of integration can be influenced by firms' strategies, with cost leaders focusing more on finance and production integration, while differentiators emphasize marketing and R&D integration (Singh & Sharma, 2016). The span of integration also impacts supply chain practices and performance, with firms integrating broadly across the supply chain demonstrating higher levels of performance and a greater focus on alignment with suppliers and customers (Kannan & Tan, 2010). Furthermore, the incorporation of System of Systems (SoS) engineering into supply chain management can enhance understanding of inter-firm coordination in value creation, bridging the gap between systems theory and supply chain management (Jaradat et al., 2017).

Building on the discussion of supply chain and value chain integration, it's important to delve into the intricacies of inbound and outbound logistics, particularly the role of multiple inventory points. According to Felea (2008), supply chains involve three or more key inventory points: inbound inventory (materials received and stored), inventory just before production (materials ready for operations), and outbound inventory (finished goods ready for shipment). These inventory points are critical in managing the flow of materials and products, ensuring that each stage of the supply chain operates smoothly and efficiently. Inbound inventories serve as a buffer against supply variability, ensuring that production processes are not halted due to material shortages. This stage is closely linked to intra-organizational process integration, where internal processes must be finely tuned to balance supply and demand effectively. As materials move into production, the inventory before operations ensures that there is a steady flow of inputs, which is essential for maintaining operational excellence. The transition from inbound to production-ready inventory highlights the importance of coordinating supply chain processes to minimize delays and optimize resource utilization. Similarly, outbound inventories, which include products ready for shipment and those already dispatched to the market, are crucial for aligning with market demand and ensuring timely delivery to customers. This stage is often managed through inter-organizational collaborative integration, where companies work closely with logistics providers and distributors to synchronize their efforts. The efficiency of outbound logistics directly impacts customer satisfaction and overall supply chain performance. The management of these multiple inventory points presents both challenges and opportunities for firms, making it a fertile area for further research. Future studies could explore how different integration strategies influence inventory management practices and the overall performance of supply chains, which affects the firms decision to integrate into value chains and enhance their overall performance. Additionally, the impact of emerging technologies, such as real-time inventory tracking and advanced analytics, on optimizing these inventory points could be a significant focus (Druehl et al., 2017; Fatorachian & Kazemi, 2020; Lee et al., 2005). This topic is increasingly relevant as firms seek to enhance their supply chain resilience and responsiveness in a dynamic global market, making it a potentially widespread and impactful area of research in value chain field.

2.3. Logistics and Supply Chain Integration in Value Chains

The concepts discussed in logistics and supply chain management are directly relevant to understanding and optimizing value chain networks, which encompass domestic, foreign, and hybrid value chains. Logistic chains encompass the entire process of moving products from suppliers to end consumers. This includes all the activities related to procurement, production, distribution, and inventory management. In the context of value chain integration, whether domestic, foreign, or hybrid, the logistic chain is essential for ensuring that resources are effectively utilized, costs are minimized, and customer satisfaction is maximized.

The integration of inventory and transportation decisions in supply chain management is a complex challenge due to their often conflicting objectives. Multiple studies emphasize the importance of considering both inventory and transportation aspects in supply chain optimization. For instance, Tavasszy et al. (2003) highlight the need for more efficient transportation and sophisticated logistics processes in FVC. Dong and Chen (2005) propose an analytical framework to analyze integrated logistic networks, emphasising on VCI. Viau et al. (2009) presents a framework that combines inventory control and transportation operations, using delivery frequencies and phases as decision variables. Combes (2011) explores the relationship between logistics and mode choice in freight transport[2], developing a model where shippers use two transport modes simultaneously to balance service levels and costs. These studies demonstrate the potential benefits of integrating multiple transport modes to meet logistical requirements efficiently. Thus, the logical reasoning behind integrating inventory and transportation decisions in supply chain management stems from the cost efficiency and enhanced flexibility that such integration provides. By viewing these elements as interdependent rather than separate, firms in Africa can achieve a more robust and responsive value chain.

[2] Freight transportation, also known as freight forwarding, refers to the physical process of transporting commodities, merchandise, and cargo. It can be done by ship, aircraft, truck, or inter-modal via train and road

2.3.1. Stakeholders involved

Stakeholders such as suppliers, manufacturers, distributors, retailers, customers and logistics providers can collaborate effectively to integrate transportation and inventory decisions in a supply chain by adopting a holistic approach that considers both logistics activities simultaneously. This is illustrated in Figure 2.3, and the arrows represent the logistics providers. Appendix B outlines the identified stakeholders and explains their importance within the value chain network.

Figure 2.3: Stakeholders involved in a value chain network *Source: Author's illustration*

This integration can be facilitated through the use of Decision Support Systems (DSS)[3] that estimate logistics activities by integrating inventory control and transportation operations. Delivery frequencies and phases can be used as decision variables to study the behavior of the logistics system (Viau et al., 2009)). One of the key challenges in integrating transportation and inventory decisions is the inherent conflict between minimizing transportation costs and increasing inventory turns. These are often contradictory objectives, making it difficult to achieve global optimization of the supply chain (Viau et al., 2009)). Additionally, the lack of visibility, long delivery delays, and complex transportation networks in decentralized supply chains further complicate this integration (Viau et al., 2009)). However, the benefits of such integration are significant. By aligning inventory control with transportation decisions, stakeholders can improve the responsiveness and efficiency of the supply chain. This can lead to better service levels, reduced stock-outs, and optimized logistics costs, hence enhanced capacity utilization. For instance, using a combination of slow and inexpensive transport modes with fast but expensive ones can help manage inventory levels more effectively and ensure timely deliveries, especially for goods where delivery disruption is unacceptable (Combes, 2011)). Moreover, the integration of logistics processes can have positive impacts on regional economic activities and the environment. Efficient transportation and sophisticated logistics processes can enhance regional development and reduce the environmental footprint of logistics operations (Tavasszy et al., 2003).

In summary, effective collaboration among stakeholders to integrate transportation and inventory decisions can be achieved through advanced decision support systems and a holistic approach to logistics. While challenges such as conflicting objectives and complex networks exist, the potential benefits in terms of improved service levels, cost optimization, and positive regional and environmental impacts make this integration worthwhile.

In Michael Porter's Value Chain model (see Figure 2.1), activities within a firm are categorized into primary and support activities, each contributing to the firm's overall value creation. Inventory and transportation play crucial roles in both primary and support activities. Inventory management is primarily associated with inbound

[3] To know more about DSS, read Viau et al. (2009)

logistics, where it involves receiving, storing, and managing raw materials and components essential for production. Efficient inventory management ensures that materials are available for production without unnecessary overstock (Akindipe, 2014). Similarly, transportation within inbound logistics refers to the movement of goods from suppliers to the company, ensuring timely and intact delivery of materials necessary for production. On the other hand, outbound logistics encompasses the management of finished goods inventory and their distribution to customers. This involves storing finished products and ensuring they are available to meet customer demand. The transportation aspect of outbound logistics focuses on the efficient and timely delivery of these finished goods to customers, enhancing customer satisfaction and service quality.

Support activities, such as procurement and technology development, further bolster inventory and transportation processes. Procurement involves acquiring raw materials, components, and services necessary for both inbound and outbound logistics, ensuring the firm has what it needs to operate effectively (Caplice & Sheffi, 2003). Technology development can enhance these processes through innovations like automated warehousing, advanced logistics software, and tracking systems, improving the efficiency and accuracy of inventory management and the reliability of transportation (Song & Savelsbergh, 2007). By aligning inventory and transportation management with these primary and support activities, a firm can optimize its operations, reduce costs, and improve overall efficiency, ultimately creating greater value.

Next, different patterns of value chains will be explored by delving into the conceptualization of domestic, foreign, and hybrid value chains, and conducting a thorough review of relevant literature.

2.4. Patterns of value chains

Firms can integrate in DVC or FVC/GVC[4]. It may also be that they jointly and strategically integrated in both forms of VC. The focus of this thesis is on these three patterns of VCI and on how the drive CU. Descriptively, Domestic value chains (DVC) represent the national linkages between firms where goods and services are produced and consumed within the same country. These chains, as shown in Figure 2.4 are fundamental for economic development, providing localized economic benefits and strengthening inter-firm relationships within borders. Conversely, foreign value chains (FVC), as shown in Figure 2.5, refer to the international systems where production processes are dispersed globally across multiple countries, maximizing comparative advantages and cost efficiencies (Beverelli et al., 2016). DVC often serve as stepping stones to GVC integration (Beverelli et al., 2019).

The analysis outlined in Figure 2.4, Figure 2.5 and Figure 2.6 draws upon the World Bank Enterprise Survey

[4]In this research, the difference between GVC and FVC is considered as follows: GVC integration involves multiple countries, for example, a firm in Egypt participating in a value chain between USA and China. FVC integration refers to specific cross-border activities, such as a firm in Egypt participating in a value chain with Nigeria. Since both FVC and GVC refers to cross border activities, they're used interchangeably.

(WBES) data, extensively discussed in the chapter 3.1.2. This data informs the creation of three dummy variables that categorize firms based on their degree of integration into value chains. The dummy variables DVC, FVC, and HVC represent firms integrated in domestic, foreign and hybrid value chains respectively.

Figure 2.4 illustrates the firms in Africa integrated into Domestic Value Chain (DVC), where (reference) firms, for instance, within Egypt engage in national buying and selling processes. Reference Firm B acts as an intermediary between Supplier Firm A and Customer Firm C, highlighting a streamlined domestic operation within national boundary.

Figure 2.5 illustrates the firms in Africa integrated into Foreign Value Chain (FVC), where for instance (reference) firm B in Egypt imports from supplier firm A outside of Egypt national boundary. (Reference) firm B then engages in both direct and indirect export activities. This demonstrates a more complex network involving both domestic and international interactions. Customer firm C functions as an intermediary between customer firm D and (reference) firm B, exemplifying indirect exports. Conversely, direct exports are illustrated in the relationship between (reference) firm B and customer firm E.

Figure 2.6 combines elements from both domestic and foreign value chains, illustrating the Hybrid Value Chain (HVC). Here, (reference) firm B is involved in both national buying and importing activities. Reference firm B then channels these goods through national sales and both direct & indirect exports to multiple customer firms, both within Egypt and abroad.

Not fully integrated firms i.e. those firms not falling into either of the FVC, DVC, or HVC categories comprises approximately 61% of the total firms in the data, indicating a significant portion of firms not fully integrated into value chains as defined by this study.

It is crucial to acknowledge that the dummy variables used in this thesis serve merely as proxies for value chain integration. In a more nuanced analysis, understanding value chains would require comprehensive data capturing the depth of inter-firm relationships. This aspect is particularly pertinent when considering how 'HVC' is conceptualized in this thesis, which aims to reflect a more complex and interconnected view of market integration.

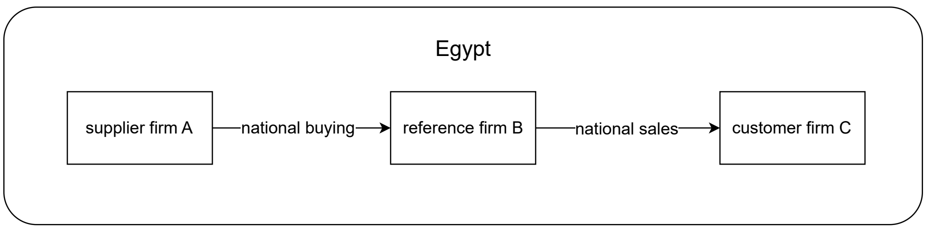

Figure 2.4: Domestic Value Chain *Source: Author's illustration*

HVC integration represents a strategic approach where firms integrate both domestic and foreign value chains to achieve an optimal balance between reliance and efficiency. By combining Domestic Value Chain (DVC)

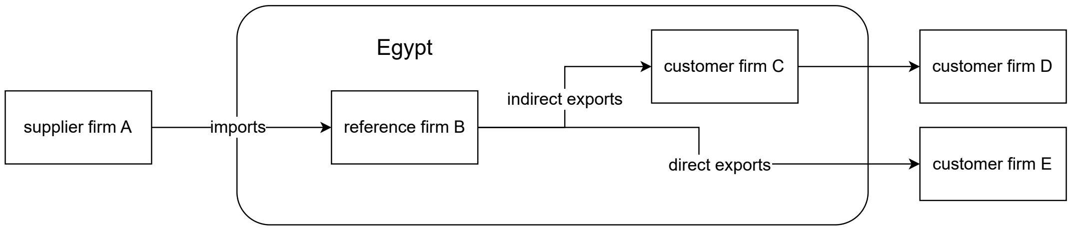

Figure 2.5: Foreign Value Chain *Source: Author's illustration*

and Foreign Value Chain (FVC) integration, firms can balance the benefits of local responsiveness with global efficiency. This hybrid approach allows firms to leverage global innovations and market access while maintaining the resilience and adaptability of local supply chains.

A firm integrated into both domestic and foreign value chains can enhance its capacity utilization (CU) by taking advantage of international best practices, technological advancements, and diverse market opportunities. This integration fosters a network that can mitigate risks associated with over-reliance on either local or global sources alone. For example, during global supply chain disruptions, firms integrated into HVC can rely more on their domestic networks to maintain operations, while still benefiting from international collaborations during stable periods. The concept of dual embeddedness in international business literature, as discussed by Meyer et al. (2011), supports this perspective. Dual embeddedness suggests that firms embedded in both local and global networks tend to perform better. This dual positioning allows firms to draw on the strengths of both environments—global networks provide access to larger markets and innovation hubs, while local networks offer deep-rooted understanding and resilience. Inspired by the concept of dual embeddedness, the possible modalities of the hybrid value chain are illustrated in Figure 2.6. The conceptualization of HVC is discussed extensively in chapter subsection 3.1.2. Figure 2.6 demonstrates how firms can simultaneously engage in national buying and importing, direct and indirect exports, and maintain interactions across different levels of the supply chain, both domestically and internationally.

However, managing a hybrid value chain integration strategy is not without challenges. It requires significant coordination and investment to align different parts of the supply chain, as noted by Flynn et al. (2009). The complexity arises from the need to synchronize operations, manage cross-border logistics, and ensure compliance with varying regulatory standards. Additionally, firms must invest in developing robust communication and information systems to facilitate seamless integration across the value chain.

In conclusion, hybrid value chain integration offers a compelling strategy for firms seeking to enhance their operational efficiency and market responsiveness. By balancing the benefits of local and global networks, firms can build a resilient and adaptable supply chain capable of navigating the complexities of modern business environments.

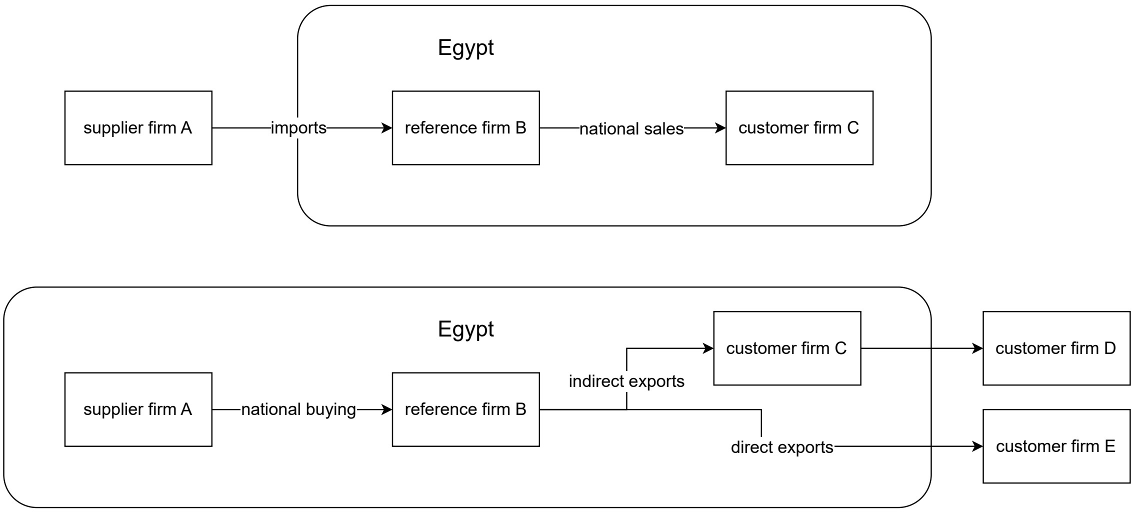

Figure 2.6: Hybrid Value Chain *Source: Author's illustration*

Firms initially engaging in domestic chains develop capabilities, relationships, and a deep understanding of business processes that are later pivotal in managing more complex international interactions. Beverelli et al. (2016, 2019) suggest that robust DVC provide a firm the foundation that eases the transition into FVC, despite the inherent challenges and increased costs associated with managing international operations.

However, integrating into FVC is not without contention. High switching costs, from domestic to foreign suppliers, and the need for new alignments pose significant risks and potential setbacks. Studies have shown that while DVC are beneficial for stepping into FVC, in industries characterized by high switching costs and low fragmentation costs, this transition can be less advantageous, thereby making DVC less conducive to FVC integration (Beverelli et al., 2019). These challenges support a strong argument for the creation and study of hybrid value chains, which blend elements of both DVC and FVC. Such hybrid model could potentially enhance capacity utilization, leading to better firm performance across various metrics. Belderbos and Grimpe (2020) and Gamme et al. (2020) further emphasize the role of learning in both foreign and domestic chains, highlighting how firms can leverage these experiences to innovate and improve operations, also shown in Figure 2.7. The potential for hybrid value chains lies in their ability to combine the localized advantages of DVC with the broad strategic benefits of FVC. This integration could allow firms to maintain strong domestic linkages while progressively engaging in global markets, thereby optimizing resource utilization and operational capacities (Cheng-Si et al., 2020; Hautala-Kankaanpaa, 2022; Shen & Yang, 2022). This model not only supports the initial benefits observed in domestic settings but also extends these benefits on a global scale, enhancing the overall performance and competitive stance of firms in international markets. Such approaches are especially crucial in industries where innovation and rapid adaptation to market changes are key drivers of success.

Moving forward, studies done by Banga (2014), Beverelli et al. (2019), and Soullier et al. (2020) show that

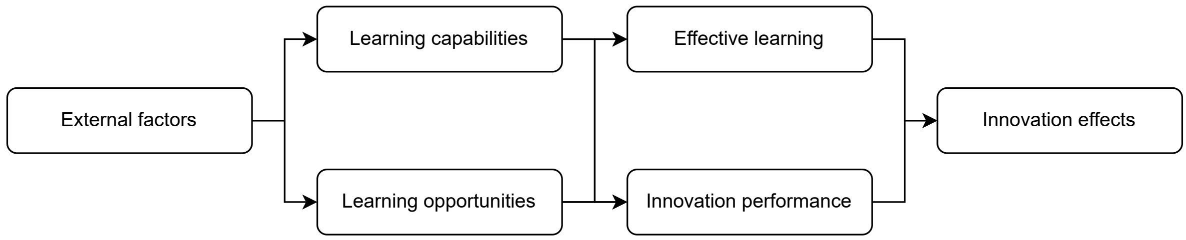

Figure 2.7: Belderbos and Grimpe (2020)'s framework *Source: Author's illustration*

domestic VC integration facilitates closer collaboration with local suppliers and distributors, which leads to more efficient resource utilization and lower transaction costs, potentially improving capacity utilization. This is also supported by Porter (2023a)'s cluster theory, which suggests that geographic concentration of interconnected companies and institutions in a particular field can enhance competitiveness and innovation. However, reliance on DVC may limit firms' capacity utilization if local suppliers lack the capability or scale to meet demand efficiently or if the domestic market is too small. This argument is consistent with the concept of economies of scale and the need for access to larger markets for optimal production efficiency (Krugman, 1980). On the other hand, FVC integration enhances capacity utilization of the firm by providing access to bigger, diverse markets and advanced technologies, which leads to both economies of scale and scope. Several literature discuss how FVC integration leads to technological upgrades and improved firm performance (including capacity utilization) through learning & innovation (Gereffi et al., 2005; Reddy et al., 2020), labour & capital productivity (Mircheva et al., 2019; Pahl & Timmer, 2019), export upgrading (Ndubuisi & Owusu, 2021), reduced costs (Andersen & Martinsen, 2018) and productive efficiency (Ndubuisi & Owusu, 2023). On the flip side, heavy reliance on FVC exposes firms to global market fluctuations and competition, potentially threatening capacity utilization. Furthermore, dependency on foreign entities for critical inputs can lead to vulnerabilities, as discussed in the dependency theory literature (Prebisch, 1950).

While the reviewed articles in this sub-section provide foundational insights into the impact of value chain integration on overall firm performance, this thesis specifically delves into how these dynamics play out within the context of firms in Africa.

2.5. Characteristics

The exploration of heterogeneity across various dimensions of VCI and overall firm performance offers an understanding of how differing conditions affect economic outcomes. This section delves into the perspectives of firm characteristics, mixed modality in value chains, firms' productive capability, and the impact of competition.

The concept of firm heterogeneity posits that differences in firm characteristics such as age, size, labour productivity, access to finance, ownership structure, and managerial experience. This significantly influences firm behavior and outcomes, including their strategies for integrating into value chains, which affects their overall performance. This perspective is rooted in the Resource-Based View (RBV) theory, which emphasizes that firm-specific assets, such as technological expertise and managerial skills, are crucial in determining the firm's strategic decisions and overall performance in both domestic and international markets (Peteraf, 1993). According to foundational research by Barney (1991) and Wernerfelt (1984), firm resources and capabilities underpin competitive advantages and performance differentials among firms. More recent studies have expanded these notions by examining the impact of firm heterogeneity on capacity utilization and the integration into domestic and foreign value chains. Studies on GVC, for instance by Ndubuisi et al. (2024) emphasize that the benefits of VCI in developing economies, like Africa, are contingent on incremental innovations. Firms involved in GVC create positive spillovers that benefit other firms in the economy. This finding underscores the critical role of internal capabilities or firm characteristics like skill intensity, access to credit, R&D investment, age, firm size, and training, along with industry, country, and year fixed effects, in navigating the complexities of integrating into VC. Moving ahead, in a recent study by Higón and Bournakis (2024), suggests that the size and age of the firm are critical in determining how effectively a firm can utilize its capacity when integrating into more complex, often international, production networks. Larger, more established firms may possess the requisite resources and experience to navigate and leverage the intricacies of global value chains. Adding on, Gereffi et al. (2005) argue that ownership structure and managerial expertise significantly modulate a firm's ability to benefit from integrating into value chains. This further indicates that the relationship between value chain integration and firm performance is not linear but contingent upon these intrinsic characteristics. For example, firms with more innovative managerial practices and distinct ownership structures could better exploit the opportunities provided by global networks, achieving superior performance outcomes compared to their less adaptable counterparts. These studies collectively underline that the strategic choice between domestic and foreign value chain integration is a multifaceted decision influenced by heterogeneous firm-specific factors. This complexity leads to non-linear impacts on capacity utilization and overall firm performance. As such, this research will further explore how these characteristics interact dynamically to influence firm strategies into value chain participation.

2.5.1. Productive capability

The productive capabilities of firms are pivotal in shaping their capacity utilization efficiency and overall firm performance. Productive capability refers to a firm's ability to effectively utilize its resources to produce goods and services. Avenyo et al. (2021) conceptualizes productive capabilities as a combination of technological and production capacities. Technological capacity include the firm's ability to innovate, adopt new technologies, and improve existing processes. Production capacity pertain to the efficiency and effectiveness of the firm's production processes. These are crucial determinants of a firm's performance, particularly capacity utilization rates. Productive capabilities, encompassing both technological and production capacities, significantly influence the relationship between capacity utilization (CU) and value chain integration (VCI). This sub-chapter aims to explore the importance of productive capabilities and their impact on the dynamics of CU and VCI, drawing on a comprehensive literature review.

A. Y. Ahmad (2020) highlights the importance of these capabilities in the agro-processing industry, suggesting that superior productive capabilities enhance firms' capacity utilization. Firms with advanced technological and production capabilities tend to manage their resources more efficiently, leading to higher CU rates. Bamber et al. (2014) argues that mere participation in GVC does not guarantee positive outcomes unless firms and governments actively work to enhance productive capabilities. This viewpoint is supported by Owusu (2021), who demonstrates that GVC participation can significantly boost productivity through efficient resource reallocation, especially in countries with lower productivity levels and non-resource-intensive sectors[5]. Furthermore, Ajide (2023) corroborates that GVC integration improves total factor productivity (TFP), particularly in firms with higher productive capabilities. Empirical studies, such as those by DeMasi (1997) and the IMF, indicate a positive relationship between TFP and CU, suggesting that firms with robust TFP growth tend to have more stable CU rates due to efficient production processes and better resource management.

Existing literature reveals several implications for understanding the interplay between productive capabilities, CU, and VCI. Hoekman and Sanfilippo (2023) finds that firms near foreign direct investment (FDI) projects benefit from improved performance through vertical and horizontal linkages. Vertical and horizontal linkages are critical components of value chain integration, playing a significant role in shaping the performance, competitiveness, and overall capacity utilization of firms. These linkages, as discussed by Tarver (2024), are not just structural elements but also strategic tools that firms can leverage to optimize their operations and achieve superior outcomes. Vertical integration refers to the relationships between firms at different levels of the value chain, such as between suppliers and manufacturers or manufacturers and retailers (Tarver, 2024). These vertical linkages are essential for the seamless flow of products and services from production to the end market. They foster mutually beneficial relationships where firms focus on their core competencies, creating synergies that enhance the overall competitiveness of the value chain. For instance, the transfer of knowledge and skills within vertically integrated firms allows for the upgrading of production processes, technologies, and management systems, which is particularly vital for smaller firms that might otherwise lack access to global best practices. Additionally, these linkages support the establishment of quality standards across the value chain, ensuring that products meet market demands consistently. The embedded services, such as training and financial support, provided by lead firms further strengthen these vertical relationships by ensuring that all participants in the chain maintain high standards of quality and efficiency. Horizontal integration, on the other hand, involves linkages between firms

[5] Non-resource-intensive sectors: Industries that do not heavily rely on natural resources, such as minerals, fossil fuels, or large amounts of water and land. Examples include information technology (IT), finance, healthcare, education, professional services, telecommunications, media, and software development.

operating at the same level of the value chain, such as among producers or retailers (Tarver, 2024). These linkages are crucial for reducing costs, increasing efficiency, and achieving economies of scale, particularly for smaller firms. By cooperating horizontally, firms can pool resources, share knowledge, and collectively access larger markets, thereby improving their market access and bargaining power. This cooperative approach also facilitates shared learning and innovation, enabling firms to collectively upgrade their processes and products more rapidly. Moreover, horizontal linkages allow for risk sharing among firms, making it easier for them to invest in new technologies or enter new markets without bearing the full brunt of potential risks. The integration of vertical and horizontal linkages within a firm's value chain has profound implications for capacity utilization and overall firm performance. By optimizing these linkages, firms can better align their resources and capabilities with market demands, leading to more efficient production processes, reduced costs, and enhanced competitiveness. This, in turn, can lead to higher capacity utilization, as firms are better equipped to meet market needs without overextending their resources. Furthermore, the strategic use of both vertical and horizontal integration can contribute to sustained firm performance by enabling firms to adapt more quickly to changes in the market environment and to innovate more effectively, as also emphasized by the findings of Hoekman and Sanfilippo (2023).

The relevance of vertical and horizontal integration to value chain integration also opens up avenues for further research. Understanding the dynamics of these linkages and their impact on firm performance can provide valuable insights into how firms can better structure their operations and strategies. This research can explore the conditions under which different types of linkages are most beneficial, the role of technology in facilitating these linkages, and the ways in which firms can overcome challenges related to integration. Moreover, this points to the necessity of conducting an analysis of a mixed modality of value chain integration. Such an analysis would offer a more comprehensive understanding of how these different forms of integration interact and contribute to overall firm performance, thereby advancing the broader field of business strategy and operations management.

Moving ahead, research has consistently shown a positive relationship between capacity utilization and value chain performance in various industries, including tea processing (Richard et al., 2015). The concept of mixed modality or hybrid value chain integration emphasizes integrating both domestic and foreign value chains to optimize capacity utilization by leveraging local efficiencies and global market access. This approach suggests that firms can benefit from dual-embeddedness, allowing for superior outcomes due to a blend of local and global network advantages. Mazzi et al. (2024) supports this perspective, showing that FVC integration, combined with R&D activities, significantly enhances firm productivity after entering foreign markets. A firm's technological capacity and its position in value chain participation contribute to product competitiveness (Gao et al., 2013). Moreover, existing literature highlights the role of foreign firms in building technological capabilities in developing economies, focusing on countries such as South Africa, Kenya, Uganda, Brazil, Costa Rica, Malaysia, and Indonesia (Rasiah, 2005). Additionally, the role of technological capabilities in enhancing productivity and competitiveness in African manufacturing firms underscores the importance of these capabilities in shaping the relationship between value chain integration and capacity utilization (Raturi & Biggs, 1997). Furthermore, Noerlina et al. (2022) finds that VCI significantly affects firm performance but does not necessarily mediate the relationship between technological capability and firm performance. This indicates the need for a nuanced understanding of the specific dynamics of technological capacity. Jouanjean et al. (2017) suggests that there is a U-shaped relationship between GVC integration and the share of domestic value added. Value added and CU have a long-run positive relationship (Simon-Oke & Awoyemi, 2010). This implies to take into account firms' continued involvement in DVC. Hence, firms engaging in both DVC and FVC activities could possibly achieve superior performance outcomes. This dual engagement could allow firms to leverage local market knowledge and networks while capitalizing on the efficiencies and innovations accessible through FVC participation. Thus, the benefits from HVC participation could depend on firms' strategic investments in enhancing their technological and production capacities while maintaining a robust presence in domestic markets.

Consequently, productivity gains from exporting are larger for exports of technological capacities like knowledge-intensive services, intermediates, and re-exports, within GVC (Benkovskis et al., 2019). Hence, the importance for studying the relationship between productive capabilities, CU, and VCI stems from the need to understand how firms can optimize their operations and enhance competitiveness in a globalized economy. Research consistently shows that firms with advanced technological capabilities and active R&D engagements experience significant productivity gains from VCI, which in turn enhances CU. Ge et al. (2018) finds that R&D intensity and government subsidies significantly influence productivity gains from VCI, particularly among technology-intensive enterprises. Additionally, Elshaarawy and Ezzat (2022) shows that financial constraints can dampen the innovation benefits derived from foreign value chain participation. Moreover, studies by Ulusoy et al. (2008), Vickery et al. (1993), and K. Ahmad and Zabri (2016) highlight the significant role of production capabilities, organizational innovations, and non-financial performance measurement systems (NFPMS[6]) in enhancing firm performance. These findings underscore the importance of aligning production capabilities with strategic goals to optimize both financial and operational outcomes. Higher CU is positively related to improved value chain performance (Nyaoga et al., 2015).

Drawing motivation from these studies, particularly A. Y. Ahmad (2020), Avenyo et al. (2021), Bamber et al. (2014), and Ge et al. (2018) it is evident that technological and production capacities of firms significantly influence the relationship between a firm's integration into value chains and its capacity utilization rate. In conclusion, firms with advanced productive capabilities such as investments in R&D, availability of fixed assets, educated workforce etc. are more likely to experience productivity gains from VCI, which enhances capacity utilization. This comprehensive understanding aligns with the literature, underscoring the critical role of production-related

[6]Detailed analysis of the relationship between NFPMS and CU is discussed in Appendix C

factors in driving capacity utilization and overall performance.

2.5.2. Informal Competition

The interaction between formal and informal sectors is a critical aspect of business dynamics in many economies, especially in developing regions (Chen, 2012). Informal competition refers to the market presence and activities of unregistered businesses that operate outside regulatory and tax frameworks Godfrey (2011). This sub-chapter examines the impact of informal competition on firm performance and capacity utilization, with a focus on how these factors influence firms' integration into value chain networks. By analyzing the existing literature, this review aims to provide a comprehensive understanding of the challenges posed by informal competition and its broader economic implications.

Informal competition significantly affects the capacity utilization of formal firms. According to Goel et al. (2021), informal competition undermines both total factor productivity (TFP) and sales per worker. The presence of informal competitors strains the resources available to formal firms, forcing them to operate below their optimal capacity, which by extension reduces capacity utilization. This strain on resources is attributed to the competitive disadvantage formal firms face, as informal businesses evade regulatory and tax obligations, allowing them to offer lower prices and capture market share. Consequently, formal firms struggle to fully utilize their production capabilities, leading to inefficiencies, increased per-unit costs and reduced capacity utilization rates. Avenyo et al. (2020) provide further insight into this issue by examining product innovation in sub-Saharan Africa. They find that local informal competition negatively impacts the product innovation intensity of formal firms. This implies that negative impacts on product innovation in turn affects capacity utilization negatively. Firms facing informal competition are less likely to invest in innovative processes and technologies, which are crucial for maximizing production capacity. This lack of innovation can lead to outdated production methods and underutilized resources, further exacerbating the problem.

The existence of informal competition also influences firms' decision-making processes concerning integration into value chain networks. Informal competition creates significant barriers to entry for formal firms attempting to integrate into global value chains. Williams and Bezeredi (2018) argue that the competitive advantage held by informal firms, through lower operational costs, makes it difficult for formal firms to compete on price. This implies that the disadvantage restricts the ability of the formal firms to scale operations and meet the stringent standards required for integration into larger, more structured value chains. Hence, the constant need to undercut informal competitors could lead to compromised quality and lower standards, which are critical barriers to full integration into value chains that demand consistency and compliance. Avenyo et al. (2020) highlight that while informal competition can spur some firms to innovate, the overall negative impact on resources and sales limits the ability of formal firms to invest in quality improvements and compliance with international standards. This limitation hampers their potential to join and sustain positions within value chains that demand high-quality and consistent outputs. The reduced profitability and heightened operational risks associated with informal competition make it difficult for formal firms to invest in the long-term capabilities required for foreign market integration.

Informal competition also has profound effects on other firm characteristics, such as productive capability and labour productivity. The study done by Rahmouni (2021) highlights that informal competition diverts resources and creates unfair competitive conditions, resulting in lower productive capabilities. The presence of informal firms, which evade taxes and regulations, results in lower cost structures, putting pressure on formal firms to either reduce their capacity or operate at sub-optimal levels. This under-utilization of capacity not only impacts profitability but also the long-term viability of formal enterprises. Informal competition impacts the availability and pricing of inputs, further complicating capacity utilization (Goel et al., 2021). The strain on resources due to informal competitors means formal firms often operate below their potential capacity, leading to inefficiencies and reduced economic output. This, in turn, affects labour productivity, as employees in formal firms may not be utilized to their full potential, resulting in lower overall productivity levels. Additionally, Ram et al. (2022) discuss the dual nature of informal competition on firm performance, which underscores the sensitivity of firm performance to the level of informal competition, suggesting that the impact varies across different performance levels and influences strategic decisions regarding value chain integration. The insights garnered from these two studies illustrate the heterogeneous interplay between competition, firm performance, and operational strategies within value chains. They highlight the need for policies that mitigate the negative impacts of informal competition and support firms in developing strategies by effective value chain integration that enhance capacity utilization.

Goel et al. (2021) further suggest that firms facing informal competition might turn to external technology licensing as a strategy to improve performance. However, this approach, while mitigating some negative impacts, does not fully address the systemic inefficiencies caused by informal competitors. The reliance on external technologies, rather than developing in-house capabilities, can further limit a firm's ability to effectively integrate into value chains, that require both innovation and adaptability. The pervasive impact of informal competition on firm performance also necessitates significant attention from policymakers. The findings from the reviewed literature indicate that informal competition creates substantial challenges for formal businesses, which in turn affects broader economic stability and growth. This suggests that the presence of informal competition negatively impacts firms' integration into value chains and reduces their capacity utilization rates. Policymakers must consider measures to level the playing field between formal and informal sectors. This could include stricter enforcement of regulations, incentives for formalization, and support mechanisms for formal firms to enhance their competitiveness. Williams and Bezeredi (2018) emphasize the need for policies that address the root causes of informal competition, such as high regulatory burdens and tax rates that drive businesses underground. By simplifying regulatory frameworks and reducing the cost of formalization, policymakers can encourage more businesses to operate within the formal sector, thereby reducing the competitive advantage of informal firms.

2.5.3. Age of the firm

The relationship between firm age and performance remains a subject of considerable debate and analysis within the field of business studies. Some research indicates that older firms tend to exhibit higher levels of productivity, profits, and overall size. For instance, Coad et al. (2010) found evidence that firm performance and capacity utilization rates improve with age, which can be attributed to accumulated experience, established customer bases, and refined business processes. However, this positive relationship is not without its caveats. The same studies also suggest that, when controlling for other factors, older firms often demonstrate lower growth rates and profitability. This can be explained by the phenomenon of organizational inertia, where established firms may become resistant to change and less adaptive to market dynamics, resulting in reduced innovation and slower growth (Coad et al., 2010). Adding to the complexity, some researchers have identified a U-shaped relationship between firm age and performance. This pattern suggests that firm performance initially declines as firms age but then improves after reaching a certain threshold. Dang et al. (2021) and Sinan (2018) argue that this U-shape is consistent with the ”liability of market newness” hypothesis, which posits that new firms face significant survival challenges and lower performance due to their lack of market experience and established networks. Over time, firms that survive these initial challenges may benefit from accumulated knowledge and market presence, leading to improved performance. The impact of firm age on performance is further complicated by factors such as ownership structure. For example, Sinan (2018) found that family-owned firms often exhibit different performance patterns compared to non-family-owned firms. Family-owned businesses might benefit from long-term strategic planning and a strong commitment to business continuity, which can positively influence performance as they age. Despite extensive research, there remains no consensus on a unified theory explaining the age-performance relationship. The findings are highly context-dependent and influenced by various external and internal factors, including market conditions, industry characteristics, and management practices (Rossi, 2016). This lack of consensus underscores the need for further investigation to better understand the nuanced dynamics at play and to develop more comprehensive models that can accurately capture the diverse trajectories of firm performance across different contexts. In conclusion, while older firms generally show higher productivity and profits, their growth rates and profitability may decline due to organizational inertia. The U-shaped performance pattern and variations in ownership structure further illustrate the complexity of the age-performance relationship. Continued research is essential to unravel these complexities and provide clearer insights into how firm age influences firm performance metrics like capacity utilization, under different circumstances.

2.5.4. Size of the firm

Higón and Bournakis (2024) highlights that small firms (less than 25 employees) are less likely to integrate into international value chains due to limited resources and capabilities, whereas large firms (more than 250 employees) leverage their extensive resources and established infrastructures to engage more effectively in international trade. These observations are consistent with the literature on firm size and performance. Aggrey et al. (2010) found an inverted U-shaped relationship between firm size and technical efficiency in East African manufacturing firms, indicating that both very small and very large firms might face inefficiencies that medium-sized firms do not. Stella (2014) discovered that medium-sized firms in Uganda grow faster than both small and large firms, challenging Porter's "stuck in the middle" hypothesis (see Appendix F) and suggesting that size influences growth trajectories in unique ways. Moreover, Cooper et al. (1989) examined the relationship between initial firm size and subsequent development, noting that smaller startups often exhibit higher percentage increases in employment and sales growth. This suggests that while smaller firms may face initial challenges in integration and resource limitations, they can achieve significant growth once they overcome these barriers. Josefy et al. (2015) reviewed organizational size research, highlighting both the advantages and disadvantages of larger firms in dynamic environments, including the ability to adapt to changing market conditions and leverage economies of scale. The insights from these studies suggest that firm size significantly influences a firm's ability to integrate into value chains, manage resources efficiently, and adapt to market demands.

These studies collectively underscore the complex relationship between firm size and various organizational outcomes, including performance, growth, and efficiency. They provide a strong rationale for using firm size as a control variable when assessing the impact of value chain integration on a firm's capacity utilization rate and overall performance.

2.5.5. Access to finance

The existing literature on access to finance and its impact on business performance and capacity utilization across firms in Africa presents compelling evidence of its significance. Bokpin et al. (2017) find that access to credit positively influences the productivity of manufacturing firms in Sub-Saharan Africa, highlighting that financial accessibility is crucial for enhancing operational efficiency and output. This is corroborated by Brixiová et al. (2020), who demonstrate that SMEs with formal financing create more jobs, particularly in the manufacturing sector, suggesting that financial resources enable firms to expand their workforce and scale operations. This suggests that access to finance leads to job creation, increases firm size, and improves operational efficiency, all of which together enhance capacity utilization. However, Kalemli-Ozcan and Sorensen (2012) reveal substantial capital misallocation within and across African countries, identifying access to finance as a significant barrier for small firms and non-exporters. Their study also underscores the importance of robust property rights and legal systems in facilitating better capital allocation, implying that institutional quality is essential for financial development and economic growth. This is further supported by Fombang and Adjasi (2018), who show that various forms of finance, such as overdrafts, trade credit, and asset finance, are critical drivers of innovation in selected countries in Africa. Their findings suggest that diverse financing options can spur technological advancements and innovative practices within firms. Collectively, these studies underscore the crucial role of access to finance in fostering productivity, capacity utilization, efficient capital allocation, and innovation among firms in Africa. Access to financial resources allows firms to invest in new technologies, expand operations, and improve efficiency, thereby enhancing overall economic performance. The evidence also highlights the need for supportive legal and institutional frameworks to ensure that financial resources are effectively allocated and utilized, promoting sustainable economic growth across the continent.

2.5.6. Labour productivity

The intricate relationship between labor productivity, firm's integration into value chains, and capacity utilization rates is crucial in understanding overall firm performance. Several studies offer insights into these dynamics, emphasizing the role of internal practices and absorptive capacity in driving competitive advantage. F. Liu et al. (2020) demonstrate that labor productivity partially mediates the relationship between absorptive capacity and firm performance. This suggests that firms capable of effectively assimilating and utilizing external knowledge can enhance their labor productivity, which in turn improves overall firm performance. Absorptive capacity thus becomes a critical internal capability that influences how well a firm can leverage value chain integration to optimize capacity utilization and enhance productivity. Preenen et al. (2015) highlight the positive impact of internal labor flexibility practices on both labor productivity and innovation performance. Flexible labor practices, such as job rotation and skill development, enable firms to adapt more swiftly to changing market demands and technological advancements. This adaptability not only boosts labor productivity but also fosters innovation, which is essential for firms integrated into dynamic value chains. Higher labor productivity derived from flexible practices ensures that firms can utilize their capacity more effectively, thereby improving performance metrics. However, Yousaf (2022) provides a nuanced contrary view, revealing that while quality certificates generally enhance firm performance, the labor productivity of certified firms may negatively impact performance, unlike non-certified firms where a positive relationship is observed. This indicates that the benefits of improved labour productivity might not straightforwardly translate into improved CU or overall firm performance. Instead, it highlights the importance of aligning effective labor practices to fully realize their potential benefits. Firms must ensure that labor productivity improvements align with broader organizational goals to optimize capacity utilization. Deshmukh and Pyne (2013) offer evidence supporting the self-selection hypothesis in export markets, showing that domestic and private firms tend to be more export-intensive than foreign and public firms. They also identify firm size and raw material intensity as significant determinants of labor productivity. This finding underscores the importance of internal firm characteristics in influencing productivity outcomes. Larger firms and those with higher raw material intensity can leverage economies of scale and more efficient production processes, thereby enhancing labor productivity. Such firms are better positioned to integrate into value chains and utilize their capacity effectively, translating into superior performance. Overall, these studies underscore the complex interplay between labor productivity, firm performance, and various organizational factors. Effective internal practices, absorptive capacity, and strategic alignment of labor productivity initiatives are essential for firms to maximize the benefits of value chain integration. By focusing on these areas, firms can enhance their capacity utilization rates and achieve sustained competitive advantage in the marketplace. This multifaceted approach highlights the need for a comprehensive understanding of internal and external dynamics to drive firm performance in an increasingly interconnected global economy.

To conclude, existing literature highlights significant heterogeneity in how firms experience and benefit from participation in local and global markets. The mixed modality perspective shows the strategic advantage of balancing local and global integration, while the emphasis on technological capabilities and informal competition underlines the varied impacts of external and internal factors on capacity utilization and overall firm performance. These varied outcomes suggest that businesses and policymakers must consider heterogeneity when designing strategies for VC participation and economic policy, respectively.

A theoretical framework for this graduation thesis is constructed, as illustrated in Figure 1.2, which takes into account the influence of different modalities of VCI on capacity utilization of firms, moderated by the impacts of productive capability and competition.

The empirical foundation laid out in this chapter discusses the theoretical framework and existing literature on value chain integration and overall firm performance, sets the stage for the econometric analysis conducted in the next chapter (3). By establishing the key variables and concepts such as capacity utilization, productive capability, and informal competition, chapter 2 provides the necessary context for the detailed examination of these factors in chapter 3. The transition from theoretical constructs to data-driven analysis highlights the study's aim to empirically validate the relationships posited in the literature, thereby offering robust insights into the dynamics of firm integration into value chains in Africa. This connection ensures that the subsequent econometric analysis is grounded in a solid theoretical understanding, enhancing the relevance and impact of the research findings.

3

Research Design

This research employs econometric analysis to compare the participation of firms in Africa in Foreign Value Chains (FVC), Domestic Value Chains (DVC), and Hybrid Value Chains (HVC), and to assess their impact on capacity utilization rates. Appendix D lists the countries of Africa in the dataset. The study utilizes panel data from the World Bank Enterprise Survey (WBES). This research is conducted in two phases. First, it introduces value chain integration dummy variables for firms in Africa and employs these dummy variables to assess the level of integration i.e. domestic, foreign or hybrid. Second, it uses econometric methods to examine the causal relationship between capacity utilization rates of firms and value chain integration, exploring how this relationship is influenced and shaped.

Throughout the development of this research, Generative AI tools were employed to assist in paraphrasing, refining the language of certain sections and addressing errors in the data analysis code. This was done to ensure clarity and coherence in the presentation of ideas. Specifically, Microsoft's Copilot, Perplexity AI, and OpenAI's ChatGPT were used under careful review to maintain the integrity and originality of the content.

3.1. Variables and data source

This section provides an overview of the variables used in the regression models and the corresponding data source. By understanding the variables and data source employed in the analysis, we can gain insights into the factors driving capacity utilization rates at the firm level.

World Bank Enterprise Survey (WBES) database is utilized to examine the impact of firm participation in value chains on capacity utilization. The World Bank conducts face-to-face interviews with top management of firms, gathering data on firm characteristics across various dimensions, such as international trade, innovation, input costs, access to finance, workforce size, bribery, competition, taxation, sales, informality, business-government relations, and performance metrics like capacity utilization rates. The WBES dataset encompasses both manufacturing and service sectors, employing a stratified random sampling method by location, size, and sector, with replacement (Dethier et al., 2008). The number of firms interviewed varies by country size (see Appendix D). Since 2006, WBES has used a standardized questionnaire template, enhancing external validity and enabling cross-country comparisons. Consequently, our analysis period is restricted to 2006–2018. During data filtering, firms with missing and incorrect information on capacity utilization rates and sales were excluded. Final sample consists of 14823 firm-year observations from 43 countries in Africa.

Regarding the data utilized in this study, there are 54 countries in Africa, not only 43. While this coverage is extensive and representative of a significant portion of the continent, the absence of data from 11 countries may pose limitations. Critically, this exclusion could mean that the findings might not fully capture the diversity of economic environments across all firms in Africa. However, the WBES data includes countries that contribute significantly to Africa's GDP, such as South Africa, Egypt, Nigeria, Ethiopia, and Morocco. Together these 5 countries account for approximately 55-60% of the continent's total GDP, according to the latest data by Statista (2024). Hence, WBES database offers a comprehensive foundation for analysis, also covering a wide range of industries and firm sizes across diverse economic contexts. This breadth ensures that the insights derived from this research are broadly applicable across Africa, even if not entirely exhaustive. Therefore, while the limitation exists, the data remains sufficiently comprehensive to draw meaningful conclusions about CU and VCI across firms in Africa.

Prior to conducting any analytical methods, an extensive data cleaning process was implemented to ensure the quality and reliability of the data. This process involved removing any records with negative values and excluding capacity utilization rates preceeding 0% and exceeding 100%, as these values were deemed implausible. Subsequently, dummy variables were generated to represent firms integrated into domestic, foreign or hybrid value chain and other relevant dummy or categorical variables to control for various firm characteristics and external factors. These variables were then normalized to standardize the data for further analysis. The coding used for data analysis is presented in Appendix G.

3.1.1. Dependent Variable: Capacity Utilization

In this research, the primary variable of interest is capacity utilization. The WBES database includes a percentage variable that captures the capacity utilization rates of firms. Respondents were asked, "In the last fiscal year, what was the capacity utilization percentage of this establishment?" Any reported values below 0% or above 100% were excluded from the analysis to ensure data accuracy and validity.

3.1.2. Independent variables: Value chain integration

The first phase involves creating novel and comprehensive value chain dummy variables that identify the appropriate elements. To determine which variables should be considered, a preliminary study, inspired by existing literature Beverelli et al. (2016, 2019), Belderbos and Grimpe (2020), Urata (2020); Avenyo et al. (2021); Reddy et al. (2020); Ndubuisi et al. (2024)), has already been conducted to identify eligible variables for assessing value chain integration of firms. A common approach in these literature is using import and export data to construct GVC indexes. Hence, to construct value chain integration indexes, it is essential to obtain a data source that provides comprehensive information on imports, exports, and value-added data. Specifically, the value-added data should include metrics such as customer satisfaction (assessed through surveys or feedback mechanisms), contract renewal rates (measuring the percentage of customers renewing their contracts), Net Promoter Score (NPS) (evaluating customer likelihood to recommend the product or service), churn rate (monitoring the rate at which customers leave the service), and the economic impact (quantifying the financial benefits provided to clients). Utilizing these data points is crucial for creating value chain integration dummy variables, which form an appropriate database for addressing all research questions.

However, the data source employed in this research, the WBES, only provides information on intermediate inputs sourcing, national sales, imports and exports. Consequently, this research will use this data to construct Domestic Value Chain (DVC), Foreign Value Chain (FVC), and Hybrid Value Chain (HVC) dummy variables. This approach is motivated by the work of Beverelli et al. (2016, 2019), who decomposed an industry's output into three components based on the required inputs: its own value-added, domestically sourced intermediate goods, and foreign sourced intermediate goods.

According to Beverelli et al. (2016, 2019), the DVC indicator is defined as the share of domestically sourced intermediate goods in domestic output. The WBES database, covering firms in Africa from 2006 to 2018, provides data on domestically and foreign-sourced intermediate goods. These variables will be used in this research to create DVC indicators. Similarly, for the Global Value Chain (GVC) analysis, Beverelli et al. (2016, 2019) calculated the amount of imported inputs and exported outputs, forming the basis of the GVC/FVC indicators constructed in this thesis. Due to the unavailability of data regarding customer satisfaction, contract renewal rates, NPS, and churn rate, in the WBES database, this research will focus solely on data related to sourcing within or outside national boundaries and selling within or outside these boundaries to compute aggregate value chain integration indicators.

Upon completing the preliminary study, five critical indicators were identified as essential for evaluating a firm's value chain integration. These indicators, sourced from the WBES database, are as follows:

- % of sales: National sales
- % of sales: Direct exports
- % of sales: Indirect exports
- % of material inputs and supplies of domestic origin
- % of material inputs and supplies of foreign origin

Each of these factors are measured and represented as numerical values in the WBES database. The ultimate goal of the framework is to integrate these five individual indicators into a comprehensive statistical method that generates final dummy variables for domestic value chain, foreign value chain, and hybrid value chain integration. Before creating dummy vriables for DVC, FVC, and HVC, an intermediary step was necessary to simplify the process. Therefore, four variables were created, as follows:

- *nsales:* Binary variable indicating if % of sales: National sales is 100%.
- *nbuy:* Binary variable indicating if % of material inputs and supplies of domestic origin is 100% i.e. national buying is 100%.
- *exporting:* Binary variable indicating if there are any direct or indirect exports. Thus, exporting gets a value 1, if % of sales: Direct exports is greater than 0% or % of sales: Indirect exports is greater than 0%.
- *importing:* Binary variable indicating if there are any imports i.e. % of material inputs and supplies of foreign origin is greater than 0%.

A firm integrated in *(dvc)* is defined by two dummy variables: *nsales*, indicating if national sales are 100%, and *nbuy*, indicating if national buying is 100%. A firm is considered part of a domestic value chain if both *nsales* and *nbuy* are equal to 1. The Foreign Value Chain *(fvc)* category involves firms that engage in both exporting and importing activities, with the *exporting* and *importing* variables being binary indicators of these activities. A firm is part of the *fvc* if both *exporting* and *importing* variables are equal to 1. Hybrid/Mixed Value Chains *(mvc)* are divided into two subcategories: *mvc1*, where a firm is involved in *exporting* and *national buying*, and *mvc2*, where a firm is involved in *importing* and *national sales*. A firm qualifies for *mvc1* if *exporting* is 1 and *nbuy* is 1, and for *mvc2* if *importing* is 1 and *nsales* is 1. The overall hybrid value chain integration *(mvc)* is determined if either *mvc1* or *mvc2* conditions are met, indicating the firm's participation in both national and international markets. These dummy indexes serve as a comprehensive measure of a firm's integration into the value chain. By incorporating these five variables, a holistic assessment of value chain participation is provided. Table 3.1 provides a summary of the constructed dummy variables. A more detailed and comprehensive explanation is provided below.

Table 3.1: Summary of dummy variables categorizing firms' integration into DVC, FVC and HVC

Dummy variables	0	1	Total
Domestic Value Chain	8721	6102	14823
Foreign Value Chain	12231	2592	14823
Hybrid Value Chain	9041	5782	14823

Note: dvc = firms integrated into domestic value chains; fvc = firms integrated into foreign value chains; mvc = firms integrated into both domestic and foreign value chains, The 'm' in mvc stands for 'mixed', and in this document, the term HVC is also used to refer to the hybrid (or mixed) value chain. Throughout this research, mvc and HVC are used interchangeably.

Domestic Value Chain:

- *nsales:* Dummy variable indicating if national sales are 100%.
- *nbuy:* Dummy variable indicating if national buying is 100%.

$$\text{dvc} = \begin{cases} 1 & \text{if nsales} = 1 \text{ and nbuy} = 1 \\ 0 & \text{otherwise} \end{cases}$$

Foreign Value Chain:

- *exporting:* Binary variable indicating if there are any direct or indirect exports.
- *importing:* Binary variable indicating if there are any imports.

$$\text{fvc} = \begin{cases} 1 & \text{if exporting} = 1 \text{ and importing} = 1 \\ 0 & \text{otherwise} \end{cases}$$

Hybrid Value Chains:

- *mvc1:* Exporting and national buying.

$$\text{mvc1} = \begin{cases} 1 & \text{if exporting} = 1 \text{ and nbuy} = 1 \\ 0 & \text{otherwise} \end{cases}$$

- *mvc2:* Importing and national sales.

$$\text{mvc2} = \begin{cases} 1 & \text{if importing} = 1 \text{ and nsales} = 1 \\ 0 & \text{otherwise} \end{cases}$$

The combined variable mvc represents a firm's overall involvement in hybrid value chain participation. Hybrid value chains are defined by a combination of national and international sales and inputs.

$$\text{mvc} = \begin{cases} 1 & \text{if mvc1} = 1 \text{ or mvc2} = 1 \\ 0 & \text{otherwise} \end{cases}$$

3.1.3. Contingent Variables

- Productive Capability

  Given that the various dimensions of technological capabilities (e.g., R&D, product innovation, and process innovation) and production capabilities (e.g., fixed assets, formal training, and workforce education) are likely to be correlated (as discussed in sub-chapter 2.5.1), these sets of relevant dimensions are combined into two composite indicators. Following Avenyo et al. (2021), a group of highly correlated dimensions for technological and production capabilities is expected.

  Following the data pre-processing, Principal Component Analysis (PCA) was employed to construct a composite indicator of productive capability. This indicator encapsulates both technological capacity and production capacity, providing a comprehensive measure of the firms' overall productive capabilities. The PCA technique was instrumental in reducing the dimensionality of the data while preserving the essential information, thereby facilitating a more robust and insightful analysis. Drawing inspiration from Avenyo et al. (2021), the variables related to productive capacity are R&D, product innovation, process innovation, fixed assets, foreign license, ownership, training, workforce education and certification. Principal Component Analysis (PCA) was conducted on these 9 variables to obtain the principal components $\mathbf{PC}_1, \mathbf{PC}_2, \ldots, \mathbf{PC}_k$. Following this, a varimax rotation was applied to the principal components to achieve a simpler and more interpretable structure. This rotation aids in maximizing the variance of the squared loadings of a factor (column) across a variable (row), thereby producing factors that are easier to interpret. The PCA revealed that two components had eigenvalues greater than 1, indicating that these components explain a significant 40.36% of the variance in the data. The results of the PCA are presented in Table 3.2, with components 1 and 2, which have eigenvalues greater than 1, highlighted in **bold.**

  Based on the rotated components, scores were predicted for technological (*tech*) and production (*prod*) capacities. These scores provide quantifiable measures of the respective capacities for each firm. It is evident that variables such as R&D, product innovation, and process innovation have high eigenvector values for component 1, thus identifying Component 1 as technological capacity. Concurrently, variables like fixed assets, foreign license, foreign ownership, formal training, and workforce education exhibit high eigenvector values for component 2, indicating production capacity.

Table 3.2: Principal components/correlation

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	**2.31639**	1.00068	0.2574	0.2574
Comp2	**1.31571**	0.325583	0.1462	0.4036
Comp3	0.990131	0.023516	0.1100	0.5136
Comp4	0.96678	0.066744	0.1074	0.6210
Comp5	0.900032	0.0788391	0.1000	0.7210
Comp6	0.821193	0.0323677	0.0912	0.8122
Comp7	0.788825	0.196803	0.0876	0.8999
Comp8	0.592023	0.283113	0.0658	0.9657
Comp9	0.38091	–	0.0343	1.0000

Table 3.3: Principal components (eigenvectors)

Variable	Comp1 : tech	Comp2 : prod
R&D	**0.4717**	-0.1509
Product Innovation	**0.5233**	-0.3027
Process Innovation	**0.5301**	0.2980
Fixed Assets	0.2203	**0.3115**
Foreign License	0.2141	**0.4844**
Foreign Ownership	0.1491	**0.5047**
Training	0.2884	**0.3942**
Workforce Education	0.1523	**0.3892**
Certification	0.0905	-0.0009

Note: tech = technological capacity of firms, prod = production capacity of firms.

A new variable for ”productive capability”, termed (*productive*), was generated as a weighted combination of the component 1 (tech) and component 2 (prod) scores. The formulation of this composite variable is as follows:

$$\text{productive} = 0.6435 \times \text{tech} + 0.3655 \times \text{prod}$$

This weighted combination was derived to optimally capture the contributions of both technological and production capacities to the overall productive capability of the firms.

- Informal Competition

Informal competition significantly affects capacity utilization and firm performance, undermining productivity and sales per worker (Goel et al., 2021). It also creates barriers to value chain integration and impacts productive capability and labor productivity (Rahmouni, 2021; Ram et al., 2022; Williams & Bezeredi, 2018). Informal competition's existence is prevalent in developing economies, and hence it is used as a control variable. Inspired by Goel et al. (2021) and Rahmouni (2021), this research constructs an informal competition indicator.

3.1.4. Control Variables

- Labour Productivity

F. Liu et al. (2020) demonstrate that absorptive capacity influences firm performance, mediated by labor productivity. Yousaf (2022) explores the effects of labor productivity on firm performance, revealing that quality certificates positively impact firm performance, with labor productivity effects varying based on certification status. These studies highlight the intricate relationship between labor practices and organizational outcomes, suggesting that effective knowledge absorption enhances labour productivity and innovation, improving firm performance and capacity utilization. Motivated by this literature, labor productivity was used as a control variable to assess the impact of firm integration into value chain on capacity utilization rates.

Labor productivity is often defined as the amount of goods and services produced per labor hour. It is calculated by dividing the value of output (such as sales) by the number of hours worked or the number of employees involved in production (Investopedia, 2020). This measure reflects how efficiently a company utilizes its workforce to generate output, indicating the level of productivity within an organization. The formula for labor productivity can also be expressed in terms of revenue per employee, where a company's total revenue is divided by its number of employees. This ratio helps in understanding how much revenue each employee generates, offering insights into the company's efficiency and the effective use of human capital.

$$\text{Labour productivity} = \text{Sales}/\text{Number of employees}$$

In the World Bank Enterprise Survey (WBES), for sales, the interviewee was asked, ”In Last Fiscal Year, What Were This Establishment's Total Annual Sales?” with their response recorded as the firm's revenue in the previous year. For the number of employees, the interviewee was asked to answer ”Total Number Of Full Time Employees, Adjusted For Temporary Workers” with their response recorded. To normalize the variable of labor productivity, logarithmic transformations were applied, as represented by the equation below:

$$\text{labprod} = \ln(1 + \text{labour\_productivity})$$

- Access to finance

The existing literature extensively explores the impact of access to finance on firm performance and capacity utilization in Africa. Notably, Bokpin et al. (2017), Brixiová et al. (2020), Kalemli-Ozcan and Sorensen (2012), and Fombang and Adjasi (2018) highlight how financial accessibility enhances productivity, employment, and innovation while addressing significant barriers such as capital misallocation and the need for robust legal frameworks. Motivated by these insights, this research uses a categorical variable of access to finance to examine its effects on value chain integration and capacity utilization of firms.

The variable k30, derived from the World Bank Enterprise Surveys (WBES), captures respondents' perceptions regarding the extent to which access to finance poses an obstacle to their operations. Based on the responses to k30, a categorical variable 'finance' has been created for further analysis. Descriptive statistics of both 'k30' and 'finance' are discussed in section 3.3.

- Age of the firm

The relationship between firm age and performance is complex, with older firms generally showing higher productivity and profits but lower growth rates; a U-shaped performance trend is sometimes observed, especially in family-owned firms (Coad et al., 2010; Dang et al., 2021; Rossi, 2016; Sinan, 2018). This indicates varying impacts of firm age based on different factors, warranting further research. Hence, the age of the firm is an important control variable in regression analysis, particularly in studies examining capacity utilization, or other metrics of firm performance. In the World Bank Enterprise Survey (WBES), the interviewee was asked, "What is the age of the firm?" with their response recorded as the firm's age in years. The distribution of firm age is often highly skewed, with a concentration of young firms and fewer older firms. This skewness can distort the regression results. To handle skewness and enhance interpretability, this age variable was transformed in the regression analysis by taking the logarithm of firm age (log_age). Descriptive summary of this variable is discussed later in section 3.3.

- Size of the firm

According to Higón and Bournakis (2024), small firms (<50 employees) are less likely to be integrated into international value chains, which is attributed to their limited resources and capabilities. In contrast, large firms (>250 employees) are more capable of engaging in international trade due to their extensive resources and established infrastructures. These findings are consistent with the existing literature reviewed in section 2.5 that suggests firm size significantly impacts technical efficiency, productivity, and overall performance. Therefore, considering firm size as a control variable is crucial for accurately assessing the effects of value chain integration on firm performance.

- Fixed Effects (Year and Industry)

In the regression model of this research, year and industry fixed effects are used to control for unobserved heterogeneity that could bias the results. Fixed effects estimators are essential for providing consistent and reliable estimates by accounting for time-invariant characteristics and industry-specific factors that might influence the dependent variable. Gormley and Matsa (2012) critique common approaches like demeaning the dependent variable and adding group means as controls, highlighting that these methods can lead to inconsistent estimates and distorted inferences. Instead, they advocate for fixed effects models, which offer robust solutions for dealing with unobserved heterogeneity. Additionally, Allison (2009) provides a comprehensive overview of fixed effects models, including their application in various data types and contexts, such as linear, logistic, and count data models, emphasizing the importance of accounting for unobserved heterogeneity to ensure robust empirical findings. By incorporating year and industry fixed effects, the model can effectively isolate the impact of the independent variables on the dependent variable, thereby enhancing the validity of the findings. This approach helps control for any time-specific or industry-specific shocks that could otherwise skew the results, ensuring that the analysis accurately reflects the underlying relationships being studied.

This section provides an overview of the variables used in the analysis, with data sourced from the World Bank Enterprise Survey (WBES) database. The primary dependent variable is capacity utilization (CU), while the key independent variables focus on value chain integration (VCI), categorized into domestic, foreign, and hybrid value chains. Additional variables include contingent factors such as productive capacity and informal competition, as well as control variables including labor productivity, firm size, firm age, and access to finance. These variables are summarized in Table 3.4. The subsequent section (3.2) discusses the model specification and estimation strategy.

Table 3.4: Summary of variables used in this research

Variables	**Name**	**Symbol**	**Type**	**Source**
Dependent	Capacity Utilization	f1	Ratio	WBES
Independent	Domestic value chains	dvc	Binary	Derived by author
Independent	Foreign value chains	fvc	Binary	Derived by author
Independent	Hybrid value chains	mvc	Binary	Derived by author
Contingent	Technological capacity	tech	Continuous	Derived by author
Contingent	Production capacity	prod	Continuous	Derived by author
Contingent	Informal competition	informal_comp	Categorical	Derived by author
Control	Labour productivity	labprod	Continuous	Derived by author
Control	Access to Finance	financial	Ordinal	Derived by author
Control	Age	ln_age	Continuous	Derived by author
Control	Size	size	Categorical	Derived by author

Note: The variables derived by the author are also sourced from the WBES. Their conceptualization is discussed in this chapter. The details of Model 1 (Equation 3.1) and Model 2 (Equation 3.2) are provided later in chapter 3.2.1.

3.2. Econometrics analysis

3.2.1. Model Specification

To examine the sub-research questions, I will employ a panel data regression model. Specifically, the model that guides this research question is as follows:

$$CU_{i,t} = \beta_0 + \beta_1 VCI_{i,t} + X'\delta + \lambda_{\text{industry}} + \lambda_{\text{year}} + \epsilon_{i,t} \tag{3.1}$$

where CU is a measure of the capacity utilization rate of firm i, and VCI is the value chain integration modality of firm i. β_0 is the intercept. X' is a vector of firm characteristics (productive capability, informal competition and other control variables) used as control variables. This includes labour productivity, access to finance, age of the firm, size of the firm, R&D, product innovation, process innovation, fixed assets, foreign license, ownership, training, workforce education, certification and informal competition. By considering these control variables, the aim is to isolate the specific impacts of the independent variable of interest on capacity utilization rate, while controlling for potential biases. Fixed effects of year λ_{year} and industry $\lambda_{\text{industry}}$ are also used, improving the accuracy and reliability of the estimates. Using fixed effects for year in regression controls for time-specific factors such as macroeconomic trends, technological advancements, or policy changes, ensuring that these common shocks do not bias the estimates. Including fixed effects for industry accounts for industry-specific characteristics such as industry regulations, market structure, and inherent industry risks, allowing for more accurate estimation. This approach allows us to isolate and quantify the effects of these factors, facilitating a more accurate understanding of the underlying dynamics and contributing to a comprehensive assessment of carbon efficiency determinants. ϵ is the error term.

Addressing second and third sub-research questions, the modeling approach involves augmenting the previous equation to account for the contingent variables (productive capability and informal competition) interacting with VCI and influencing CU. Hence, the baseline equation that guides the second and third sub-research questions is as follows:

$$CU_{i,t} = \beta_0 + \beta_1 VCI_{i,t} + \beta_2 Y' + \beta_3 (VCI_{i,t}.Y') + Z'\delta + \lambda_{\text{industry}} + \lambda_{\text{year}} + \epsilon_{i,t} \tag{3.2}$$

where Y' = function of PC & IC and PC + IC + Z' = X'. PC represents Productive Capacity, derived from the principal component analysis methodology, incorporating multiple factors (R&D, product innovation, process innovation, fixed assets of the firm, foreign license, foreign ownership, training, workforce education, and certification) that influence the relationship between capacity utilization and value chain integration of firms. IC denotes Informal Competition, a categorical variable that reflects the extent to which competitors in the informal sector pose an obstacle.

3.2.2. Estimation Strategy

For estimating the two regression models described, appropriate strategies are employed to ensure reliable and meaningful results. The first regression model, focusing on the relationship between firms' capacity utilization rates (CU) and value chain integration (VCI) modes, utilizes an ordinary least squares (OLS) method with firm characteristics as control variables. This approach will allow the assessment of the magnitude and direction of the relationships between CU and VCI by estimating the regression coefficients. The second regression model, which examines the influence of productive capacity and the role of competition on the causal relationship between CU and VCI, also employs the OLS method.

Both regression models will be estimated using a statistical analysis software: Stata[1], taking into account the assumptions of linear regression.

Overall, the chosen estimation strategies provide a rigorous analysis of the relationships between CU and VCI. By employing these robust estimation techniques, the goal is to provide accurate insights into the complex dynamics driving firms' CU, informing evidence-based decision-making for strategies firms can adopt to optimize their capacity use and policies governments can implement to support sustainable economic growth.

3.3. Descriptive statistics

Table 3.5 presents descriptive statistics of all the key variables. It provides a snapshot of key economic indicators over the observed period. The variable f1 (Capacity Utilization) indicates a right-skewed distribution with a mean of 70.18656 and high variability, evidenced by a standard deviation of 22.68075. The dvc (Domestic Value Chain), fvc (Foreign Value Chain), and mvc (Hybrid Value Chain) variables are binary, showing moderate variability with standard deviations around 0.39 to 0.5. The 'productive' (Productive Capability), 'tech' (Technological Capacity) and 'prod' (Production Capacity) variables, with a mean near zero are likely a result of the data being centered around zero. The informal_comp (Informal Competition) variable is right-skewed, with a mean of 1.819727 and moderate variability (standard deviation of 0.977526). Labour Productivity 'labprod' shows slight right-skewness, with a mean of 13.44107 and a high variability reflected by a standard deviation of 2.644888. Access to Finance 'finance' is right-skewed, with a mean of 1.388473 and moderate variability (standard deviation of 0.652161). The ln_age (Age of the Firm) variable, is log tranformed, with a mean of 2.529582 and a maximum value of 5.351858, indicates right-skewness and moderate variability (standard deviation of 0.8870982). Similarly, size (size of the

[1] Stata is a statistical software used for data analysis, data management, and graphics. It is widely used by researchers in various fields, including economics, sociology, and biomedicine, for its comprehensive range of statistical tools and user-friendly interface. For more information, visit their website: https://www.stata.com/

firm) is right-skewed with a mean of 1.689537 and moderate variability (standard deviation of 0.763987).

Table 3.5: Descriptive statistics of variables used in this research

Variable	Description	Obs	Mean	Std. Dev.	Min	Max
f1	Capacity Utilization	14,823	70.18656	22.68075	0	100
dvc	Domestic Value Chain	14,823	0.4116576	0.4921503	0	1
fvc	Foreign Value Chain	14,823	0.1748634	0.379963	0	1
mvc	Hybrid Value Chain	14,823	0.3900695	0.4877821	0	1
productive	Productive Capability	14,823	0.1582545	0.2481675	0	1
tech	Technological Capacity	14,823	0.1318792	0.303433	0	1
prod	Production Capacity	14,823	0.2145974	0.3681654	0	1
informal_comp	Informal Competition	14,823	1.819727	0.977526	0	4
labprod	Labour Productivity	14,823	13.44107	2.644888	0	25.85096
finance	Access to Finance	14,823	1.062875	0.819551	0	2
ln_age	Age of the Firm	14,823	2.506373	0.9153668	0	5.351858
size	Size of the Firm	14,823	1.689537	0.763987	1	3

The construction of the indices, *'tech'* (technological capacity), *'prod'* (production capacity), and *'productive'* (productive capability) using principal component analysis (PCA) result in values that naturally extend beyond the 0-1 range. These variables are constructed from various indicators with different scales and units, such as R&D, product innovation, process innovation, foreign ownership, certification, fixed aseets etc., which vary widely. Hence, in this table, the variables are normalized to a range of 0 to 1. Thus, the normalized values offer a comprehensive and more nuanced understanding of technological and production capacities, maintaining the inherent variability and distribution of the underlying data.

Table 3.6 presents the pairwise correlation of the variables used in this research. From the table, it is evident that CU (denoted as f1) is weakly correlated with the other variables. The highest correlation of CU is with labor productivity, which is approximately 0.13. The aggregate Value Chain (VC) participation dummy variables — Domestic Value Chain (DVC), Foreign Value Chain (FVC), and Hybrid Value Chain (HVC) —which are the main explanatory variables, also exhibit weak correlations with the control variables, although not as weak as in the case of CU. The highest correlations of DVC and FVC with the control variables are with the size of the firm, at -0.29 and 0.36 respectively.

Among the VC participation variables, the aggregate DVC participation dummy correlates strongly with MVC (approximately -0.72), but is weakly correlated with FVC (approximately -0.38). This pattern is understandable, as firms in developing countries, such as those in Africa, are predominantly integrated within domestic value chains (Beverelli et al., 2016, 2019). Additionally, HVC firms are those firms which are integrated into both domestic and foreign value chains. Hence, a strong correlation between DVC and HVC is expected since, by construction, the latter is computed using the former. It was anticipated that there would be a similarly strong correlation between FVC and HVC; however, this was not observed (-0.34). Furthermore, DVC and FVC are not perfectly correlated, showing only a negative correlation of approximately -0.38. This finding further supports the view that firms in developing economies, like those in Africa, participate in FVC through DVC (Beverelli et al., 2016, 2019). This suggests that focusing solely on one sub component provides an incomplete picture of a firm's VC participation. Therefore, in this research, comprehensive dummy variables for DVC, HVC, and FVC are constructed.

Table 3.6: Correlation matrix for the variables

	f1	dvc	fvc	mvc	PC	IC	labprod	finance	ln_age	size
Capacity Utilization	1.00									
Domestic Value Chain	0.02	1.00								
Foreign Value Chain	0.00	-0.38	1.00							
Hybrid Value Chain	-0.02	-0.72	-0.34	1.00						
Productive Capability	0.00	-0.18	0.19	0.04	1.00					
Informal Competition	0.04	-0.01	0.05	-0.02	-0.00	1.00				
Labour Productivity	0.13	-0.06	0.07	0.09	0.02	-0.22	1.00			
Access to finance	-0.03	-0.09	0.02	0.07	0.01	-0.18	0.04	1.00		
Age of the firm	-0.01	-0.12	0.16	0.01	0.13	-0.04	0.01	0.05	1.00	
Size of the firm	0.04	-0.29	0.36	0.03	0.23	0.23	0.03	-0.03	0.29	1.00

In Table 3.7, mean values of the dependent variable (CU) and contingent variables (productive capability and informal competition) between the three aggregate VCI groups (DVC, FVC and HVC) are presented. The CU mean of the DVC firm sample is 70.25%, FVC firm sample is 71.14%, HVC firm sample is 69.73%. This first piece of evidence suggests that FVC participation is associated with highest CU levels, followed by DVC and then HVC. Similarly, Table 3.7 indicates that firms participating in FVC exhibit the highest productive capability and face the least challenges with informal competition. Additionally, it is evident that firms integrated into DVC have the lowest technological capacity (0.086) compared to those in FVC (0.225) and HVC (0.137).

Table 3.7: Mean values of dependent and contingent variables of firms integrated into domestic, foreign and hybrid VC

	N	CU	PC	tech	prod	IC
DVC = 1	6102	70.25%	0.113	0.086	0.171	1.785
FVC = 1	2592	71.14%	0.243	0.225	0.281	1.956
HVC = 1	5782	69.73%	0.165	0.137	0.224	1.790

Note: This table presents descriptive statistics of dependent, independent and contingent variables; where DVC = firms integrated into domestic value chains, FVC = firms integrated into foreign value chains, HVC = firms integrated into both domestic and foreign value chains, N = number of observations, CU = capacity utilization rates, PC = productive capabilities of firms, tech = technological capacity of firms, prod = production capacity of firms, and IC = informal competition.

Further, to check the mean difference among the three groups (DVC, FVC and HVC) with respect to CU, productive capability annd informnal competition, differences in means t-test is conducted for three pairs: (i) DVC vs.

FVC, (ii) DVC vs. HVC, and (iii) FVC vs. HVC. The result of this exercise is reported in Table 3.8. In general, for CU rates, at 10% significance levels, there is a statistically significant difference in the CU levels between the groups DVC & FVC, and FVC & HVC. However, there is no statistically significant difference between the CU levels of the groups of DVC and HVC, as shown in Panel A2 of Table 3.8. This outcome was anticipated, given the significant overlap between HVC and DVC firms. As shown in Table 3.7, about 40% of firms in the sample are integrated into DVC and HVC, while only 17.5% are integrated into FVC. This suggests that firms in DVC and HVC may derive similar benefits from VC participation. Consequently, this observation motivates a more detailed regression analysis to explore the impact of overall VC participation on CU rates, considering firm characteristics and other external factors that may influence this relationship. Building on this argument, Panel C2 of Table 3.8 also reveals no statistically significant difference in the impact of informal competition between the DVC and HVC groups. Lastly, in Table 3.8, a two-tailed test is used to assess significance because there is potential for a relationship in either direction, meaning the mean of one group could be either greater or less than the mean of the other group. In contrast, Panel B2 of Table 3.8 clearly shows that there are statistically significant differences in the productive capabilities between the DVC and HVC groups. The difference in productive capability might be due to the differing nature of the value chains. HVC, as conceptualized before in sub-chapter 3.1.2 typically involve integration into both domestic and international components, requiring firms to develop more advanced productive capabilities to manage these operations effectively. In contrast, DVC firms might not face the same need for such advanced capabilities, leading to the observed difference in productive capability. This difference could also reflect varying levels of investment in technology, skills, and infrastructure between the two types of value chains. Therefore, this complexity can be further investigated by combining DVC, FVC, and HVC, and then performing additional statistical tests, such as ANOVA[2].

[2]ANOVA, which stands for Analysis of Variance, is a statistical method used to compare the means of three or more groups to determine if there are any statistically significant differences between them. Unlike t-tests, which are typically used to compare the means of two groups, ANOVA is designed to handle comparisons across multiple groups simultaneously.

Table 3.8: Mean difference t-test results for capacity utilization, productive capability and informal competition levels across aggregate VC participation groups

Panel A1		**DVC**	**FVC**	**|t-value|**	**df**
	Mean (N)	70.25% (6102)	71.14% (2592)	1.6575**	8692
Panel A2		**DVC**	**HVC**		
	Mean (N)	70.25% (6102)	69.73% (5782)	1.2612	11882
Panel A3		**FVC**	**HVC**		
	Mean (N)	71.14% (2592)	69.73% (5782)	2.6356**	8372
Panel B1		**DVC**	**FVC**		
	Mean (N)	0.113 (6102)	0.243 (2592)	23.1444***	8692
Panel B2		**DVC**	**HVC**		
	Mean (N)	0.113 (6102)	0.165 (5782)	12.3177***	11882
Panel B3		**FVC**	**HVC**		
	Mean (N)	0.243 (2592)	0.165 (5782)	12.0711***	8372
Panel C1		**DVC**	**FVC**		
	Mean (N)	1.785 (6102)	1.956 (2592)	7.4777***	8692
Panel C2		**DVC**	**HVC**		
	Mean (N)	1.785 (6102)	1.790 (5782)	0.2781	11882
Panel C3		**FVC**	**HVC**		
	Mean (N)	1.956 (2592)	1.790 (5782)	7.2167***	8372

Note: Panels A (A1, A2, A3), B (B1, B2, B3) and C (C1, C2, C3) show the results of mean difference t-tests with respect to capacity utilization, productive capability and informal competition, respectively; where DVC = firms integrated into domestic value chains, FVC = firms integrated into foreign value chains, HVC = firms integrated into both domestic and foreign value chains, N = number of observations, and df = degrees of freedom; ***, **, * means the estimated coefficient is statistically significant at 1%, 5% and 10% significance level, respectively.

Finally, to simultaneously perform a difference test among the three groups (DVC, FVC and HVC), ANOVA (analysis of variance) test was performed. The result of this exercise is reported in Table 3.9. For CU rates, the p-value of 0.062 suggests that there are statistically significant differences in the CU levels between the three groups, at the 10% significance level, as shown in Panel A of Table 3.9. Similarly, the p-value of 0.000 for both productive capability (Panel B in Table 3.9) and informal competition (Panel C in Table 3.9) suggests that there are statistically significant differences in the productive capability and informal competition levels between the three groups, at the 1% significance level.

Table 3.9: ANOVA Results for the differences in capacity utilization, productive capability and informal competition levels across aggregate VC participation groups

Source	**SS**	**df**	**MS**	**F**	**Prob > F**
Panel A					
Between groups	3768.94443	3	1256.31481	2.44	0.0622*
Within groups	7620913.83	14820	514.266403		
Panel B					
Between groups	31.6893339	3	10.5631113	177.65	0.000***
Within groups	881.155127	14820	0.059461173		
Panel C					
Between groups	62.840268	3	20.946756	22.01	0.000***
Within groups	14099.4714	14820	0.951509747		

Note: Panels A, B and C show the results of ANOVA (analysis of variance) tests with respect to capacity utilization, productive capability and informal competition, respectively; ***, **, * means the estimated coefficient is statistically significant at 1%, 5% and 10% significance level, respectively.; where SS = sum of squares, df = degrees of freedom, MS = mean square, F = f-statistic, and Prob > F = p-value.

Distribution of contingent variables

Table 3.10 provides the summary statistics for the indicators constructed for this research, conceptualized in sub-chapter 3.1.3, based on the results of the PCA (Principal Component Analysis). The analysis suggests that firms in Africa (from this sample dataset of 14823 firms) have greater production capacities (0.214) compared to technological capacities (0.132), as also noted by Avenyo et al. (2021). This indicates that firms in Africa should consider investing in technological capacities to further enhance their productive capabilities.

Table 3.10: Summary statistics for productive capability

Variable	N	Mean	SD	Min	Max
tech	14,823	0.132	0.303	0	1
prod	14,823	0.214	0.368	0	1
PC	14,823	0.158	0.248	0	1

Note: This table presents summary statistics of productive capabilities of the firms in the dataset; where N = number of observations, SD = standard deviation, PC = productive capabilities of firms, tech = technological capacity of firms, and prod = production capacity of firms.

Regarding informal competition, in the World Bank Enterprise Survey (WBES), the interviewee was asked, ”How

Much Of An Obstacle: Practices Of Competitors In Informal Sector?” with their response recorded as a byte type in variable e30. Respondents can choose from seven categories: ”Don't Know (Spontaneous)”, ”Does Not Apply”, ”No obstacle”, ”Minor obstacle”, ”Moderate obstacle”, ”Major obstacle”, and ”Very severe obstacle”. Based on the responses to e30, a categorical variable 'informal_competition' has been created for further analysis. This variable consolidates the original categories into four broader classifications: ”no obstacle” (3), ”minor or moderate obstacle” (2), ”major obstacle” (1), and ”severe obstacle” (0).

Table 3.11: Distribution of informal competition

Informal competition	Freq.	Percent (%)	Cum. (%)
0	1,947	13.14	13.14
1	2,817	19.01	32.14
2	6,019	40.61	72.75
3	4,039	27.25	100.00
Total	**14,822**	**100.00**	

Distribution of the control variables

Moving ahead, to normalize the variables of the age of the firm and labor productivity, logarithmic transformations were applied, as represented by the equations below:

$$\text{labprod} = \ln(1 + \text{labour\_productivity})$$

$$\text{ln\_age} = \ln(1 + \text{age})$$

In a linear model, the relationship between age and the outcome (capacity utilization) is assumed to be direct and proportional. However, this is not realistic. The log transformation allows us to interpret the coefficients in terms of percentage changes. For instance, a coefficient of the log of firm age indicates the expected percentage change in the rate of capacity utilization for a 1% change in firm age. This is more meaningful in economic analyses, where relative changes are more informative than absolute changes. Descriptive summary of 'ln_age' is shown in Table 3.12 Similarly, for labour productivity, this approach is widely used in econometric analysis to address skewness and reduce the influence of outliers, ensuring a more normal distribution of the data. The addition of 1 inside the logarithm function prevents the undefined nature of the log of zero and negative values, facilitating more robust statistical modeling and interpretation. Log transformations help in stabilizing the variance and making the data more suitable for linear regression models, thereby improving the accuracy and reliability of the results (Cameron & Trivedi, 1998). Descriptive summary of both *labprod* and *labour_productivity* are shown in Table 3.13.

Table 3.12: Summary Statistics for Log of Firm Age (ln_age)

Variable	N	Mean	SD	Min	Max
Age of the firm	14,687	2.529582	0.8870982	0	5.351858

Note: N = number of observations; SD = standard deviation; ln_age = logarithmic transformation of the age of firms; size = size of the firms in terms of number of employees.

Table 3.13: Descriptive statistics for labprod and labour_productivity variables.

Variable	N	Mean	SD.	Min	Max
Log of Labour Productivity	14,823	13.44107	2.644888	0	25.85906
Labour Productivity	14,823	5.58×10^7	1.76×10^9	0	1.70×10^{11}

Note: N = number of observations; SD = standard deviation; labprod = logarithmic transformation of labour_productivity.

Regarding the variable access to finance, in the WBES, the survey question specifically asks, ”How much of an obstacle is access to finance?” Respondents can choose from six categories: ”Don’t Know (Spontaneous)”, ”Does Not Apply”, ”No obstacle”, ”Minor obstacle”, ”Moderate obstacle”, ”Major obstacle”, and ”Very severe obstacle”. This categorization is shown in Table 3.14. Based on the responses to k30, a categorical variable ’finance’ has been created for further analysis. This variable consolidates the original categories into three broader classifications: ”no obstacle” (2), ”minor or moderate obstacle” (1), and ”major or severe obstacle” (0). The distribution of the new ’finance’ variable reveals that 9.39% of respondents perceive no obstacle, 42.38% identify minor or moderate obstacles, and 48.23% report major or severe obstacles in accessing finance. This categorization, as shown in Table 3.15, facilitates a more streamlined analysis of the impact of financial access barriers on businesses, enabling researchers to draw more generalized conclusions from the data. The reclassification of the original variable into broader categories also aids in reducing complexity while preserving the essential distinctions in respondents’ perceptions of financial obstacles.

Table 3.14: Distribution of responses for the k30 variable.

How Much Of An Obstacle: Access To Finance	Freq.	Percent (%)	Cum. (%)
Don’t Know (Spontaneous)	62	0.45	0.45
Does Not Apply	56	0.40	0.85
No obstacle	3,476	25.05	25.90
Minor obstacle	2,251	16.22	42.12
Moderate obstacle	2,558	18.43	60.56
Major obstacle	3,057	22.03	82.59
Very severe obstacle	2,416	17.41	100.00
Total	13,876	100.00	

Regarding the size of the firm, the variable ’b6’ from the WBES database indicates the number of full-time employees at an establishment. This variable was utilized to create a categorical variable named ’size,’ which

Table 3.15: Distribution of responses for the ’finance’ variable.

Finance	Freq.	Percent (%)	Cum. (%)
0 (Major or severe obstacle)	1,065	9.39	9.39
1 (Minor or moderate obstacle)	4,809	42.38	51.77
2 (No obstacle)	5,473	48.23	100.00
Total	11,347	100.00	

classifies firms into small, medium, and large categories based on the number of employees. The Table 3.16 summarizes the distribution of firms based on their size, categorized by the number of employees. It includes three categories: small firms with fewer than 20 employees, medium firms with 20 to 99 employees, and large firms with 100 or more employees. There are 7,341 small firms, making up 49.52% of the total firms. There are 4,743 medium firms, accounting for 32.00% of the total. There are 2,739 large firms, representing 18.48% of the total. The table also shows cumulative percentages to indicate the overall proportion up to each category. For instance, SMEs i.e. small and medium firms together account for 81.52% of the total firms. The total number of firms in the dataset is 14,823, which constitutes 100% of the firms surveyed.

Table 3.16: Distribution of firms by size (based on number of employees)

Categories	Frequency	Percentage (%)	Cumulative (%)
Small (<20 employees)	7,341	49.52	49.52
Medium (20-99 employees)	4,743	32.00	81.52
Large (more than 100 employees)	2,739	18.48	100.00
Total	14,823	100.00	

4

Empirical Findings

4.1. The effect of aggregate VCI on CU

Table 4.1, Table 4.2, Table 4.3, and Table 4.4 present the OLS regression results for this research, illustrating the impact of value chain (VC) participation on capacity utilization. Additionally, Appendix G contains the code employed for analyzing the data.

In Table 4.1, columns 1, 2 and 3 present the results when capacity utilization (f1) is regressed on the aggregate VC participation dummy variables of DVC, FVC, and HVC, respectively, conditioning on year and industry fixed effects, and no controls. The estimated coefficient of FVC participation is positive and statistically significant at the 10% significance level, indicating that firms that participate in FVC catch up to the efficient capacity utilization levels. The estimated coefficient of HVC participation is negative and statistically significant at the 5% significance level, indicating that countries that participate both in DVC and FVC face challenges. This aligns with the literature discussed in sub-chapter 2.4.

Table 4.2 shows the results when CU (f1) is regressed on aggregate VC participation, including the control variables productive capability, informal competition, labour productivity, access to finance, age and size of the firm. Column 1 shows the estimated coefficient of DVC participation is positive and is statistically significant at the 1% significance level, indicating that firms that participate in DVC experience efficient capacity utilization levels. Column 3 shows the results when capacity utilization (f1) is regressed on HVC participation. The estimated co-

Table 4.1: Regression results of aggregate VC participation on capacity utilization, with only industry and year FE

	(1)	(2)	(3)
Capacity Utilization			
Domestic Value Chain	0.21 (0.38)		
Foreign Value Chain		1.37*** (0.49)	
Hybrid Value Chain			-0.74** (0.38)
Number of observations	14823	14823	14823
Industry FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Covariance type	Robust	Robust	Robust

Note: This table presents panel estimations of the effect of firms integrating into value chains in Africa on their capacity utilization over the 2006-2018 period. The sample includes the countries specified in Appendix D across industries specified in Appendix E. Standard errors in parentheses; ***, **, * means the estimated coefficient is statistically significant at $p < 0.01$, $p < 0.05$ and $p < 0.10$ significance level, respectively.

efficient of HVC participation is negative and statistically significant at the 5% significance level, demonstrating the challenges firms face when integrating into both DVC and FVC, as discussed in sub-chapter 2.4. Column 4 shows the combined effects of DVC, FVC, and HVC participation on CU, controlling for other factors. The results indicate that all three forms of VC participation have a positive and statistically significant impact on capacity utilization, with DVC having the strongest effect, followed by HVC and FVC. The inflated positive significant impact of the aggregate VC participation types is discussed later, following the multi-collinearity check conducted in section 4.2.

Table 4.2: Regression results of aggregate VC participation on capacity utilization, with all controls

	(1)	(2)	(3)	(4)
Capacity Utilization				
Domestic Value Chain	1.71*** (0.40)			4.65*** (1.30)
Foreign Value Chain		-0.74 (0.53)		2.84** (1.35)
Hybrid Value Chain			-0.79** (0.38)	3.11** (1.29)
Productive Capability	0.04 (0.28)	-0.03 (0.28)	-0.05 (0.28)	0.05 (0.28)
Informal Competition	0.70*** (0.19)	0.69*** (0.19)	0.67*** (0.19)	0.71*** (0.19)
Labour Productivity	0.75*** (0.07)	0.74*** (0.07)	0.73*** (0.07)	0.76*** (0.07)
Access to finance	-1.26*** (0.24)	-1.27*** (0.24)	-1.25*** (0.24)	-1.26*** (0.24)
Age of the firm	-0.18 (0.22)	-0.21 (0.21)	-0.21 (0.21)	-0.17 (0.21)
Size of the firm	2.16*** (0.27)	1.98*** (0.28)	1.86*** (0.26)	2.16*** (0.28)
Number of observations	14823	14823	14823	14823
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Covariance type	Robust	Robust	Robust	Robust

Note: This table presents panel estimations of the effect of firms integrating into value chains in Africa on their capacity utilization over the 2006-2018 period. The sample includes the countries specified in Appendix D across industries specified in Appendix E. Age and labour productivity have been log-transformed. Standard errors in parentheses; ***, **, * means the estimated coefficient is statistically significant at $p < 0.01$, $p < 0.05$ and $p < 0.10$ significance level, respectively.

Table 4.3 shows the results when capacity utilization (f1) is regressed on aggregate VC participation, including the interaction of aggregate VC participation with productive capabilities (technological capacity and production capacity). Column 1 shows the estimated coefficient of DVC participation is positive and is statistically significant at the 1% significance level, indicating that firms that participate in DVC experience efficient capacity utilization levels. Column 2 shows the estimated coefficient of FVC participation is negative and is statistically significant at all significance levels, indicating that firms that participate in FVC experience challenges. However, the interaction between FVC and technological capacity has a positive and significant estimated coefficient. This underscores the importance of technological advancements in mitigating potential downsides and challenges that firms face when integrating into FVC. The coefficient for HVC is negative and not statistically significant. This suggests that hybrid value chain integration, by itself, does not have a significant impact on capacity utilization in this sample. However, this result warrants further investigation with a larger sample with additional control variables, or an improved conceptualization of firms integrating into HVC.

Table 4.3: Regression results of aggregate VC participation and productive capabilities on capacity utilization, with all controls

	(1)	(2)	(3)
Capacity Utilization			
Domestic Value Chain	1.71*** (0.40)		
Foreign Value Chain		-1.88*** (0.72)	
Hybrid Value Chain			-0.81** (0.38)
Domestic Value Chain x Productive Capability	0.45 (0.60)		
Domestic Value Chain x Technological Capacity	-0.02 (1.36)		
Domestic Value Chain x Production Capacity	1.50 (1.05)		
Foreign Value Chain x Productive Capability		-0.49 (1.67)	
Foreign Value Chain x Technological Capacity		1.24** (0.53)	
Foreign Value Chain x Production Capacity		-2.29 (1.22)	
Hybrid Value Chain x Productive Capability			0.28 (0.53)
Hybrid Value Chain x Technological Capacity			0.39 (1.22)
Hybrid Value Chain x Production Capacity			0.56 (1.01)
Productive Capability	-0.09 (0.32)	0.04 (0.92)	-0.17 (0.35)
Technological Capacity	-0.14 (0.72)	-0.44* (0.27)	-0.48 (0.79)
Production Capacity	-0.05 (0.7)	0.86 (0.65)	0.14 (0.73)
Labour Productivity	0.74*** (0.07)	0.73*** (0.07)	0.72*** (0.07)
Access to finance	-1.44*** (0.23)	-1.39*** (0.24)	-1.43*** (0.23)
Age of the firm	-0.20 (0.21)	-0.21 (0.21)	-0.23 (0.21)
Size of the firm	2.24*** (0.27)	1.98*** (0.26)	1.95*** (0.26)
Number of observations	14823	14823	14823
Industry FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Covariance type	Robust	Robust	Robust

Note: This table presents panel estimations of the effect of firms integrating into value chains in Africa on their capacity utilization over the 2006-2018 period. The sample includes the countries specified in Appendix D across industries specified in Appendix E. Age and labour productivity have been log-transformed. Standard errors in parentheses; ***, **, * means the estimated coefficient is statistically significant at $p < 0.01$, $p < 0.05$ and $p < 0.10$ significance level, respectively.

Table 4.4 presents the outcomes of regressing capacity utilization (f1) on aggregate venture capital (VC) participation, incorporating the interaction term between aggregate VC participation and informal competition. The findings reveal that the interaction term between aggregate VC participation and informal competition is statistically insignificant across all specifications. This observation raises concerns and underscores the necessity for a more nuanced conceptualization of informal competition encountered by firms in Africa. Future research should therefore delve deeper into the dynamics of informal competition to address this gap. Nonetheless, informal competition, when included as a control variable, exerts a positive and significant effect on capacity utilization within this model, corroborating the literature discussed in sub-chapter 2.5.2. The results demonstrate a direct relationship between informal competition and capacity utilization (CU). Firms not encountering informal competition ("no obstacle") exhibit higher levels of capacity utilization, which is consistent with the findings of Avenyo et al. (2020) and Goel et al. (2021).

Table 4.4: Regression results of aggregate VC participation and informal competition on capacity utilization, with all controls

	(1)	(2)	(3)
Capacity Utilization			
Domestic Value Chain	1.92** (0.79)		
Foreign Value Chain		-1.74* (1.10)	
Hybrid Value Chain			-1.19 (0.78)
Domestic Value Chain x Informal Competition	-0.12 (0.38)		
Foreign Value Chain x Informal Competition		0.51 (0.50)	
Hybrid Value Chain x Informal Competition			0.21 (0.38)
Informal Competition	0.74*** (0.25)	0.60*** (0.21)	0.58** (0.24)
Labour Productivity	0.75*** (0.07)	0.74*** (0.07)	0.73*** (0.07)
Access to finance	-1.26*** (0.24)	-1.26*** (0.24)	-1.26*** (0.24)
Age of the firm	-0.18 (0.21)	-0.21 (0.21)	-0.21 (0.21)
Size of the firm	2.16*** (0.27)	1.98*** (0.27)	1.85*** (0.26)
Number of observations	14823	14823	14823
Industry FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Covariance type	Robust	Robust	Robust

Note: This table presents panel estimations of the effect of firms integrating into value chains in Africa on their capacity utilization over the 2006-2018 period. The sample includes the countries specified in Appendix D across industries specified in Appendix E. Age and labour productivity have been log-transformed. Standard errors in parentheses; ***, **, * means the estimated coefficient is statistically significant at $p < 0.01$, $p < 0.05$ and $p < 0.10$ significance level, respectively.

Regarding the control variables, it is observed that the estimated coefficient of the size of the firm is consistently positive across all tables and columns, indicating the important role of the size of firm in overall firm performance (Higón & Bournakis, 2024). This is in line with the argumentation presented in sub-chapter 2.5.4. Similarly, the coefficient of labor productivity is also significantly positive in all columns. This suggests that higher labor productivity is associated with better utilization of existing production capacity and overall firm performance (F. Liu et al., 2020). This is in line with the argumentation presented in sub-chapter 2.5.6 and is also consistent with the findings of Deshmukh and Pyne (2013), who demonstrated a positive relationship between firm size and labor productivity. However, contrary to the prevailing literature reviewed in sub-chapter 2.5.5, the current study found a negative correlation between access to finance and CU, which diverges from the positive relationships previously reported by researchers such as Bokpin et al. (2017) and Brixiová et al. (2020). This further suggests potential for future research, particularly focusing on the return on long-term investments rather than immediate capacity optimization.

Overall, the results presented in the tables indicate that VC participation by firms is a strong predictor of capacity utilization rates. This finding contributes to the broader literature on VCI by establishing a direct relationship between VC participation and firm performance. It also provides motivation for researchers in the field of value chain integration to further explore this relationship, as discussed in detail in the next chapter (see 5.5).

4.2. Sensitivity Analysis

VIF Analysis

In the last section (4.1), the regression results were examined to understand the impact of value chain integration on capacity utilization. However, to ensure the robustness and reliability of these findings, it is crucial to conduct a Variance Inflation Factor (VIF) analysis, a component of sensitivity analysis. VIF analysis specifically helps in detecting multi-collinearity among independent variables, which can inflate the variance of regression coefficients, leading to unreliable estimates and misleading conclusions. In this section, VIF analysis for the regression models is presented in columns 1, 2, 3, and 4 of Table 4.2, to evaluate the presence and extent of multi-collinearity in these models.

VIF analysis quantifies how much the variance of a regression coefficient is inflated due to the correlation between the independent variables. A VIF value greater than 10 typically indicates significant multi-collinearity, while values below this threshold suggest that multi-collinearity is not a major concern. In the models presented in Table 4.5 (Column 1), Table 4.6 (Column 2), and Table 4.7 (Column 3), where capacity utilization was regressed on Domestic Value Chain (DVC), Foreign Value Chain (FVC), and Hybrid Value Chain (HVC) participation respectively, along with control variables, the VIF values were consistently low across all variables.

As shown in Table 4.5, the VIF values ranged from 1.09 to 1.31, with the highest VIF observed for firm size. The low VIF values indicate minimal multi-collinearity, suggesting that the coefficients for DVC and the control variables can be reliably interpreted.

Similarly, in Table 4.6, the VIF values ranged from 1.09 to 1.37, with firm size again showing the highest VIF. The VIF for FVC was 1.24, indicating that multi-collinearity is not a concern for this model as well.

The VIF values in Table 4.7 were also low, ranging from 1.04 to 1.26. The VIF for HVC was particularly low

Table 4.5: VIF analysis for Column 1 in Table 4.2

Variable	VIF	1/VIF
Domestic Value Chain	1.21	0.826806
Productive Capability	1.15	0.866285
Informal Competition	1.09	0.914334
Labor Productivity	1.27	0.789016
Access to Finance	1.16	0.861690
Firm Age	1.17	0.852534
Firm Size	1.31	0.762573

Table 4.6: VIF Analysis for Column 2 in Table 4.2

Variable	VIF	1/VIF
Foreign Value Chain	1.24	0.805413
Productive Capability	1.15	0.866918
Informal Competition	1.09	0.913501
Labor Productivity	1.27	0.789450
Access to Finance	1.16	0.861523
Firm Age	1.17	0.852863
Firm Size	1.37	0.730692

at 1.04, further confirming that multi-collinearity is not an issue in this model. These results suggest that the regression models in columns 1, 2, and 3 do not suffer from significant multi-collinearity, making the estimated coefficients for DVC, FVC, and HVC, as well as the control variables, robust and reliable.

Table 4.7: VIF Analysis for Column 3 in Table 4.2

Variable	VIF	1/VIF
Hybrid Value Chain	1.04	0.963371
Productive Capability	1.15	0.872654
Informal Competition	1.09	0.914478
Labor Productivity	1.26	0.791767
Access to Finance	1.16	0.861593
Firm Age	1.17	0.854125
Firm Size	1.22	0.821010

The VIF analysis for the regression model in Column 4, where all three forms of value chain participation (DVC, FVC, and HVC) were included together, presents a contrasting picture. As shown in Table 4.8, the VIF values for DVC, FVC, and HVC were 12.38, 7.94, and 11.97, respectively. The VIF for DVC and HVC exceeds the threshold of 10, indicating significant multi-collinearity between these variables. This suggests that the independent effects of DVC and HVC on capacity utilization may be difficult to isolate due to their high correlation, potentially leading to inflated standard errors and unreliable coefficient estimates. This was also expected from the correlation matrix discussed earlier in Table 3.6. This confirms that the conceptualization of DVC and HVC is coherent, given that HVC is defined as a combination of FVC and DVC integration. Moreover, the reason why multi-collinearity is not a significant issue between FVC and HVC is that, in developing economies like those in Africa, relatively few firms are integrated into FVC. This observation also aligns with the literature reviewed in chapter 2.

Table 4.8: VIF Analysis for Column 4 in Table 4.2

Variable	**VIF**	**1/VIF**
Domestic Value Chain	12.38	0.080749
Foreign Value Chain	7.94	0.125881
Hybrid Value Chain	11.97	0.083519
Productive Capability	1.16	0.862849
Informal Competition	1.10	0.912490
Labor Productivity	1.27	0.786887
Access to Finance	1.16	0.861495
Firm Age	1.17	0.851823
Firm Size	1.41	0.708343

5

Discussion and Conclusion

5.1. Discussion of main results

This research identifies a significant relationship between VCI and CU at the firm level. The regression analysis indicates that integration into DVC and FVC has a statistically significant positive impact on CU. Specifically, firms integrated into DVC experience an average increase of 1.7 units in CU compared to those not integrated. This implies that localizing certain aspects of the value chain, such as procurement, production, and distribution, can enhance production efficiency and resource use within firms. This aligns with findings in the literature discussed in section 2.4, indicating that proximity to suppliers and customers within domestic markets can reduce logistical complexities and transportation costs, leading to better CU (Gereffi et al., 2005; Porter, 1985). Conversely, firms integrated into FVC exhibit an average decrease in CU by 1.88 units (see Table 4.3). This decrease can be attributed to several factors associated with global operations such as increased coordination costs (Gereffi et al., 2005), cultural and regulatory differences (Rugman & Verbeke, 2001), extended lead times (Christopher, 2016), high switching costs and low fragmentation costs (Beverelli et al., 2019), etc. However, this negative effect is mitigated in firms possessing technological capabilities, such as R&D and innovation, where an increase of +1.24 units in CU is observed. This suggests that technological advancement plays a crucial role in overcoming the challenges posed by FVC integration. Hence, technological tools and innovations streamline coordination and communication across global supply chains, which reduces inefficiencies and errors. R&D and innovation enable firms to develop more flexible and responsive production processes, which can better handle the variability and uncertainty in international markets. Advanced technologies, such as automation and data analytics, allow for more efficient resource management, reducing waste and improving CU. Continuous innovation fosters the development of new products and processes that can adapt to diverse market demands and regulatory requirements, thus enhancing overall operational efficiency (Porter, 1985). Detailed hypothetical examples of firms integrated and not integrated into DVC and FVC, based on the results from Table 4.3, are elucidated in section 5.3. The impact of DVC and FVC on CU appears modest, yet the expectation of significant negative results for firms integrated into a HVC was unforeseen. Therefore, it is essential to examine the complexities firms encounter when integrating into both domestic and foreign VC.

Regarding informal competition, the findings of this study indicate a positive relationship between high CU rates and informal competition variable. This analysis is based on responses from business leaders of formal firms, who report facing ”no obstacle” from informal competition. This observation can be interpreted in two distinct ways. First, it may indicate an actual absence of informal competition within the industry. In such cases, formal firms operate in a market environment free from the influence of unregulated or informal players. This lack of competition could be due to high barriers to entry, stringent regulatory frameworks, or the unique characteristics of the industry that deter informal participation. Second, the perception of ”no obstacle” may exist even when informal competition is present. This can occur in scenarios where business leaders of formal firms have developed effective strategies to overcome the challenges posed by informal competitors. Such strategies may include leveraging superior resources, brand reputation, regulatory compliance, and technological capabilities to maintain a competitive edge. Additionally, in niche industries, the presence of informal competition can actually be beneficial to formal firms. Informal competitors can contribute to market expansion by introducing products or services to new customer segments, thereby increasing consumer awareness and demand for the product category. In these cases, formal firms benefit from the educational role that informal competitors play in familiarizing consumers with niche products or services. This increased awareness can drive demand for the higher-quality offerings of formal firms, allowing them to capitalize on their established market position. Thus, the observed positive relationship between high CU rates and firms that report facing ”no obstacle” from informal competition reflects a complex interaction of market dynamics where formal firms either do not encounter informal competitors or are able to effectively navigate and even benefit from their presence.

Several areas of concern arise in this research. Firstly, there is a significant negative impact of firms integrating into HVC. Secondly, while FVC integration shows a positive significant relationship with CU without controls, it exhibits a negative relationship when controls are included. Lastly, the interaction of aggregate VC participation and informal competition yields insignificant results.

Integrating into both domestic and foreign VC presents a multitude of complexities for firms, encompassing logistical, regulatory, market-related, technological, and geopolitical challenges. In the regression results, HVC shows negative significant direct effects on CU, as shown in Table 4.1, Table 4.2, and Table 4.3. This is contrary to the initial hypothesis of this research, as discussed in section 2.4. This finding suggests that switching from DVC to FVC or GVC is challenging for firms, as supported by Beverelli et al. (2016, 2019).

The shift from a positive to a negative relationship between FVC integration and CU after accounting for control variables such as labor productivity, age, size, and finance is intriguing. To argue, older and larger firms might have already optimized their CU, deriving fewer benefits from FVC integration. Firms with financial constraints might struggle to invest in necessary technology, training, or infrastructure to leverage FVC integration effectively, leading to reduced CU. High labor productivity might indicate that firms are already operating efficiently, leaving little room for additional gains from FVC integration. Finally, for firms already performing well, further integration might lead to market saturation, where additional capacity from integration is not matched by demand, reducing overall CU.

Additionally, the interaction between aggregate VC participation and informal competition has an insignificant impact on the CU rates of firms. This points to the need for a more refined conceptualization of the informal competition variable. Inspired by Goel et al. (2021) and Rahmouni (2021), this research constructed the informal competition indicator. However, Avenyo et al. (2020) constructed two indicators of informal competition—one region-specific (local) and the other industry-specific, which might have provided better insights into informal competition across firms in Africa, for this research. Also, diversifying data sources beyond the WBES could also help overcome data limitations and provide a more comprehensive understanding of informal competition.

To overcome these challenges, a more nuanced approach involving a detailed analysis of Porter's Value Chain model could have been beneficial in identifying inefficiencies within firms' primary and support activities that negatively impact CU. By examining specific industries and countries rather than focusing broadly on the entire continent of Africa, the research could have provided more precise insights into the unique regulatory, market, and geopolitical challenges faced by firms, in a specific region. This focused approach might have revealed why FVC integration shows varying effects on CU, offering tailored strategies for different contexts. Additionally, a deeper exploration of supply chain management operations, including outbound and inbound logistics, could have uncovered inefficiencies in sender-receiver links and risk management practices, which were not sufficiently addressed. By refining the conceptualization of informal competition and diversifying data sources, the research could have provided a more comprehensive understanding of how these factors influence VCI outcomes. This further highlights the need for a more targeted and context-specific analysis to address the complexities and improve firm performance in the face of HVC integration challenges.

Regarding other control variables, specifically, labor productivity is positively associated with CU, suggesting that firms with higher productivity tend to utilize their capacity more effectively. Conversely, the negative impact of finance was counter-intuitive, potentially indicating a focus on long-term investments over immediate

CU. Comparing these regression results to the complexities of integrating into value chains, several parallels can be drawn. Firstly, firms must coordinate supply chains across diverse geographies, maintaining timely delivery and quality amidst varying infrastructure standards and potential disruptions (ADBI, 2020; Lim & Kimura, 2020). This is related to the need for high labor productivity and efficient resource management highlighted in the regression results. Secondly, regulatory hurdles involve navigating differing local laws, trade policies, and compliance standards, requiring adaptability and thorough knowledge of international agreements (Gao et al., 2023). This resonates with the significant year and industry effects observed in the regression analysis (see Appendix H). The negative and significant coefficients for certain years (e.g., 2011 and 2015) and industries (e.g., Transport) suggest that regulatory and economic conditions critically impact CU. Firms must be adept at managing these external factors to maintain high utilization rates. Thirdly, market-related issues demand an understanding of local consumer preferences and competitive landscapes, with additional complications from fluctuating foreign exchange rates (Gao et al., 2023). This also relates to the significant positive effect of informal competition (see Table 4.2). Last but not the least, firms must invest in advanced manufacturing technologies and skill development, a significant barrier for smaller enterprises (ADBI, 2020; Arudchelvan & Wignaraja, 2020). Finally, geopolitical risks, including political instability and protectionist policies, further complicate operations by potentially disrupting supply chains and market access (Gao et al., 2023). This is indirectly supported by the regression's findings on firm size, where larger firms, which are likely better equipped to manage such risks, show higher CU. Addressing these challenges necessitates robust risk management strategies, technological investments, and informed regulatory compliance, alongside strategic partnerships and diversification of supply sources.

5.2. Theoretical contributions

This thesis has made significant contributions to the existing literature in several key areas. New indicators have been developed to provide a more nuanced conceptualization of how firms engage within domestic and foreign VC, using trade metrics. Prior metrics for analyzing these interactions were used as a motivation. The introduction of these novel indicators enables more precise measurement and analysis of the dynamics between firms integrated in domestic, hybrid and foreign VC, which is crucial for both academic research and practical applications. This advancement allows for better policy formulation and strategic decision-making within firms.

Adding on to it, significant gap in the literature has been addressed by introducing a category for firms integrated into both domestic and foreign VC. The concept of HVC recognizes the complexity and dual nature of some firms' operations, providing a more comprehensive framework for understanding how firms navigate and benefit from both domestic and international markets. This new category enriches the theoretical landscape and offers a more realistic portrayal of the operational strategies of modern firms.

Moreover, the empirical analysis conducted has demonstrated that firms encounter substantial challenges when integrating into FVC. However, it has also been shown that investing in technological capacities like R&D and innovation, can mitigate these challenges. Enhancing technology improves the integration process, leading to better CU and overall firm performance. This finding not only validates the importance of technological investment but also offers actionable insights for firms looking to enhance their competitive edge in global markets. The results provide a clear link between technological advancement and operational success in the context of GVC, thus offering a practical roadmap for firms and policymakers.

5.3. Hypothetical firms derived from regression findings

Impact of DVC integration on CU

The regression results reveal that DVC integration has a statistically significant positive effect on capacity utilization. Specifically, firms with DVC integration exhibit an increase in capacity utilization by 1.71 units on average, compared to firms without DVC integration.

To illustrate the effect of DVC integration, consider the following example involving two hypothetical firms, Firm A and Firm B:

- **Firm A**: This firm is not integrated into the domestic value chain, hence DVC = 0.
- **Firm B**: This firm is integrated into the domestic value chain, hence DVC = 1.

According to the regression results, the baseline capacity utilization for firms without DVC integration (i.e., Firm A) is represented by the intercept term, denoted as β_0. Thus, the capacity utilization for Firm A can be expressed as:

$$\text{Capacity Utilization}_{\text{Firm A}} = \beta_0$$

For Firm B, which has DVC integration (DVC = 1), the capacity utilization is influenced by the presence of DVC integration. The capacity utilization for Firm B is given by:

$$\text{Capacity Utilization}_{\text{Firm B}} = \beta_0 + 1.71$$

This indicates that Firm B, due to its integration into the domestic value chain, has an expected increase of 1.736901 units in capacity utilization compared to Firm A.

To provide a concrete numerical example, assume that the baseline capacity utilization (β_0) is 50 units. Therefore:

- **Firm A (DVC = 0)**: Capacity utilization is 50 units.
- **Firm B (DVC = 1)**: Capacity utilization is $50 + 1.71 = 51.71$ units.

In summary, Firm B, which is integrated into the domestic value chain, has a higher capacity utilization rate of 51.71 units, reflecting an increase of 1.71 units compared to Firm A, which is not integrated into the domestic value chain. This empirical finding underscores the significant positive impact of domestic value chain integration on enhancing the efficiency and operational capacity of firms.

Impact of FVC and Technological Capacity on CU

The analysis explores the interaction effect between foreign value chain integration (FVC) and technological capacity (tech) on capacity utilization. The regression results indicate a significant positive interaction term, suggesting that the negative impact of FVC integration on capacity utilization can be mitigated by higher technological capacity. To illustrate this interaction effect, consider the following example involving three hypothetical firms, Firm G, Firm H, and Firm I, each with different levels of FVC integration and technological capacity.

- **Firm G**: This firm is not integrated into foreign value chain integration (FVC = 0).
- **Firm H**: This firm is integrated in foreign value chain (FVC = 1) and a low level of technological capacity, hence facing challenges.
- **Firm I**: This firm is integrated in foreign value chain (FVC = 1) and a high level of technological capacity, hence achieving good capacity utilization.

According to the regression results, the baseline capacity utilization for firms without FVC integration and with average technological capacity (tech) is represented by the intercept term, denoted as β_0. The impact of FVC integration and technological capacity on capacity utilization is given by:

$$\text{Capacity Utilization} = \beta_0 + \beta_1 \cdot \text{FVC} + \beta_2 \cdot \text{tech} + \beta_3 \cdot (\text{FVC} \times \text{tech}) + \text{other terms}$$

Here, β_1 is the coefficient for FVC, β_2 is the coefficient for technological capacity, and β_3 is the coefficient for the interaction term (FVC × tech). The specific coefficients are as follows:

- $\beta_1 = -1.885961$
- $\beta_2 = -0.4402772$
- $\beta_3 = 1.245865$

Examples

Firm G (FVC = 0):

- This firm does not have FVC integration.

- Its capacity utilization is simply the baseline value (β_0).

$$\text{Capacity Utilization}_{\text{Firm G}} = \beta_0$$

Assuming the baseline capacity utilization (β_0) is 50 units:

$$\text{Capacity Utilization}_{\text{Firm G}} = 50$$

Firm H (FVC = 1, low tech):

- This firm has FVC integration but low technological capacity.
- Let's assume low tech equals 5 units of technological capacity.

$$\text{Capacity Utilization}_{\text{Firm H}} = \beta_0 - 1.885961 - 0.4402772 \cdot 5 + 1.245865 \cdot (1 \times 5)$$

Substituting the values:

$$\text{Capacity Utilization}_{\text{Firm H}} = 50 - 1.885961 - 2.201386 + 6.229325 = 52.141978$$

Firm I (FVC = 1, high tech):

- This firm has FVC integration and high technological capacity.
- Let's assume high tech equals 15 units of technological capacity.

$$\text{Capacity Utilization}_{\text{Firm I}} = \beta_0 - 1.885961 - 0.4402772 \cdot 15 + 1.245865 \cdot (1 \times 15)$$

Substituting the values:

$$\text{Capacity Utilization}_{\text{Firm I}} = 50 - 1.885961 - 6.604158 + 18.687975 = 60.197856$$

Summary

- **Firm G (FVC = 0)** has a capacity utilization rate of 50 units, representing the baseline level without foreign value chain integration.
- **Firm H (FVC = 1, low tech)**, facing challenges due to low technological capacity, has a capacity utilization rate of 52.141978 units. This reflects the negative impact of FVC integration, partially mitigated by the low level of technological capacity.

- **Firm I (FVC = 1, high tech)**, with high technological capacity, achieves a higher capacity utilization rate of 60.197856 units. This demonstrates the positive interaction effect of high technological capacity, which significantly offsets the negative impact of FVC integration.

These empirical findings underscore the critical role of technological capacity in enhancing the capacity utilization of firms engaged in foreign value chains, highlighting how higher technological capacity can mitigate the challenges associated with FVC integration.

5.4. Practical implications

Strategy recommendations for firms

To advise firms in emerging markets, like Africa, on integrating into value chains and enhancing their overall performance, a comprehensive strategy framework can be developed by synthesizing insights from the existing literature. This framework can be structured around three key dimensions: innovation strategies, trade policies, and firm-level strategies. Firstly, drawing motivation from FVC results, discussed in chapter 4, firms should prioritize product innovation and R&D to increase their likelihood of exporting (Bich et al., 2022). This approach enables firms to create unique products capable of competing in international markets. Additionally, focusing on process improvements enhances the likelihood of selling to foreign direct investment (FDI) buyers by improving operational efficiency and meeting the quality standards required by international partners (Bich et al., 2022). Additionally, the quality of the local business environment plays a crucial role in the effectiveness of innovation strategies. Enhancements in local infrastructure, regulatory frameworks, and access to finance can significantly amplify the positive effects of innovation on VCI, particularly for SMEs. Secondly, firms must be prepared to adapt to changing trade policies, such as restrictions and new trade agreements. This adaptability involves altering supply and demand locations and switching supply-chain partners to mitigate the impact of trade disruptions (Gereffi et al., 2021). Furthermore, firms can leverage the shifting geographies associated with new trade rules to upgrade their value chain activities. This includes investing in new technologies and capabilities that align with the evolving trade landscape. Thirdly, strategic decision-making regarding corporate boundaries is essential for firms. Decisions about what to produce in-house and what to outsource should be informed by the selection of trading partners that provide complementary strengths and capabilities (Sako & Zylberberg, 2018). Refer to Appendix I for relevant details on Apple's strategy. Utilizing the "profiting from innovation" framework, firms should focus on capturing the value they create by owning or accessing specialized complementary assets, such as intellectual property, advanced manufacturing technologies, and skilled labor (Sako & Zylberberg, 2018). Additionally, firms should proactively influence the institutions that govern economic transactions in the value chain. This can be achieved through policy advocacy, participation in industry associations, and collaboration with government agencies to shape favorable regulatory environments. By adopting this structured approach, firms in emerging markets can enhance their integration into global value chains and improve their overall performance. Figure 5.1 visualizes the prioritization of strategic tasks for firms in emerging markets. It categorizes tasks by their impact and the effort required, guiding firms to focus on high-impact, low-effort ”Quick Wins” for immediate improvements, while planning for ”Major Projects” that demand more resources but offer significant long-term benefits.

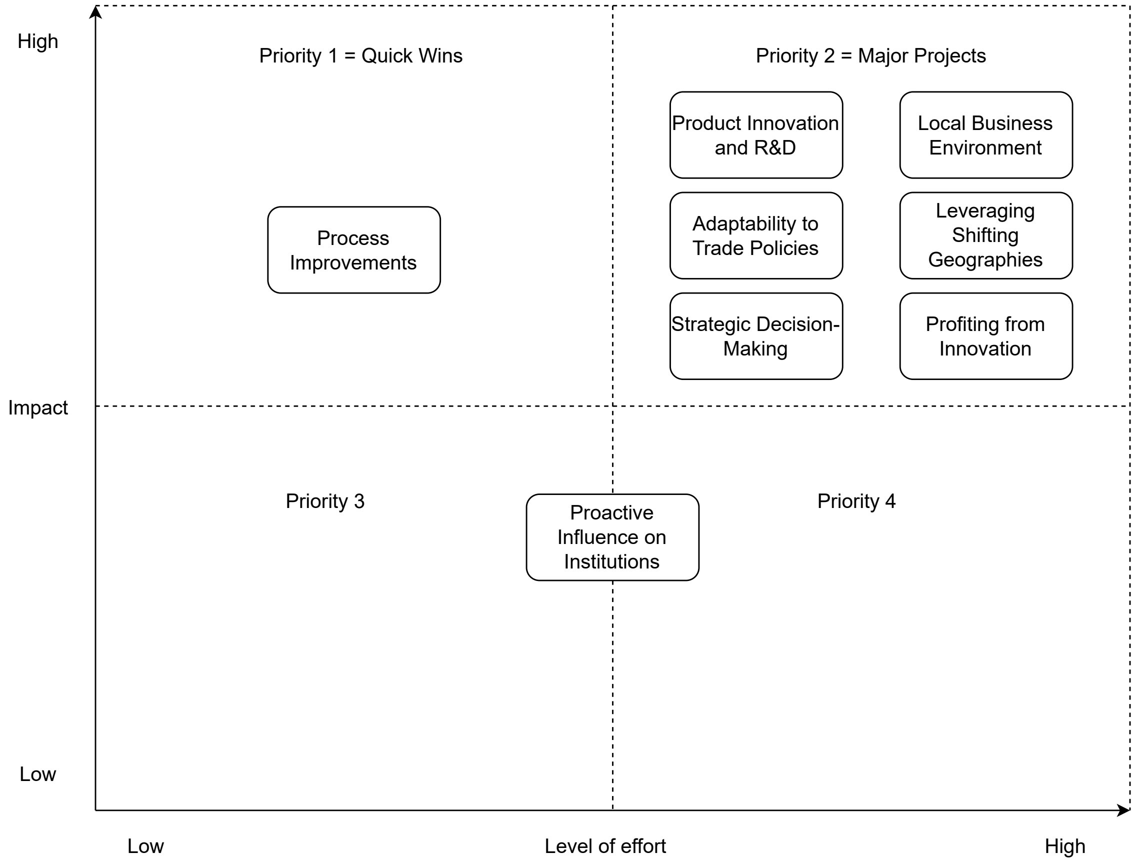

Figure 5.1: Prioritization of strategic tasks for firms, using impact-effort matrix framework *Source: Author's illustration*

Drawing inspiration from the findings of this research and the literature reviewed in this section, firms in emerging markets, such as those in Africa, should undertake a series of strategic implementation steps (see Figure 5.2) to effectively integrate into value chains and enhance CU and overall performance:

- **Assess Current Capabilities:** Begin by conducting a comprehensive assessment of the firm's existing innovation capabilities, supply chain structure, and market positioning (Grant, 1991). This evaluation will identify strengths and areas needing improvement, providing a baseline for further action.
- **Develop an Innovation Roadmap:** Create a detailed roadmap that outlines plans for product innovation, research and development (R&D), and process improvements (Amati et al., 2020). This roadmap should be tailored to leverage the firm's unique strengths and capitalize on market opportunities.

- **Engage with Policymakers:** Actively engage with local and international policymakers to remain informed about relevant trade policies and to advocate for measures that support the firm's strategic goals. This engagement is crucial for navigating the complex regulatory environment of global trade.
- **Build Strategic Partnerships:** Establish strategic alliances with key partners within the value chain. These partnerships can enhance the firm's capabilities, provide access to new markets, and facilitate the sharing of knowledge and resources.
- **Invest in Technology and Skills:** Allocate resources strategically to acquire advanced technologies and develop the skills necessary for competing in global markets. This investment is essential for maintaining a competitive edge and fostering innovation.
- **Monitor and Adapt:** Continuously monitor the global trade environment to stay aware of new challenges and opportunities. Be prepared to adapt strategies as needed to respond to evolving market conditions and regulatory changes.

By following these steps, firms in emerging markets can effectively integrate into value chains and significantly improve their overall performance.

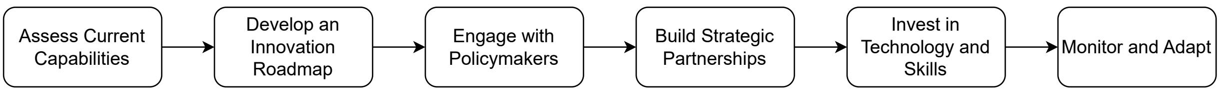

Figure 5.2: Series of strategic implementation steps for firms to integrate into VC *Source: Author's illustration*

Recommendations for policymakers

This research demonstrates a significant enhancement in CU for firms integrating into DVC. For firms entering FVC, investments in innovation and R&D, indicative of their technological capacities, are crucial in overcoming integration challenges. Foreign Direct Investments (FDIs) enhance technological capacities, as extensively discussed in the literature (Bodman & Le, 2013; Iqbal et al., 2016; Kumar & Marg, 2000; Loukil, 2016; Lwesya, 2022; Sultana & Turkina, 2020). Adding on to it, Africa seeks to accelerate the establishment of African Union Financial Institutions[1] (Union, 2023). In July 2022, the African Union Commission and the African Securities Exchanges Association (ASEA) signed a Memorandum of Understanding (MoU). This collaboration seeks to expand the African Exchanges Linkage Project (AELP) and ultimately transform it into a Pan African Stock Exchange (PASE). Officially launched in 2022 with nine participating securities exchanges, the AELP will see the African Union Commission actively encouraging more countries to join, paving the way for the establishment of PASE. Therefore, the commencement of the Pan African Stock Exchange (PASE) would encourage cross-border

[1]The African Union (AU) has established several financial institutions aimed at fostering economic integration. Key financial institutions under the African Union are African Central Bank (ACB), African Investment Bank (AIB), and African Monetary Fund (AMF).

equity trading, hence inviting global investors (FDIs), not just those from within Africa, thus enabling MSMEs to integrate into value chains.

Cross-border equity trading significantly influences firms' decisions to integrate into value chains by providing enhanced access to capital, shaping market conditions and organizational choices, promoting economic upgrading and competitiveness, and enabling strategic positioning and flexibility (H. Liu et al., 2024). Firstly, cross-border equity trading offers firms greater access to international capital markets (Claessens & Schmukler, 2007). This is crucial for financing the integration of different production stages. Access to a broader pool of investors lowers capital costs and provides necessary funds for vertical integration or forming more extensive value chains (Acemoglu et al., 2009). Secondly, firms are more likely to vertically integrate when they can leverage cross-border equity trading to raise capital efficiently. Integration decisions depend on the elasticity of demand for their products and the substitutability of their inputs. In markets where demand is elastic, firms tend to integrate upstream stages to secure critical inputs and control production costs, using the capital raised through cross-border equity trading to finance these investments (Alfaro et al., 2019). Additionally, participation in global and regional value chains, facilitated by cross-border equity trading, allows firms to upgrade economically (Lwesya, 2022). This integration helps firms enhance competitiveness by improving productivity, gaining access to new technologies, and meeting international market standards, hence enhance CU. Such upgrading is crucial for firms in developing regions like the East African Community (EAC), where access to finance, infrastructure, and skilled labor are significant barriers (Lwesya, 2022). Moreover, cross-border equity trading enables firms to be more flexible and responsive to market changes. They can strategically position themselves within global value chains to optimize production processes and reduce costs. For example, firms might keep high-value-added activities in-house while outsourcing less critical stages to take advantage of cost efficiencies and expertise available in other countries (see Appendix I. Overall, cross-border equity trading positively affects firms' decisions to integrate into value chains by providing the financial resources needed for investment, enabling strategic flexibility, and promoting economic upgrading and competitiveness. This integration helps firms to better manage their production processes, improve efficiencies, and enhance their global market presence. In conclusion, this research recommends that the African Union continue its efforts towards establishing the Pan African Stock Exchange (PASE).

5.5. Limitations and future research

One of the primary limitations of this research is the negative significant results obtained from the analysis of HVC. Although this study aims to demonstrate that firms use domestic VCI as a preliminary step towards integrating into FVC, the data analysis did not yield appropriate results to substantiate this claim. This raises questions about the conceptualization of HVC within the study. Future research should focus on refining the conceptual framework of HVC and investigate the factors contributing to the negative significance of the results. A more nuanced understanding and clearer definition of what constitutes a hybrid value chain could lead to more precise and meaningful outcomes in subsequent studies.

Secondly, the data sourced from the World Bank Enterprise Survey (WBES) presents another notable limitation, particularly in the categorization of export and import variables. While the survey categorizes exports into direct and indirect categories, it does not make the same distinction for imports. Consequently, the import variable used in this research is an amalgamation of both direct and indirect imports. This lack of distinction potentially obscures important differences in firm behavior and performance related to direct versus indirect imports, leading to a less precise analysis. Future research would benefit from data sources that distinctly categorize imports, enabling a more detailed and accurate examination of the impacts of direct and indirect imports on VCI.

Thirdly, this thesis utilizes publications on VCI from both emerging and developed economies to support its argumentation. However, this approach introduces a significant limitation due to the contextual differences between regions. For example, observations and findings from VCI and CU literature in China may not be applicable to the context of Africa completely, despite both being emerging markets. Similarly, insights drawn from literature based on firms in USA might not hold in regions with different regulatory and economic conditions, such as Africa, particularly concerning labor market regulation. The reliance on a broad spectrum of global literature can obscure these contextual nuances, potentially weakening the applicability of the arguments presented. Future studies should consider a more context-specific approach, analyzing VCI within the unique economic, social, and regulatory environments of the regions under study, to provide more relevant and accurate insights.

Last but not least, limitations of the econometric examination also exist. The choice of control variables used in the linear regression may not be entirely significant and might not capture all relevant factors influencing capacity utilization. Different researchers might choose different variables, leading to variations in results. Additionally, as discussed in section 1.4, constructing value chain integration dummies requires comprehensive data on imports, exports, and specific value-added metrics (such as customer satisfaction, contract renewal rates, NPS, churn rate, and economic impact). However, the WBES database only provides sourcing and sales data. The quality and accuracy of the data used in the regression model can significantly impact the results. The DEA analysis[2] and the comprehensiveness of the linear regression heavily depend on the availability and quality of data. The WBES data was collected between 2006 and 2018 and does not extend to 2024, meaning the data is partially outdated and does not account for the impact of COVID-19, which could lead to inaccuracies in the assessment and results. It is essential to ensure that data sources are reliable and that any potential errors or inconsistencies are addressed. Additionally, missing data, such as the impact of COVID-19 on firms in Africa, can affect the completeness of the

[2]Data Envelopment Analysis (DEA) is a non-parametric method used in operations research and economics to evaluate the efficiency of decision-making units (DMUs), such as firms, public sector agencies, etc. If the operational efficiency of firms in Africa is to evaluated with respect to their CU, DEA could be used to compare how efficiently different firms convert their resources (e.g., labor, capital, raw materials) into outputs (e.g., production levels, revenue). DEA would help identify which firms are operating on the efficiency frontier and which are lagging, providing insights into best practices and areas for improvement.

analysis. Regarding model specification, the choice of variables and the functional form of the regression model can impact the results. Sensitivity analyses with different model specifications should be conducted to test the robustness of the findings. While VIF is a specific diagnostic tool for multicollinearity, its role in identifying and quantifying the sensitivity of regression coefficients to correlated predictors makes it a form of sensitivity analysis. However, VIF does not indicate how sensitive the results are to the inclusion or exclusion of particular variables. VIF also does not address how sensitive the model is to changes in the data itself (e.g., outliers or changes in sample size) or assess the impact of assumptions (such as linearity, normality of errors, etc.) on the model's outcomes. Additional methods for sensitivity analysis that could be conducted include subsample analysis, outlier analysis, and difference-in-differences analysis. These analyses are discussed in the context of this research in Appendix J. Returning to the temporal and spatial variation, the model covers a specific time period (2006-2018) and focuses on 43 out of 54 countries in Africa. The results may not generalize to firms in the other 11 countries. Moreover, omitted variables that are not included in the regression model can lead to omitted variable bias. Factors not accounted for in the model, such as certification, but which are relevant to capacity utilization efficiency, could lead to biased coefficient estimates. The model may not fully capture cultural, historical, or contextual factors that influence capacity utilization and value chain integration. Qualitative research or case studies may be necessary to provide a more comprehensive understanding. While the model may imply causal relationships, it's essential to be aware of the possibility of reverse causality, where effects can flow in both directions. For example, firms with better capacity utilization levels may integrate into foreign value chains more easily. Additionally, adding interaction terms and multiple variables can increase the complexity of the model. These limitations highlight the importance of careful data collection, model specification, and interpretation of regression results. Addressing these limitations and conducting sensitivity analyses (see Appendix J) can enhance the reliability and validity of the findings.

Detailed value chain analysis and characteristics in supply chain

The research presented in this thesis lays a solid foundation for future explorations into value chain analysis within supply chains. Building on this foundation, future studies could delve into how different support activities and primary activities interact across various industries. This is crucial because collective studies often overlook the intricate details of the value chain, which can yield valuable insights for optimizing supply chain management and operational efficiency.

One promising direction for future research is to map the value chain and supply chain interactions, particularly focusing on production, inventory, and transport. This would involve creating a visualization of the logistic chains, highlighting the key actors and organizations involved, such as suppliers, manufacturers, distributors, retailers, and customers. The research could estimate and represent the locations of inventories within the supply chain, explaining the logic behind their placements, whether at production facilities, distribution centers, or retail outlets. Additionally, it would be important to detail the various transport modalities used, such as road, rail, air, or sea, and how these modes facilitate the movement of goods through the supply chain. Understanding the expected inventory re-order systems in place, such as just-in-time (JIT) or economic order quantity (EOQ), would also be critical in assessing their impact on supply chain efficiency. Additionally, the research findings could inspire inventory management researchers to delve deeper into the specifics of inbound and outbound operations. These operations often encompass three or more inventory points: inbound inventories, inventories at the beginning and end of production/operations, and outbound inventories at the beginning (materials ready for production) and end (materials shipped or requested by the market). Such detailed mapping can help identify bottlenecks, optimize inventory levels, and enhance the overall flow of goods and information through the supply chain.

Another significant area for future research involves a detailed examination of product characteristics from both the sender's and receiver's perspectives. This includes analyzing how various product attributes influence logistics services, costs, and overall supply chain performance. Future studies could investigate the trade-offs between logistics service quality and cost efficiency, exploring how different logistics services impact costs. The value weight factor of products—how the value relative to their weight affects transportation and inventory decisions—could be a focal point. Additionally, the impact of packaging size and weight on logistics costs and handling requirements should be examined. The importance of meeting product delivery deadlines and its effect on supply chain planning and execution is another crucial area. Safety concerns related to the handling and transport of products, especially those requiring special care, such as temperature-sensitive or fragile items, need thorough investigation. Furthermore, understanding how the stage of a product's life cycle affects supply chain strategies and operations, assessing the accuracy of demand forecasting, and identifying seasonal variations in demand and supply are essential. Evaluating the reliability of different transportation modes and their suitability for various product types, along with investigating the impact of order size on supply chain efficiency and cost-effectiveness, would provide a comprehensive understanding of how product characteristics influence supply chain dynamics. This research can help companies tailor their supply chain practices to better align with the specific needs of their products and markets, ultimately enhancing competitiveness and customer satisfaction.

Economic implications of optimizing CU

When CU increases, it often indicates that a firm is operating closer to its maximum production potential. This scenario can lead to a situation where demand outpaces supply, granting firms significant price-setting power. In this context, firms are presented with two primary options to leverage their advantageous position, each with distinct implications for both the firm and the broader economy.

Firstly, firms can choose to capitalize on the high demand by raising prices. This strategy maximizes short-term profits, as consumers are willing to pay more for products or services in limited supply. However, this approach also contributes to inflation, reflected in a rising Consumer Price Index (CPI). As prices increase across the board, the purchasing power of consumers decreases, potentially leading to broader economic challenges such as reduced consumer spending and increased cost of living. In this context, how does an increase in CU affect the Consumer Price Index (CPI) and contribute to inflation? Conversely, does this scenario influence the government to implement policies that enhance both competition and production to increase supply?

Alternatively, firms can reinvest the additional revenue generated from high demand into expanding their production capacity. This strategy, while potentially yielding lower immediate profits compared to simply raising prices, has more substantial long-term benefits. By enhancing capacity, for instance, through building new factories, purchasing advanced machinery, or hiring additional labour can increase supply to meet the heightened demand. This approach not only stabilizes prices but also supports economic growth by creating employment and fostering innovation. The decision to expand capacity reflects a more sustainable and socially responsible business strategy. It addresses the supply-demand imbalance without exacerbating inflationary pressures. Furthermore, increased production capacity can lead to economies of scale, reducing per-unit costs and potentially lowering prices in the long run. This benefits consumers and enhances the firm's competitive position in the market. Moreover, the broader social impact of capacity expansion includes stimulating economic development in regions where new facilities are established, thereby supporting local communities and economies. Investment in new technologies and infrastructure can also drive advancements in efficiency and productivity, contributing to the overall economic health. Therefore, firms experiencing high CU should prioritize capacity enhancement strategies. This proactive approach ensures they can sustain growth, meet market demand, and contribute positively to the economy.

This research underlines the importance of strategic investment in capacity building as a foundational element for achieving sustained economic success and stability. Firms should be encouraged to explore detailed methodologies and best practices for capacity enhancement, ensuring they are well-prepared to capitalize on high CU rates effectively. Hence, this thesis can act as foundational research to explore the possibilities of firms expanding their capacities for long-term benefits and/or making short-term profits by increasing prices. This can be further studied and taken forward, providing a detailed framework for firms to make informed decisions about CU and market strategies.

5.6. Conclusion

In response to the first sub-research question, the findings of this study indicate that firms' decisions to integrate into value chains have a significant and positive impact on CU, thereby enhancing overall firm performance. Integration into DVC increases CU, whereas integration into FVC typically reduces it due to challenges such as higher coordination costs and regulatory differences. However, technological capabilities of firms, such as R&D and innovation, can alleviate these negative impacts, emphasizing the crucial role of technology in managing VCI. Integration into HVC also decreases CU due to similar challenges faced in FVC integration. Additionally, the interaction between HVC and contingent variables (such as firms' productive capabilities and the presence of informal competition) yielded insignificant results, suggesting the need for further research into the dynamics of firms, operating in the HVC integration.

The second sub-research question investigates how productive capabilities of firms in Africa influence the relationship between VCI and CU. The findings suggest that technological capacity, as a component of productive capability, assists firms in overcoming challenges associated with FVC integration. The interaction between aggregate DVC or HVC integration and productive capabilities, including technological and production capacities, did not produce statistically significant results. This suggests that while firms benefit from integrating into DVC and encounter challenges when using DVC as a stepping stone to FVC, the effect on CU is complex and necessitates further analysis.

The third sub-research question explores the impact of informal competition on the relationship between VCI and CU, among firms in Africa. The study finds a positive relationship between high CU rates and firms reporting "no obstacle" from informal competition. This indicates either an absence of informal competitors or that formal firms effectively navigate and benefit from informal competition, especially in niche markets. However, the interaction between aggregate VC participation and informal competition has an insignificant impact on firms' CU rates, indicating a need for a more refined conceptualization of the informal competition variable.

Collectively, this research indicates that VCI significantly influences firm CU in Africa, with notable differences in how DVC, FVC and HVC affect firms. Integration into DVC positively impacts CU by increasing efficiency and resource use through localized procurement, production, and distribution, which reduces logistical complexities and costs. Conversely, FVC integration initially appears beneficial, but when control variables like labor productivity, age, size, and financial constraints are considered, its impact turns negative due to increased coordination costs, regulatory differences, and other challenges associated with global operations. Technological capabilities, such as R&D and innovation, are crucial for mitigating these negative effects, allowing firms to streamline coordination, develop flexible production processes, and better handle international market variability. Firm heterogeneity plays a critical role in this relationship; firms with advanced technological capabilities or those in niche markets can effectively navigate or even benefit from the challenges posed by informal competition, whereas firms lacking these resources face significant obstacles. The study underscores the complexity of integrating into both DVC and FVC, i.e. HVC, which exhibit significant negative impacts on CU. These findings highlight the importance of firm-specific capabilities and strategic adaptations in overcoming integration challenges, emphasizing the need for further research to refine the conceptualization of informal competition and VC dynamics in different regional contexts across Africa.

Last but not the least, this study introduces new indicators for measuring firm engagement in DVC, FVC, and HVC, addressing a significant gap in the literature. These indicators offer a more detailed understanding of VC dynamics and their impact on firm performance, facilitating better policy and strategic decisions. To enhance CU and overall firm performance in VC network, firms should focus on investments into R&D, product and process innovation, adapt to changing trade policies, and make strategic decisions about value addition. Policymakers should support these efforts by fostering a conducive business environment and advancing initiatives like cross border equity trading by commencing the Pan African Stock Exchange (PASE), which can attract global investments and aid in integrating MSMEs into VC. Future research should refine the concept of HVC, improve data categorization, improve informal competition conceptualisation, and consider regional context differences. Detailed analyses of VC network, supply chain interactions, product characteristics, and the economic implications of CU optimization are also recommended. This research lays the groundwork for further exploration into enhancing firm performance and economic stability through strategic VCI and CU.

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A

World Bank Enterprise Surveys

Please click on the below link and it will take you to the questionnaire which was sent to top management of the firms:

[Link to the WBES questionnaire (last update: April 2023)]

Please click on the link below to access the WBES Manual:

[Link to the WBES Manual & Guide (last update: April 2023)].

For further details on the WBES methodology, please click on the link below:

[Link to the WBES Methodology webpage]

B

Stakeholders in involved in logistics (Figure 2.3)

Suppliers play a crucial role in the value chain by providing the raw materials and components necessary for production. Their inventories are typically located near manufacturing facilities to ensure a steady and timely supply of inputs. This proximity minimizes delays and disruptions in the production process. **Manufacturers**, on the other hand, are responsible for converting these raw materials into finished products. They maintain inventories both in the form of raw materials and as finished goods ready for distribution, ensuring a smooth flow of production and availability of products for subsequent stages of the supply chain. **Distributors** manage the movement of products from manufacturers to retailers or directly to consumers. Their inventory is strategically placed in warehouses and distribution centers to optimize delivery times and reduce transportation costs. This strategic placement helps in maintaining efficiency in the supply chain by ensuring that products are available where and when they are needed. **Retailers** sell the final products to end consumers and keep their inventories in storefronts and regional warehouses. This ensures that products are readily available for consumer purchase, thereby enhancing customer satisfaction. Finally, **logistics providers** handle transportation, warehousing, and other logistics services. They operate across various points in the supply chain to ensure the smooth flow of goods from suppliers to end consumers. Their role is critical in maintaining the efficiency and reliability of the supply chain by coordinating the movement and storage of products throughout the network.

C

Non-financial performance measurement systems

According to K. Ahmad and Zabri (2016), non-financial performance measurement systems (NFPMS) have a significant impact on capacity utilization by providing insights and driving improvements in various aspects of an organization's operations. NFPMS related to internal efficiency, product development, and corporate social responsibility (CSR) can affect capacity utilization in several ways.

In terms of internal efficiency, shorter process cycle times lead to more efficient use of capacity, as processes are completed faster and resources can be reallocated more quickly. Higher employee productivity levels mean that employees handle more work within the same time frame, effectively increasing capacity utilization. Efficient use of resources ensures that materials, energy, and equipment are used optimally, enhancing overall capacity utilization by reducing waste and idle time. Reducing operational downtime increases the available productive time, thereby improving capacity utilization. Effective inventory management ensures that production is not delayed due to lack of materials, thus maintaining high capacity utilization. Lower error rates and reduced rework mean that processes are more efficient, freeing up capacity for additional production.

In the realm of product development, faster time to market lead to better capacity planning and utilization, as products move through the development and production stages more quickly. High innovation rates lead to more efficient processes and technologies, enhancing capacity utilization by optimizing production methods. Efficient

R&D spending ensures that resources are allocated to successful projects, leading to better use of capacity in producing new and improved products. High product quality reduces the need for rework and returns, ensuring that capacity is used effectively in producing salable products. Positive customer feedback on new products drive demand, leading to better capacity planning and utilization to meet market needs. High project completion rates on time and within budget ensure that capacity is not wasted on prolonged or failed projects.

Regarding corporate social responsibility (CSR), efforts to reduce carbon footprint often lead to more efficient energy use, which can improve capacity utilization by reducing energy waste and costs. Lower energy consumption through efficient practices can lead to cost savings and better capacity utilization. Effective waste management reduces the amount of waste generated, ensuring that capacity is used for productive purposes rather than handling waste. Strong community engagement can enhance the company's reputation, leading to a more motivated workforce and better capacity utilization. Diverse and inclusive workplaces can lead to higher employee satisfaction and productivity, positively affecting capacity utilization. Ethical sourcing can lead to more reliable supply chains, ensuring that capacity is not disrupted due to supply issues.

In summary, NFPMS that focus on internal efficiency, product development, and CSR can significantly affect capacity utilization by optimizing processes, improving resource use, enhancing product quality, and ensuring sustainable practices. These improvements lead to more effective and efficient use of an organization's production capacity. The conceptual model of NFPMS by K. Ahmad and Zabri (2016) is illustrated in the Figure C.1.

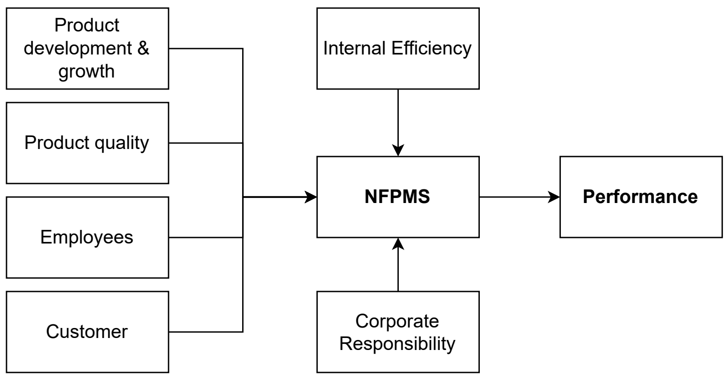

Figure C.1: A conceptual model on non-financial performance measurement systems dimensions and performance (*Source: K. Ahmad and Zabri (2016)) & Author's illustration*

D

List of countries in the dataset

The following table lists the countries in the dataset, along with the number of observations and their respective percentages. The year next to each country indicates the specific year(s) in which the data was collected for that country.

Table D.1: List of countries in the dataset

Country (Year)	Count	Percentage	Cumulative Percentage
Angola 2006	208	1.40	1.40
Angola 2010	79	0.53	1.94
Benin 2016	61	0.41	2.35
Botswana 2006	109	0.74	3.08
Botswana 2010	77	0.52	3.60
Burkina Faso 2009	85	0.57	4.18
Burundi 2006	102	0.69	4.86
Burundi 2014	57	0.38	5.25
Cameroon 2009	106	0.72	5.96
Cameroon 2016	77	0.52	6.48
Chad 2018	66	0.45	6.93

Continued on next page

Table D.1 – continued from previous page

Country (Year)	Count	Percentage	Cumulative Percentage
Congo 2009	62	0.42	7.35
Côte d'Ivoire 2009	135	0.91	8.26
Côte d'Ivoire 2016	64	0.43	8.69
DRC 2006	149	1.01	9.69
DRC 2010	91	0.61	10.31
DRC 2013	190	1.28	11.59
Djibouti 2013	24	0.16	11.75
Egypt 2013	1,680	11.33	23.09
Egypt 2016	969	6.54	29.62
Ethiopia 2011	192	1.30	30.92
Ethiopia 2015	330	2.23	33.14
Gabon 2009	143	0.96	34.11
Gambia 2006	32	0.22	34.33
Ghana 2007	292	1.97	36.29
Ghana 2013	258	1.74	38.04
Guinea 2006	135	0.91	38.95
Guinea 2016	12	0.08	39.03
Guinea Bissau 2006	50	0.34	39.36
Kenya 2007	396	2.67	42.04
Kenya 2013	330	2.23	44.26
Lesotho 2016	68	0.46	44.72
Liberia 2009	149	1.01	45.73
Liberia 2017	70	0.47	46.20
Madagascar 2009	173	1.17	47.37
Madagascar 2013	192	1.30	48.66
Malawi 2014	104	0.70	49.36
Mali 2007	301	2.03	51.39
Mali 2010	74	0.50	51.89
Mali 2016	80	0.54	52.43
Mauritania 2006	79	0.53	52.96

Continued on next page

Table D.1 – continued from previous page

Country (Year)	Count	Percentage	Cumulative Percentage
Mauritania 2014	34	0.23	53.19
Mauritius 2009	139	0.94	54.13
Morocco 2013	162	1.09	55.22
Mozambique 2007	341	2.30	57.53
Namibia 2006	100	0.67	58.20
Namibia 2014	64	0.43	58.63
Niger 2017	22	0.15	58.78
Nigeria 2007	947	6.39	65.17
Nigeria 2014	693	4.68	69.84
Rwanda 2006	59	0.40	70.24
Senegal 2007	259	1.75	71.99
Senegal 2014	150	1.01	73.00
Sierra Leone 2009	149	1.01	74.01
Sierra Leone 2017	76	0.51	74.52
South Africa 2007	679	4.58	79.10
South Sudan 2014	73	0.49	79.59
Sudan 2014	31	0.21	82.01
Swaziland 2006	66	0.45	82.45
Swaziland 2016	59	0.40	82.85
Tanzania 2006	272	1.83	84.69
Tanzania 2013	201	1.36	86.04
Togo 2016	39	0.26	86.31
Tunisia 2013	316	2.13	88.44
Uganda 2006	307	2.07	90.51
Uganda 2013	186	1.25	91.76
Zambia 2007	304	2.05	93.81
Zambia 2013	287	1.94	95.75
Zimbabwe 2011	354	2.39	98.14
Zimbabwe 2016	276	1.86	100.00
Total	**14,823**	**100.00**	**100.00**

E

List of industries in the dataset

The following table lists the types of industries analyzed in the dataset, along with the number of observations and their respective percentages:

Table E.1: Types of industries in the dataset

Industry	**Count**	**Percentage**	**Cumulative Percentage**
Basic Metals & Metal Products	103	0.69	0.69
Basic Metals/Fabricated Metals/Machinery	108	0.73	1.42
Chemicals & Chemical Products	258	1.74	3.16
Chemicals, Plastics & Rubber	76	0.51	3.68
Construction	6	0.04	3.72
Fabricated Metal Products	183	1.23	4.95
Food	2,811	18.96	23.92
Furniture	305	2.06	25.97
Garments	1,390	9.38	35.35
Hospitality & Tourism	3	0.02	35.37
Hotels & Restaurants	12	0.08	35.45
IT & IT Services	2	0.01	35.47
Continued on next page			

Table E.1 – continued from previous page

Industry	Count	Percentage	Cumulative Percentage
Leather Products	159	1.07	36.54
Machinery, Equipment, & Electronics	63	0.43	36.96
Manufacturing	2,852	19.24	56.20
Manufacturing Panel	183	1.23	57.44
Mining Related Manufacturing	30	0.20	57.64
Non-Metallic Mineral Products	453	3.06	60.70
Other Manufacturing	3,621	24.43	85.12
Other Services	189	1.28	86.40
Other Services Panel	12	0.08	86.48
Petroleum products, Plastics & Rubber	115	0.78	87.26
Printing & Publishing	126	0.85	88.11
Rest of Universe	375	2.53	90.64
Retail	56	0.38	91.01
Retail Panel	24	0.16	91.18
Rubber & Plastics Products	99	0.67	91.84
Services	319	2.15	94.00
Services of Motor Vehicles	5	0.03	94.03
Textiles	221	1.49	95.52
Textiles & Garments	453	3.06	98.58
Transport	1	0.01	98.58
Transport, Storage, & Communications	3	0.02	98.60
Wholesale	33	0.22	98.83
Wood Products	66	0.45	99.27
Wood products, Furniture, & Paper	108	0.73	100.00
Total	**14,823**	**100.00**	**100.00**

F

Michael Porter's "Stuck in the Middle" Hypothesis

Introduction

Michael Porter's "stuck in the middle" hypothesis is a concept in competitive strategy that suggests a firm that fails to choose between a cost leadership strategy and a differentiation strategy is likely to perform poorly compared to firms that adopt either one of these strategies effectively. Here's a more detailed breakdown of the hypothesis, based on the findings of Porter (2023b) and Short and Ketchen (2005):

Porter's Generic Strategies

Porter identifies three generic strategies that firms can use to achieve competitive advantage:

1. **Cost Leadership**: Achieving the lowest cost of operation in the industry. This strategy focuses on gaining an advantage by reducing costs, which allows the company to sell its products or services at lower prices than its competitors, potentially attracting a larger customer base.
2. **Differentiation**: Offering unique products or services that are valued by customers. This strategy involves developing products or services with distinctive attributes that customers perceive as valuable and different from those of competitors, which allows the firm to charge premium prices.

3. **Focus**: Targeting a specific market niche. This strategy can be based on cost or differentiation but is focused on serving a particular segment of the market better than competitors.

Stuck in the Middle

According to Porter, firms that do not make a clear choice between cost leadership and differentiation (or effectively focus on a niche market) risk becoming ”stuck in the middle.” This situation can occur due to several reasons:

- **Lack of Clear Strategy**: The firm does not have a clear strategic direction and tries to achieve both low cost and differentiation but ends up achieving neither effectively.
- **Inconsistent Investments**: Resources are spread too thinly across different strategic initiatives, preventing the firm from excelling in either cost leadership or differentiation.
- **Confused Market Position**: The firm fails to communicate a clear value proposition to its customers, leading to a weak market position where customers do not see a compelling reason to choose the firm’s products over competitors.

Consequences of Being Stuck in the Middle

Firms that are stuck in the middle typically experience several negative outcomes:

- **Competitive Disadvantage**: They may struggle to compete on price with cost leaders or on unique value with differentiators.
- **Lower Profit Margins**: Without a clear competitive advantage, these firms often face pressure on their pricing and costs, leading to lower profit margins.
- **Market Share Erosion**: Customers may prefer competitors that have a clearer value proposition, leading to a loss of market share over time.

Strategic Implications

To avoid being stuck in the middle, firms should:

- **Choose a Clear Strategy**: Decide whether to pursue cost leadership or differentiation based on their strengths, resources, and market conditions.
- **Allocate Resources Appropriately**: Invest in areas that support the chosen strategy to build a sustainable competitive advantage.

- **Communicate Value Proposition**: Clearly articulate the benefits of their products or services to the target market to strengthen their market position.

Conclusion

In summary, Porter's "stuck in the middle" hypothesis highlights the risks of not having a clear and focused competitive strategy. Firms need to make strategic choices that align with their capabilities and market opportunities to avoid the pitfalls of an unclear or blended approach.

G
Data Analysis Code

Below is the Stata code used for the data analysis:

Listing G.1: Stata Code for Analysis

```
sysuse auto, clear

use "C:\Users\Asus\OneDrive - Delft University of Technology\TU Delft\Q7\Thesis\Global Value
    Chains\Stata License\Thesis\VB_student.dta"

//Total firms in database = 14823 firms

* Dependent variable: Capacity Utilization

        //Capacity Utilization variable: f1
        drop if f1 < 0 | f1 > 100

*Independent variables: VCI dummies

        /* Domestic Value chain*/
        **National sales
                gen nsales=1 if d3a==100
                replace nsales=0 if nsales==.

```

```
        **National buying
        gen nbuy=1 if d12a==100
        replace nbuy=0 if nbuy==.

        gen dvc=1 if nsales==1 & nbuy==1
        replace dvc=0 if dvc==.

        /* Foreign Value chain*/
        *exporting
        gen exporting=1 if d3b > 0 & d3b !=.
        replace exporting=1 if d3c>0 & d3c !=.
        replace exporting=0 if exporting==.

        **importing
        gen importing=1 if d12b >0 & d12b !=.
                replace importing=0 if importing==.

        gen fvc=1 if    exporting==1 & importing==1
        replace fvc=0 if fvc ==.


        /* Mixed 1*/

        gen mvc1=1 if exporting==1 & nbuy==1
        replace mvc1=0 if mvc1==.


        /* Mixed 2*/

        gen mvc2=1 if importing==1 & nsales==1
        replace mvc2=0 if mvc2==.

        gen mvc=1 if mvc1==1 | mvc2==1
        replace mvc=0 if mvc==.

*Contingent variable: Productive capability

        pca RnD product_innovation process_innovation fixed_assets2 ForeignLicense Foreignown
             Training workforce_edu Qcertificate
        rotate , varimax
        predict tech prod, score

```

```
        gen productive = (0.6435 * tech) + (0.3655 * prod)
        // Proportion of component 1 = tech (0.2574) and component 2 = prod (0.1462) in
            cumulative (0.4)

        // Normalize the 'tech' variable
        egen min_techh = min(tech)
        egen max_techh = max(tech)
        gen tech2 = (tech - min_techh) / (max_techh - min_techh)

        // Normalize the 'prod' variable
        egen min_prodd = min(prod)
        egen max_prodd = max(prod)
        gen prod2 = (prod - min_prodd) / (max_prodd - min_prodd)

        // Normalize the 'productive' variable
        egen min_prodddd = min(productive)
        egen max_prodddd = max(productive)
        gen productive2 = (productive - min_prodddd) / (max_prodddd - min_prodddd)

        // Display summary statistics to check
        sum tech2 prod2 productive2


*Contingent variable: Informal competition

        sum e30
        tab e30
        label list E30 // value label of e30 = E30

        gen informal_competition = .
        // no response, don't know, minor effect, moderate effect
        replace informal_competition = 2 if e30 == -9 | e30 == -7 | e30 == 1 | e30 == 2
        //major effect
        replace informal_competition = 1 if e30 == 3
        //no effect
        replace informal_competition = 0 if e30 == 4
        //severe affect
        replace informal_competition = 3 if e30 == 0

*Interaction of independent and contingent variables

        gen dvcproductive = dvc*productive
```

```

        gen fvcprod=fvc*prod
        gen fvctech=fvc*tech

        gen fvccomp=fvc*informal_competition
        replace fvccomp = 0 if fvccomp == .
        gen dvccomp=dvc*informal_competition
        replace dvccomp = 0 if dvccomp == .
        gen mvccomp=mvc*informal_competition
        replace mvccomp = 0 if mvccomp == .

        gen mvctech2=mvc*tech2
        gen mvcprod2=mvc*prod2
        gen mvcproductive2=mvc*productive2

        gen dvcproductive=dvc*productive
        replace dvcproductive = 0 if dvcproductive == .

        gen dvcinform=dvc*informal_competition
        replace dvcinform = 0 if dvcinform == .

        gen mvcproductivee=mvc*productive
        replace mvcproductivee = 0 if mvcproductivee == .

        gen mvcinform=mvc*informal_competition
        replace mvcinform = 0 if mvcinform == .


*Control Variables

**Labour Productivity
        gen labour_productivity = sales/Emp
        gen labprod=ln(1+labour_productivity) //Normalize

**Access to finance

        des finance
        sum finance
        gen Financial = .
        replace Financial = 2 if finance == 0
        replace Financial = 0 if finance == 2
        replace Financial = 1 if finance == 1
```

```

**Size of the firm

        drop Emp if Emp < 0
        gen size = 1 if Emp < 20
        replace size = 2 if Emp < 100
        replace size = 3 if Emp >=100

**Age of the firm

        gen ln_age = ln(1 + age)



// Mean and number of observations for each group
tabstat f1, by(dvc) statistics(mean n)
tabstat f1, by(fvc) statistics(mean n)
tabstat f1, by(mvc) statistics(mean n)

tabstat productive2, by(dvc) statistics(mean n)
tabstat productive2, by(fvc) statistics(mean n)
tabstat productive2, by(mvc) statistics(mean n)

tabstat tech2, by(dvc) statistics(mean n)
tabstat tech2, by(fvc) statistics(mean n)
tabstat tech2, by(mvc) statistics(mean n)

tabstat prod2, by(dvc) statistics(mean n)
tabstat prod2, by(fvc) statistics(mean n)
tabstat prod2, by(mvc) statistics(mean n)

tabstat informal_competition, by(dvc) statistics(mean n)
tabstat informal_competition, by(fvc) statistics(mean n)
tabstat informal_competition, by(mvc) statistics(mean n)

** CU

// t-test between DVC and FVC
ttest f1 if VCI == 1 | VCI == 2, by(VCI)

// t-test between DVC and MVC
ttest f1 if VCI == 1 | VCI == 3, by(VCI)
```

```
// t-test between FVC and MVC
ttest f1 if VCI == 2 | VCI == 3, by(VCI)


** Productive capability

// t-test between DVC and FVC
ttest productive2 if VCI == 1 | VCI == 2, by(VCI)

// t-test between DVC and MVC
ttest productive2 if VCI == 1 | VCI == 3, by(VCI)

// t-test between FVC and MVC
ttest productive2 if VCI == 2 | VCI == 3, by(VCI)

** Informal competition

// t-test between DVC and FVC
ttest informal_competition if VCI == 1 | VCI == 2, by(VCI)

// t-test between DVC and MVC
ttest informal_competition if VCI == 1 | VCI == 3, by(VCI)

// t-test between FVC and MVC
ttest informal_competition if VCI == 2 | VCI == 3, by(VCI)


// Initialize the new variable with missing values
gen VCI = .

// Apply the conditions
replace VCI = 1 if dvc == 1
replace VCI = 2 if fvc == 1
replace VCI = 3 if mvc == 1
replace VCI = 0 if VCI == .

* Run ANOVA for VCI (all 3 groups combined)

oneway f1 VCI
oneway productive2 VCI
oneway informal_competition VCI
```

```
*Regression

**Table 1: No controls
        reg f1 dvc i.Year i.industry
        reg f1 fvc i.Year i.industry
        reg f1 mvc i.Year i.industry

**Table 2: only controls (no interaction)

        reg f1 dvc productive informal_competition labprod finance ln_age size i.Year i.industry, robust

        reg f1 fvc productive informal_competition labprod finance ln_age size i.Year i.industry, robust

        reg f1 mvc productive informal_competition labprod finance ln_age size i.Year i.industry, robust

**Table 3: Interaction of VCI with productive capability

        reg f1 dvc dvcproductive3 productive labprod finance ln_age size i.Year i.industry, robust

        reg f1 fvc fvctech tech prod labprod finance ln_age size i.Year i.industry, robust

        reg f1 mvc mvcproductivee productive labprod finance ln_age size i.Year i.industry, robust


**Table 4: Interaction of VCI with informal competition

        reg f1 dvc dvccomp informal_competition labprod finance ln_age size i.Year i.industry, robust

        reg f1 fvc fvccomp informal_competition labprod finance ln_age size i.Year i.industry, robust

        reg f1 mvc mvccomp informal_competition labprod finance ln_age size i.Year i.industry, robust
```

H

Detailed Regression Results

H.1. Detailed DVC Regression Results of Table 4.2 Column 1

This analysis investigates the determinants of capacity utilization (f1) among firms, with a particular focus on the role of domestic value chain integration (dvc) and various firm-specific characteristics.

Model Fit

The overall model is statistically significant with an F-statistic of 12.63 and a p-value of 0.000, indicating that the predictors collectively explain the variance in capacity utilization. The R-squared value is 0.0581, suggesting that approximately 5.81% of the variation in capacity utilization is explained by the model. This R-squared value, while modest, is common in firm-level cross-sectional analyses due to the multitude of unobserved factors that can influence capacity utilization.

Key Variables

- Domestic Value Chain Integration (dvc): The coefficient for dvc is 1.736901 with a standard error of 0.5054083, and it is statistically significant at the 1% level (p-value = 0.001). This positive coefficient indicates that higher levels of domestic value chain integration are associated with higher capacity utilization among firms. This suggests that firms benefiting from robust domestic value chain networks can operate more efficiently and maximize their capacity utilization.
- Productive Capacity (productive): The coefficient for productive capacity is 0.013012 with a standard error

of 0.3254943, and it is not statistically significant (p-value = 0.968). This result implies that production capacity, by itself, does not have a significant impact on capacity utilization in this sample.

- Informal Competition: The coefficient for informal competition is 0.8505318 with a standard error of 0.2423624, significant at the 1% level (p-value = 0.000). This positive and significant coefficient suggests that firms facing higher levels of informal competition tend to have higher capacity utilization. This may reflect the pressure to operate more efficiently to remain competitive against informal sector entities.
- Labor Productivity (labprod): The coefficient for labor productivity is 0.9723948 with a standard error of 0.0999427, significant at the 1% level (p-value = 0.000). Higher labor productivity is strongly associated with higher capacity utilization, underscoring the importance of an efficient workforce in optimizing firm operations.
- Finance: The coefficient for finance is -0.822554 with a standard error of 0.3823547, significant at the 5% level (p-value = 0.031). This negative coefficient suggests that better access to finance is associated with lower capacity utilization. This counter-intuitive result may indicate that financial resources are being allocated to long-term investments or expansion rather than immediate capacity optimization.
- Firm Age (ln_age) and its Squared Term (lnage_squared): The coefficient for firm age is 0.882179, which is not significant (p-value = 0.406), while the squared term is -1.719147, significant at the 1% level (p-value = 0.000). The significant squared term suggests a non-linear relationship, indicating that capacity utilization initially increases with firm age but starts to decline after reaching a certain age. This could reflect the challenges older firms face in maintaining optimal capacity utilization over time.
- Firm Size: The coefficient for size is 1.581653 with a standard error of 0.3601532, significant at the 1% level (p-value = 0.000). Larger firms tend to have higher capacity utilization, likely due to economies of scale, better resource management, and more efficient production processes.

Conclusion

This regression analysis provides a detailed view of the factors affecting capacity utilization in firms integrated in domestic value chain. The findings emphasize the importance of domestic value chain integration in enhancing capacity utilization. Additionally, labor productivity and firm size are critical determinants of capacity utilization. The significant non-linear relationship between firm age and capacity utilization highlights the dynamic nature of firm performance over time. Significant year and industry effects further underscore the influence of broader economic conditions and sector-specific factors on capacity utilization.

Table H.1: Detailed Regression Results of DVC on CU of firms in Africa

Variable	**Coefficient**	**Std. Err.**	**t**	**P>** $\|t\|$	**[95% Conf. Interval]**
dvc	1.713901	0.4054083	3.44	0.001	0.7461858 2.727616
productive	0.043012	0.2784943	0.04	0.968	-0.6250117 0.6510741
informal_competition	0.7005318	0.1923624	3.51	0.000	0.3754643 1.325601
labprod	0.7523948	0.0699427	9.73	0.000	0.7764484 1.168341
finance	-1.262554	0.2423547	-2.15	0.031	-1.572056 -0.0730518
ln_age	-0.182179	0.21956	0.83	0.406	-1.194616 2.958975
lnage_squared	-1.719147	0.223235	-7.70	0.000	-2.156739 -1.281556
size	2.161653	0.2701532	4.39	0.000	0.8756713 2.287635
Year					
2007	0.0257689	0.8578407	0.03	0.976	-1.655794 1.707332
2009	-2.440719	1.241747	-1.97	0.049	-4.874826 -0.0066132
2010	-0.7577026	1.691741	-0.45	0.652	-4.073871 2.558466
2011	-4.029839	1.165368	-3.46	0.001	-6.314282 -1.745395
2013	3.735273	0.8571635	4.36	0.000	2.055314 5.415231
2014	2.874524	1.140738	2.52	0.012	0.6384838 5.110562
2015	-7.939174	1.688279	-4.70	0.000	-11.24858 -4.629763

Variable	Coefficient	Std. Err.	t	P> $|t|$	[95% Conf. Interval]
Industry					
Chemicals & Chemical Products	14.19304	3.12437	4.54	0.000	8.068568 20.31752
Chemicals, Plastics & Rubber	6.336408	3.664093	1.73	0.084	-0.8460475 13.51886
Construction	11.29589	12.78026	0.88	0.377	-13.75631 36.3481
Fabricated Metal Products	9.334134	2.954109	3.16	0.002	3.543409 15.12486
Food	8.214667	2.313716	3.55	0.000	3.679257 12.75008
Furniture	14.15474	2.639587	5.36	0.000	8.963055 19.32893
Garments	10.26064	2.361948	4.34	0.000	5.630684 14.89059
Hotels & Restaurants	5.237714	7.249411	0.72	0.472	-8.97327 19.4487
IT & IT Services	-1.122823	15.57453	-0.01	0.994	-30.6517 30.40754
Leather Products	2.864693	3.534228	0.81	0.417	-4.0979 9.793285
Manufacturing	13.08135	2.377985	5.50	0.000	8.419968 17.74273
Manufacturing Panel	1.086099	3.084893	0.35	0.725	-4.960182 7.13438
Non-Metallic Mineral Products	12.6587	2.650278	4.78	0.000	7.465537 17.85185
Other Manufacturing	6.403117	2.89554	2.21	0.027	0.7190617 12.09116
Other Services	6.172842	3.065224	2.02	0.044	-0.1695862 12.1761
Other Services Panel	-5.973295	7.805321	-0.77	0.442	-19.56962 7.794728
Printing & Publishing	12.00294	3.299013	3.64	0.000	5.553968 18.46909
Rest of Universe	8.409889	2.677094	3.14	0.002	3.162065 13.6576
Retail	17.75449	4.175347	4.25	0.000	9.569685 25.9393
Retail Panel	-5.152536	5.332267	-0.96	0.336	-15.57326 5.327904

Variable	**Coefficient**	**Std. Err.**	**t**	**P>** $\|t\|$	**[95% Conf. Interval]**
Rubber & Plastics Products	7.650244	3.34086	2.29	0.022	1.101399 14.19909
Services	31.36745	11.16854	2.81	0.005	9.447457 53.26032
Services of Motor Vehicles	7.614098	10.08076	0.76	0.447	-12.0045 27.23269
Textiles	12.1958	2.887464	4.22	0.000	6.535877 17.85589
Textiles & Garments	3.424823	2.684535	1.28	0.200	-1.83746 8.682122
Transport	-10.72027	21.91356	-0.49	0.625	-53.79649 32.356
Transport, Storage, & Communications	37.21625	21.91158	1.70	0.090	-6.509334 80.94183
Wholesale	17.12127	4.829832	3.54	0.000	7.653442 26.58964
Wood Products	12.51233	3.937637	3.18	0.001	5.37318 19.65149
_cons	35.80077	3.115523	11.49	0.000	29.69363 41.9079

H.2. Detailed FVC Regression Results of Table 4.3 Column 2

This analysis examines the determinants of capacity utilization (f1) among firms, focusing particularly on the role of foreign value chain integration (fvc) and various firm characteristics.

Model Fit

The overall model is statistically significant with an F-statistic of 12.06 and a p-value of 0.000, indicating that the predictors collectively explain the variance in capacity utilization. The R-squared value is 0.0580, suggesting that approximately 5.8% of the variation in capacity utilization is explained by the model. While this R-squared value is relatively low, it is common in firm-level cross-sectional data, where numerous unobserved factors may influence capacity utilization.

Key Variables

- Foreign Value Chain Integration (fvc): The coefficient for fvc is -1.885961 with a standard error of 0.7220611, and it is statistically significant at the 1% level (p-value = 0.009). This negative coefficient suggests that higher levels of foreign value chain integration are associated with lower capacity utilization among firms. This may indicate that firms involved in complex international production networks face coordination challenges or that they rely on less efficient foreign suppliers.
- Technological Capacity (tech): The coefficient for technological capacity is -0.4402772, with a standard error of 0.2787836. However, it is not statistically significant at conventional levels (p-value = 0.114). This implies that technological capacity, by itself, does not have a significant impact on capacity utilization, in this sample.
- Production Capacity (prod): The coefficient for production capacity is 1.1733849 with a standard error of 0.282801, but it is not statistically significant (p-value = 0.540). Similar to technological capacity, production capacity does not show a significant direct effect on capacity utilization.
- Interaction Term (fvctech): The interaction term between foreign value chain integration and technological capacity (fvctech) has a coefficient of 1.245865 with a standard error of 0.5336594, and it is significant at the 5% level (p-value = 0.020). This positive and significant coefficient suggests that the negative impact of foreign value chain integration on capacity utilization can be mitigated by higher technological capacity. Firms that are technologically advanced can better manage the complexities of international value chains.
- Labor Productivity (labprod): The coefficient is 0.7344715 with a standard error of 0.0700554, significant at the 1% level (p-value = 0.000). Higher labor productivity is strongly associated with higher capacity utilization, highlighting the importance of an efficient workforce.
- Finance: The coefficient for finance is -1.3909368 with a standard error of 0.3824224, significant at the

5% level (p-value = 0.028). This negative coefficient suggests that firms with better access to finance have lower capacity utilization, which might indicate that financial resources are directed towards expansion or other investments rather than immediate capacity use.

- Firm Age (ln_age) and its Squared Term (lnage_squared): The coefficient for firm age is 0.214696, not significant (p-value = 0.448), while the squared term is -1.750828, significant at the 1% level (p-value = 0.000). The significant squared term suggests a non-linear relationship where capacity utilization increases with age up to a point and then decreases, indicating that very young and very old firms might struggle with optimal capacity utilization.
- Firm Size: The coefficient for size is 1.558752 with a standard error of 0.367402, significant at the 1% level (p-value = 0.000). Larger firms tend to have higher capacity utilization, likely due to economies of scale and better resource management.

Conclusion

This regression analysis provides a comprehensive view of factors influencing capacity utilization in firms. The findings highlight the complex interplay between foreign value chain integration, technological capacity, and other firm-specific characteristics. The interaction between fvc[1] and tech[2] underscores the importance of technological advancements in mitigating potential downsides of international integration. Significant year and industry effects suggest that broader economic conditions and sector-specific dynamics are also crucial determinants of capacity utilization.

[1] Firms integrated into foreign value chain
[2] Technological capacity of firm (R&D, product innovation and process innovation)

Table H.2: FVC Regression Results

Variable	**Coefficient**	**Std. Err.**	**t**	**P>** $\|t\|$	**[95% Conf. Interval]**
fvc	**-1.885961**	0.7220611	-2.61	**0.009**	-3.301365 -0.4705571
tech	-0.4402772	0.2787836	-1.58	0.094	-0.9867565 0.10602
prod	1.1733849	0.282801	0.61	0.540	-0.3809605 0.7277383
fvctech	**1.245865**	0.5336594	2.33	**0.020**	-0.199779 2.291958
labprod	0.7344715	0.0700554	8.05	0.000	0.7308399 1.162603
finance	-1.3990936	0.2324224	-2.20	0.028	-1.589538 -0.0902678
ln_age	-0.214696	0.213055	0.76	0.448	-1.280991 2.890383
lnage_squared	-1.750828	0.2233851	-7.84	0.000	-2.188713 -1.312942
size	1.984752	0.267402	4.24	0.000	0.8385601 2.278943
Year					
2007	0.4008533	0.8505845	0.47	0.637	-1.266486 2.068192
2009	-2.251694	1.244691	-1.81	0.070	-4.691572 0.1881837
2010	-0.7019339	1.692298	-0.41	0.680	-3.999104 2.615181
2011	-3.895868	1.18388	-3.29	0.001	-6.216361 -1.575374
2013	3.669309	0.970764	3.78	0.000	1.76508 5.448643
2014	2.87988	1.189139	2.42	0.015	0.5488967 5.210863
2015	-8.040969	1.713744	-4.69	0.000	-11.403 -4.681641

Variable	**Coefficient**	**Std. Err.**	**t**	**P> $\|t\|$**	**[95% Conf. Interval]**
Industry					
Chemicals & Chemical Products	14.45056	3.134062	4.61	0.000	8.307086 20.59403
Chemicals, Plastics & Rubber	6.65876	3.67401	1.81	0.070	-0.543136 13.86066
Construction	11.73711	12.78172	0.92	0.359	-13.31797 36.79219
Fabricated Metal Products	9.662823	2.95477	3.27	0.001	3.878001 15.44784
Food	8.643365	2.312661	3.74	0.000	4.110824 13.17641
Furniture	14.43751	2.640323	5.47	0.000	9.281672 19.59324
Garments	10.57777	2.367072	4.47	0.000	5.93777 15.21777
Hotels & Restaurants	5.641163	7.250722	0.78	0.436	-8.566098 19.84842
IT & IT Services	1.116065	15.58728	0.07	0.943	-29.43855 31.67068
Leather Products	2.867004	3.539599	0.81	0.417	-4.064643 9.798649
Manufacturing	13.34433	2.378115	5.61	0.000	8.682685 18.00598
Manufacturing Panel	1.519065	3.085266	0.49	0.622	-4.528768 7.566898
Non-Metallic Mineral Products	13.5024	2.646819	5.10	0.000	8.314035 18.69077
Other Manufacturing	6.743849	2.291589	2.94	0.003	2.251814 11.23588
Other Services	6.25934	3.06431	2.04	0.041	-2.525956 12.26668
Other Services Panel	-5.773523	7.009679	-0.82	0.410	-19.5088 7.961755
Printing & Publishing	12.15582	3.301544	3.68	0.000	5.684048 18.6276
Rest of Universe	8.713646	2.681406	3.25	0.001	3.457481 13.96981
Retail	17.67307	4.177098	4.23	0.000	9.485009 25.86114
Retail Panel	-4.969571	5.336722	-0.93	0.352	-15.43076 5.491618

Variable	**Coefficient**	**Std. Err.**	**t**	**P> $\|t\|$**	**[95% Conf. Interval]**
Rubber & Plastics Products	7.855917	3.347145	2.35	0.019	1.294751 14.41708
Services	32.60969	11.17548	2.92	0.004	10.79231 54.51617
Services of Motor Vehicles	8.644472	2.816406	3.07	0.002	3.123811 14.16513
Textiles	12.57267	2.889679	4.35	0.000	6.908244 18.2371
Textiles & Garments	13.50623	3.684812	3.66	0.000	6.273055 20.7394
Transport	-9.491319	21.94767	-0.43	0.667	-52.45435 33.50971
Transport, Storage, & Communications	26.7558	21.91647	1.22	0.222	-16.24557 69.75717
Wholesale	17.12357	4.832161	3.54	0.000	7.651432 26.5957
Wood Products	12.8979	3.934812	3.28	0.001	5.173812 20.62198
_cons	36				

H.3. Combined HVC Regression Results

This analysis examines the factors influencing capacity utilization (f1) among firms, with a particular emphasis on the role of hybrid value chain integration (mvc) and various firm characteristics, as presented in column 3 of Tables 4.2, 4.3, and 4.4.

Model Fit

The overall model is statistically significant with an F-statistic of 11.80 and a p-value of 0.000, indicating that the predictors collectively explain the variance in capacity utilization. The R-squared value is 0.0575, suggesting that approximately 5.75% of the variation in capacity utilization is explained by the model. This R-squared value, though modest, is typical for firm-level cross-sectional data, where many unobserved factors may influence capacity utilization.

Key Variables

- Hybrid Value Chain Integration (mvc):

  The coefficient for mvc is -0.7966238 with a standard error of 0.384992, and it is statistically significant at conventional levels (p-value = 0.047). This suggests that hybrid value chain integration, by itself, does have a negative significant impact on capacity utilization in this sample. This may indicate that firms involved in both DVC and FVC networks face coordination challenges.

- Productive Capacity (productive):

  The coefficient for technological capacity is -0.0501118 with a standard error of 0.2815415, and it is not statistically significant (p-value = 0.797). This result indicates that productive capacity, on its own, does not significantly affect capacity utilization.

- Production Capacity (prod):
- Interaction Term: mvc x productive:

  The coefficient for the interaction term between hybrid value chain integration and technological capacity is 0.2828698 with a standard error of 0.5329142, and it is not statistically significant (p-value = 0.668). This indicates that the combined effect of hybrid value chain integration and productive capacity does not significantly influence capacity utilization.

- Interaction Term: mvc × informal_competition :

  The coefficient for the interaction term between hybrid value chain integration and informal competition is 0.2118044 with a standard error of 0.3836214, and it is not statistically significant (p-value = 0.573). This suggests that the combined effect of hybrid value chain integration and informal competition is also not significant in determining capacity utilization.

- Informal Competition:

  The coefficient for informal competition is 0.5810271 with a standard error of 0.2420769, significant at the 5% level (p-value = 0.004). This positive and significant coefficient implies that firms facing lower levels of informal competition (”no obstacle”) tend to have higher capacity utilization.

- Labor Productivity (labprod):

  The coefficient for labor productivity is 073355738 with a standard error of 0.0739823, significant at the 1% level (p-value = 0.000). Higher labor productivity is strongly associated with higher capacity utilization, highlighting the importance of an efficient workforce in optimizing firm operations.

- Finance:

  The coefficient for finance is -1.266074 with a standard error of 0.2418675, significant at the 1% level (p-value = 0.004). This negative coefficient suggests that better access to finance is associated with lower capacity utilization. This counter-intuitive result might indicate that financial resources are being directed towards long-term investments or expansion rather than immediate capacity optimization.

- Firm Age (ln_age_centered) and its Squared Term (lnage_squared_centered):

  The coefficient for firm age is -0.2178825, insignificant, while the squared term is -1.713001, significant at the 1% level (p-value = 0.000).

  These results suggest a non-linear relationship where capacity utilization initially decreases with age but starts to decline more steeply as firms get older, indicating that very young and very old firms might struggle with optimal capacity utilization, as discussed thoroughly in chapter 2.

- Firm Size:

  The coefficient for size is 1.862072 with a standard error of 0.2673508, significant at the 1% level (p-value = 0.000). Larger firms tend to have higher capacity utilization, likely due to economies of scale, better resource management, and more efficient production processes.

Conclusion

This regression analysis provides a detailed view of the factors affecting capacity utilization in firms. The findings highlight the complex interplay between hybrid value chain integration, technological capacity, production capacity, and other firm-specific characteristics. The interaction terms do not significantly influence capacity utilization, suggesting that hybrid value chain integration’s impact may not be moderated by technological or production capacities. The significant effects of informal competition, labor productivity, firm age, and size underscore their importance in optimizing capacity utilization. Significant year and industry effects further emphasize the role of broader economic conditions and sector-specific dynamics in determining capacity utilization.

Table H.3: Combined HVC Regression Results

Variable	**Coefficient**	**Std. Err.**	**t**	**P>** $\lvert t \rvert$	**[95% Conf. Interval]**
mvc	-0.7986238	0.3874992	-1.60	0.109	-1.70855 0.1713026
tech	-0.0801118	0.3115415	-0.26	0.797	-0.6908052 0.5305776
prod	0.0666205	0.3420845	0.19	0.853	-0.6049342 0.7381731
mvctech	-0.2028698	0.4729142	-0.43	0.668	-1.129888 0.7244185
mvcprod	-0.3618044	0.6436214	-0.56	0.573	-1.623965 0.900356
informal_competition	0.6710271	0.1920769	3.43	0.001	0.3565019 1.305552
labprod	0.7355738	0.0739823	9.36	0.000	0.7394736 1.131674
finance	-1.2580745	0.2418675	-2.25	0.024	-1.636383 -0.1365101
ln_age_centered	-0.2178825	0.3650917	-2.30	0.215	-1.534137 -0.1416276
lnage_squared_centered	-1.713001	0.2230401	-7.68	0.000	-2.152021 -1.275973
size	1.862072	0.2663508	3.67	0.000	0.5972658 1.966878
Year					
2007	-0.1814449	0.858996	-0.21	0.833	-1.502381 1.86527
2009	-2.454167	1.244842	-1.97	0.049	-4.894337 -0.0139977
2010	-0.7530777	1.675485	-0.45	0.654	-4.037809 2.531653
2011	-4.313563	1.182	-3.65	0.000	-6.630548 -1.996577
2013	3.413563	0.9027663	3.78	0.000	1.644855 5.182271
2014	2.663941	1.178946	2.26	0.024	0.3524947 4.974941
2015	-8.059017	1.716477	-4.70	0.000	-11.4237 -4.694353

Variable	**Coefficient**	**Std. Err.**	**t**	**P>** $|t|$	**[95% Conf. Interval]**
Industry					
Chemicals & Chemical Products	14.25509	3.14018	4.54	0.000	8.099629 20.41055
Chemicals, Plastics & Rubber	6.378772	3.663643	1.74	0.082	-0.8072943 13.56034
Construction	11.81147	12.81267	0.92	0.357	-13.30424 36.92718
Fabricated Metal Products	9.935739	2.950521	3.37	0.001	3.950899 15.92058
Food	8.480172	2.320535	3.65	0.000	3.931759 13.02859
Furniture	14.24111	2.645994	5.38	0.000	9.054363 19.42785
Garments	10.3081	2.370581	4.35	0.000	5.661225 14.95497
Hotels & Restaurants	-0.3969907	6.968519	-0.06	0.955	-14.05686 13.26288
IT & IT Services	0.0805707	15.62272	0.01	0.995	-30.4347 30.70461
Leather Products	2.737065	3.54406	0.77	0.440	-4.210899 9.684121
Manufacturing	13.16944	2.383244	5.53	0.000	8.497745 17.84113
Manufacturing Panel	0.2916261	3.084863	0.09	0.925	-5.755401 6.338653
Non-Metallic Mineral Products	13.8257	2.667276	5.18	0.000	8.596868 19.05452
Other Manufacturing	6.441736	2.297545	2.80	0.005	1.938208 10.94526
Other Services	6.577789	3.065224	2.15	0.032	-0.567732 12.72231
Other Services Panel	-5.918914	7.022633	-0.84	0.399	-19.68485 7.847026
Printing & Publishing	12.21873	3.311058	3.69	0.000	5.725533 18.70993
Rest of Universe	8.439075	2.686494	3.14	0.002	3.172541 13.70561
Retail	17.87321	4.148069	4.31	0.000	9.667145 26.07928
Retail Panel	-5.57366	5.345526	-1.04	0.297	-16.04838 4.900067

Variable	**Coefficient**	**Std. Err.**	**t**	**P> $\|t\|$**	**[95% Conf. Interval]**
Rubber & Plastics Products	7.781639	3.355769	2.32	0.020	1.203576 14.3597
Services	32.01292	11.19997	2.86	0.004	10.08546 53.94038
Services of Motor Vehicles	7.89355	10.03541	0.79	0.432	-11.77814 27.56524
Textiles	12.17724	2.896951	4.20	0.000	6.598467 17.95598
Textiles & Garments	3.277926	2.686023	1.22	0.222	-1.987585 8.543538
Transport	-11.91225	21.93544	-0.54	0.591	-55.01326 31.18876
Transport, Storage, & Communications	27.49896	21.96731	1.25	0.211	-15.56192 70.55984
Wholesale	17.44911	4.831814	3.61	0.000	7.951599 26.94662
Wood Products	12.6975	3.949345	3.22	0.001	4.955899 20.43911
_cons	46.88019	2.933709	15.98	0.000	41.12946 52.63092

I

Apple's strategy

One real example of firms keeping high-value-added activities in-house while outsourcing less critical stages to take advantage of cost efficiencies and expertise available in other countries is the business model of Apple Inc. Apple designs its high-value products, such as the iPhone, iPad, and MacBook, in-house in the United States, where it focuses on research, development, and product design. These activities are crucial as they involve significant intellectual property and require a high level of expertise, innovation, and confidentiality.

On the other hand, Apple outsources the manufacturing and assembly of its products to specialized firms in countries like China. For instance, Foxconn, a major Apple supplier, handles the assembly of iPhones and other Apple products. This outsourcing is driven by cost efficiencies and the expertise available in these countries. China's manufacturing sector is known for its ability to produce electronics at a large scale with lower labor costs compared to the United States. Additionally, suppliers like Foxconn have developed specialized capabilities in electronics manufacturing, which allows them to achieve high levels of efficiency and quality.

This strategy enables Apple to focus on its core competencies in design and innovation while leveraging the cost advantages and manufacturing expertise of its international suppliers. By maintaining control over high-value activities and outsourcing less critical stages, Apple can optimize its production processes, reduce costs, and maintain a competitive edge in the global market.

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Additional Analyses

Definitions and Examples

Subsample Analysis

Subsample analysis involves dividing a dataset into smaller, distinct groups based on specific characteristics, such as firm size, industry, or geographic location. The purpose is to analyze whether the effects observed in the overall sample hold true within these specific subsamples, providing insights into potential heterogeneity in the data. This method is particularly useful for identifying differential impacts of an independent variable across various segments of the population.

Example: If you're examining the impact of Domestic Value Chain (DVC) participation on capacity utilization across different types of firms, a subsample analysis could involve splitting the dataset into small and large firms. You might find that DVC participation significantly increases capacity utilization among small firms but has a lesser effect on large firms. This could indicate that smaller firms benefit more from domestic integration, potentially due to closer ties with local suppliers and markets.

Outlier Analysis

Outlier analysis focuses on identifying and examining data points that significantly deviate from the rest of the dataset. Outliers can have a disproportionate influence on the results of a regression analysis, potentially leading to misleading conclusions. Detecting outliers allows researchers to investigate whether these data points represent errors, special cases, or important deviations that need to be understood separately from the general trend.

Example: During your regression analysis, suppose you notice a firm that is extremely integrated into both domestic and foreign value chains but has unusually low capacity utilization compared to others. This firm could be an outlier, and further investigation might reveal unique circumstances, such as supply chain disruptions or management inefficiencies. Adjusting for or excluding this outlier might lead to a clearer understanding of the general relationship between value chain integration and capacity utilization.

Difference-in-Differences (DiD) Analysis

Difference-in-Differences (DiD) Analysis is a quasi-experimental technique used to estimate causal effects by comparing the changes in outcomes over time between a treatment group and a control group. The approach assumes that any difference in outcomes between the groups before the treatment should remain constant over time, except for the effect of the treatment. DiD is commonly used in policy evaluation where a particular intervention affects one group but not another.

Example: Imagine a scenario where a policy or economic event, such as a trade agreement, is implemented that specifically encourages foreign value chain (FVC) integration in one region but not in another. A DiD analysis could compare the change in capacity utilization before and after the event between firms in the region affected by the policy (treated group) and firms in a region not affected (control group). If capacity utilization increases significantly more in the treated region, this would suggest that the policy effectively enhanced capacity utilization through greater FVC integration.