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Exploring Factors Influencing Local Engagement in the Downstream Segment of Zambia's Copper Value Chain

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Abstract: **This study explored the determinants of local participation in the downstream segment of the Zambian copper value chain. This study examines the factors influencing the engagement of local Zambian entrepreneurs in the copper industry's downstream activities, and identifies the challenges they face. A mixed-methods approach, including surveys, interviews, and statistical analysis, was employed to gather and analyze data from relevant stakeholders. The findings provide insights into the roles of education, entrepreneurship, technical expertise, government support, international competitiveness, domestic market demand, fair pricing mechanisms, collaboration, and continual monitoring and evaluation in promoting local participation. The paper concludes with recommendations to enhance local participation and stimulate sustainable economic Zambian copper development.**

Keywords: **value chain, downstream, mining, determinants, Zambia, copper.**

1. INTRODUCTION

Copper is a precious mineral that has served mankind for over ten thousand years. This is a foundational element in the development of human civilization. The discovery and exploration of copper as a mineral have been pivotal in delivering humanity from the Stone Age. It serves as a resource for employment in the development of certain tools and ornaments. The ubiquity of copper metal and its association with human civilization since Sumeria and pre-dynastic Egypt give copper a unique position in the history of technology (Webster, 2008)[1].

The discovery and exploration of copper around the year 8700BC, and its subsequent fabrication into simple tools and ornaments have been one of the greatest human discoveries. Over the centuries, copper has continued to be an invaluable natural resource that serves mankind with various capabilities. Copper has been a driving force in the development of many modern industries because it is a fundamental resource.

Zambia has been a major player in the copper industry for the past One Hundred (100) years. According to Garside (2022)[2], Zambia is the world's seventh largest producer of copper in the world and the second in Africa. It is estimated to have produced 830,000 metric tons of copper by 2021. It is also estimated that approximately 70 percent of Zambian foreign exchange is earned from copper and other mineral exploration (Accelerated Growth for SMEs in Zambia, 2021)[3].

It is quite unfortunate that a blessed country like Zambia is unable to unearth the full potential of its minerals, especially copper. Most copper mines are located in the northwestern province and copper belt in Zambia. Most mining and processing of copper ores occur in these areas. The government of Zambia seems to have had very little stake in mineral reserves.

Since the commencement of commercial exploration of copper in Zambia, raw copper has mostly been exported in the form of anodes or cathodes to other regions, such as Europe and Asia, for further processing. Smelters and fabricators in these

areas add value to raw copper to produce finished products that are then imported into the country in the form of copper rods, cables, generators, stoves, and freezes, among many others (Ahmad & Walker, 2005)[4].

The cost of participating in the upstream copper value chain is relatively high. The costs of mining equipment and consumables are very high. This has led to foreign companies dominating the copper mining industry (Accelerated Growth for SMEs in Zambia, 2021)[3]. Zambian nationals are unable to derive the benefits needed upstream of the copper value chain.

A few major corporations have already played major roles in the processing of copper in Zambia. The relative cost implication to participate downstream of the copper industry is less than that upstream. A major corporation downstream is unable to meet the local demand for finished copper products. There is an argument to be made for a competitive advantage that Zambia stands to enjoy if it decides to venture into the sub-region.

This study examines the roles and opportunities available to local Zambian entrepreneurs downstream of the copper industry in Zambia. This study also identifies the challenges faced by local entrepreneurs downstream of the copper industry.

2. LITERATURE REVIEW

The scope of this review is to provide insight into copper, its nature, production, development, and final usage of the commodity. Emphasis will be placed on the Zambia copper industry, major players in the value chain, the historic development of copper in Zambia, the contribution of the commodity to the country, the challenges and opportunities facing the industry, and the role of local Zambia entrepreneurship in the value chain.

Copper as a Raw Material

Finding pure copper in nature is rare because copper is mostly found with other chemicals in the ore. The most common copper ore in nature is sulfide ore, which is the product of the reaction between copper and sulfur. Other common copper ores include carbonate and oxide. It is quite common to discover that copper ores include elements of gold and nickel, and in some cases, silver.

Approximately 80 percent of the world's copper in ores is obtained fCu rom–Fe–S ores. Cu-FE-S copper is commonly known as chalcopyrite or yellow copper ore. Other common copper ores include Cu2S (Chalcocite o red copper) ores. Both yellow and red copper ores are examples of sulfide ores. Cu2O, Cu (OH) 2.CuCO3 is a common copper ore found in nature. (Davenport, King, Schesinger, & Biswas, 2002)[5].

In addition to ores, some chemicals have been employed to process and refine copper. Among other organic compounds, sulfuric acid, iron, and silica can be used to facilitate the extraction of copper.

The Copper Production Process

The extraction of copper from copper includes a series of procedures, depending on the type of ore and the expected purity of the final product. The process involves several steps with the ultimate aim of eliminating waste products from the ore. The steps involved both activities carried out at the mine and at the separation site. The process involved in the processing of sulfide ores is as follows.

Mining

Copper is mostly mined through open-pit or underground mining. It is estimated that approximately 90% of the copper produced is obtained through open-pit mining, thus extracting the ores near the surface of the earth through graduated steps towards the earth's crust. Where ores are too deep, underground mining may be used (Global X Research Team 2018[6]). With underground mining, a shaft is created to make way for machines or explosives to separate ores (Hartman, 1992[7]).

Concentration

Copper ores usually contain large amounts of dirt, clay, and other minerals. The process of eliminating non-copper materials is known as the concentration process. The flotation method is usually adopted (Davenport, King, Schlesinger, & Biswas, 2002[5]). The ore was first crushed into fine particles to loosen the Cu material. The particles were mixed with water and other chemicals to make a copper water repellent. Air was passed through the mixture, allowing the copper to attach to the bubbles and float to the surface.

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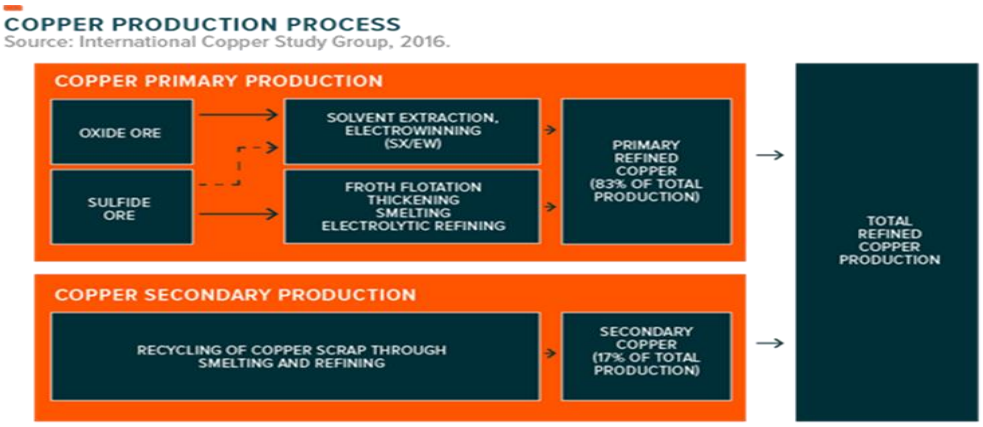
Smelting

After physically removing unwanted materials, the remaining copper concentrate must undergo a chemical reaction to remove sulfur and iron. According to Rodney et al. (2015)[8], smelting involves two furnaces. Some modern plants may use one furnace for the smelting process (Rodney et al, 2015)[8]

Refining

Although copper blisters are Ninety- Nine percent pure, they contain some levels of sulfur, oxygen, and other impurities that hamper further refining. To remove or adjust the levels of these materials, the blister copper is first fire refined before it is sent to the final electro-refining process

Figure 1



Zambian copper Production

There are three historical eras in the history of copper mining in Zambia, from the 1900s to the present day. The brief details of each of these eras are as follows:

Pre-Independence Mining Production

Sikkim et al. (2015)[9] in their study highlighted the discovery of mineral deposits with the help of the natives of Zambia, who were aware of the location of copper deposits. The presence of copper in Zambia contributed to its colonization by the British in 1889. Following colonization, copper exploitation was carried out by both foreign and native companies. Exploration activities led to the first commercial copper mine in Zambia, Kansanshi-Solwezi, in 1908. Subsequently, other commercial mines were established. In the quest to maximize profit, mine owners invested in concentrators, smelters, and other mineral extraction facilities (Sikamo, Mwanza, & Mweemba, 2015)[10]. Through huge investments in the copper industry, Zambia was classified as a middle-income country in 1969, with the highest GDP in Africa.

Independence Era

Green (2009) noted that at independence, Zambia still had the status of a middle-income country with many prospects for growth due to copper mines. The economic growth of Zambia is directly linked to the copper mines.

Re- Privatization

From the mid-1970s, Zambia's copper mining sector came under mounting pressures: on the one hand from plummeting world prices and on the other, from scarce re-investment from the government for re-capitalization and exploration activities. This was coupled with an increase in transport costs due to the disruption of the main transport routes through Zimbabwe and South Africa ICMM (2014)[11]. Consequently, the annual output fell from 750,000 tons in 1973 to 257,000 tons in 2000 (Zambia Chamber of Mines, 2005)[12], as shown in Table 2-2. Production costs rose by 100 percent in only eight years between 1969 and 1977 (Libby and Woakes, 2014)[13]. The failure of the government to undertake major reforms to restructure the politically sensitive mining sector (Shafer, 1990)[14] forced Zambia to increasingly rely on foreign debt. Between 1975 and 2004 (the HIPC completion point was achieved in 2005), debt service averaged 9% of GDP (Simutanyi, 2008)[15].

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A Structural Adjustment Program (SAP) commenced in 1983 but was implemented consistently only from 1991, with the newly-elected Chiluba government. The core of the SAP was the privatization of the mines. Between 1992 and 1997, ZCCM was dismantled, and the first mine was sold to foreign investors in a process fraught with complications: the strategic importance of the mines, their dire financial situation at the time, pressures from donor agencies to complete the process, and inconsistent positions from the main actors (Craig, 2001[16]; Kaunda, 2002[17]). By 2001, all mines, except the KCM, had been privatized.

Zambia Mineral Development Resource Policy

The Government of the Republic of Zambia has implemented two main policies for mineral resources. The July 2013 policy was a revision of the 1995 policy and draws attention to the vision of 2030 for Zambia, which provides a blueprint for achieving accelerated growth aimed at raising the standards of living for the people of Zambia (MRDP, July 2013)[18].

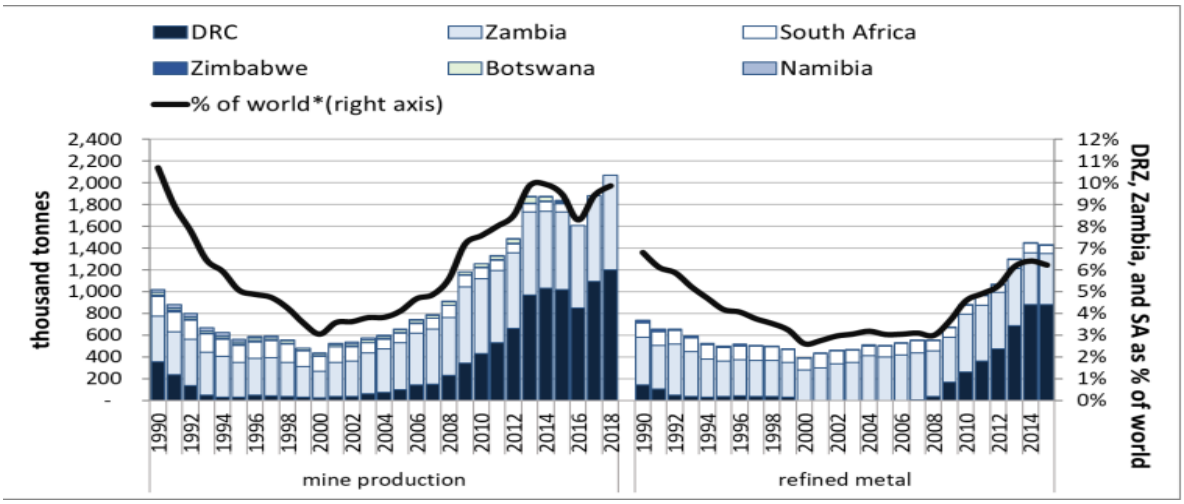
The formulation of the policy enables the following: attracting both local and foreign investment in the sector for the orderly and Sustainable exploration of mineral resources; integrating the mining sector into the domestic economy; acceptable standards for best practices in health, safety, and environment; and promotion of local processing of mineral raw materials into finished products for value addition

Clause 7.10 of the mineral policy (MRDP, July 2013)[18] explains value addition to the raw materials by identifying market potential for the national and regional consumption of raw materials of value-added products

The Copper Value Chain

Over the past decades, Southern Africa has been able to create a niche in the copper value chain. As of 2015, the southern Africa block accounted for approximately 10% of the global ore and concentrate production and approximately 6% of all refined copper metal globally (Makgetla, Levin, & Mtanga, 2019)[19]. Most of this copper is produced by the Zambia and Democratic Republic of the Congo.

Figure 2: Southern Africa Contribution to Global Copper production



Source: (Makgetla, Levin, & Mtanga, 2019)[19]

In the global copper value chain, Zambia and the rest of South Africa are regarded as commodity suppliers. As seen in the chart above, Southern Africa's role as producers of copper ores and refined metals has been on the rise since 2000.

Copper usually undergoes five phases of production: mining, concentrate production, refining in basic metal, semi-manufacturing, and manufacturing into usable products. As copper moves through various value addition phases, it moves downward in the value chain. Over the years, the Democratic Republic of Congo and Zambia has concentrated its activities on the production of raw copper, with the Democratic Republic having less than 1% of the total copper refined until about 2010.

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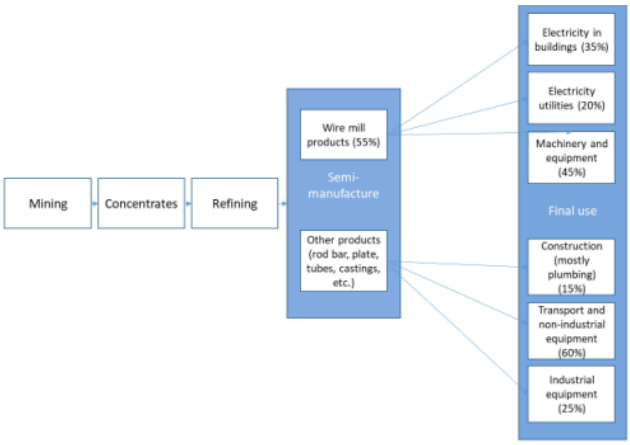
Figure 3: phases of copper production with shares in End use by weight



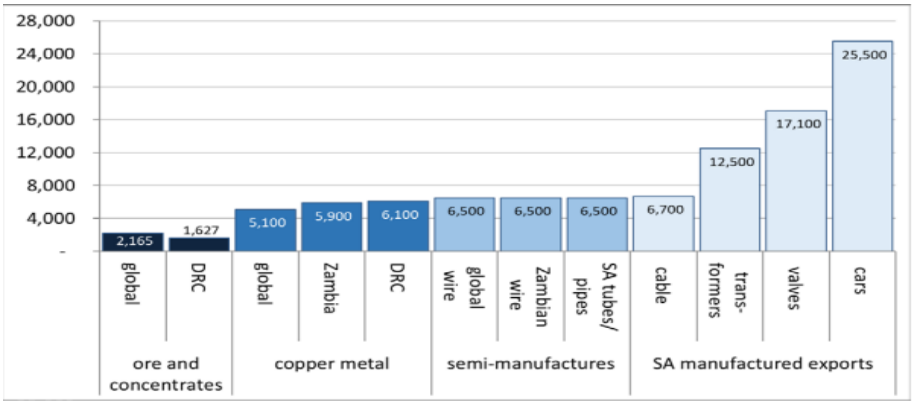
Source: (Makgetla, Levin, & Mtanga, 2019)[19]

It is worth noting that most modern copper mines like those of southern Africa do not enjoy economies of scale when it comes to the production of semi-manufactured and finished products. Since copper does not lose much bulk in the manufacturing process, there is less gain as a result of its close proximity to refineries (Matos, Miller, & Barry, 2017)[20].

When copper mining, smelting, and refining moved to Africa and Latin America, further processing into semi-manufactured and finished products did not develop near these mines. Processing remained mostly in Europe and North America until the 1990s, when China became a major player.

With the current multiple phases of processing copper in the value chain, an important factor that is employed to determine the amount of value added to the copper as it moves down the value chain is the global unit price. Based on the global price of copper, there is much gain in processing copper from concentrates to refine copper, and from semi-manufactured products to finished goods.

Figure 4: Price of Copper and Copper Products 2017



Source: (Makgetla, Levin, & Mtanga, 2019)[19]

Both Zambia and the Democratic Republic of the Congo process only a small proportion of their total output into semi-manufactured goods. The majority of copper processed in Zambia is into Copper wire. According to Makgetla et al. (2019)[19], when the total mine production increased in 2010, the Zambia export of semi-manufactured products fell. By 2017, the export value of Zambia semi-manufactured products fell from an all-time high of 8% in 2008 to less than 2%.

Zambia exports a proportional increase in almost all refined copper metal to the global markets. By refining a greater proportion of its copper, Zambia is able to more than price its gain from their copper, unlike their neighbors in the Democratic Republic of Congo.

The gain in value from processing copper from refined metals to semi – manufactured products was relatively low. This low value associated with the processing of copper to semi-manufactured products may be attributed to many factors, including the cost of imputes, level of technology required, and skill required, among several other possible reasons.

This research intends to actually pay a close attention to this portion of the copper value chain. This study explores the activities carried out during the processing of copper from refined metals to semi-manufactured products.

Evaluating the gain in the value of copper as it is processed from semi-manufactured to finished products is difficult. The production of finished copper products entails a variety of other inputs and resources coupled with technology, making it difficult to determine the gain in value for copper alone.

Key Player Players in the Zambia Copper Value Chain

The copper fabrication industry in Zambia uses copper from copper mines and the recycling of scrap copper. There is a distinction between mine owners and the Cu fabrication industry. Some refineries in industrial economies may add a line to their refinery to enable them to produce rods and add value to their output (World Bank, 2011)[21].

Zambia Metal Fabricator (ZAMEFA)

ZAMEFA was established in 1967 as a joint venture between the governments of Zambia, Phelps Dodge, and Svenska Metallverken International Corporation. According to a company-owned website, the company was privatized in 1996. The company became publicly traded in 2004 when it was listed on the Lusaka Stock Exchange. Currently, the company produces bare copper products, general wire insulated low voltage power cables, and medium voltage power cables

Non-Ferrous Metal Works (Z)

Non-ferrous Metal Works (Zambia) Limited was established in 1965 as a metal trading company with a foundry division engaged with tin and lead-based alloys. It the increasing need for spare parts, in the 1980s the company ventured into the fabrication industry. Currently, the company produces billets, solids, impellers, cage slippers, housing, coupling, crusher liners, pulleys, mill balls, bronze oil rings, locomotive brake shops, and propellers. (Non-Ferrous Metal Works (Z) Limited, 2022)[22]

Sewedy Transformers

El Sewedy Transformers is a joint venture between the El Sewedy Group in Egypt and the Zambia Electricity Supply Corporation to produce 50–500 kW transformers. This venture was established in 2009.

Kavino

Kavino manufactures electric cables and adds value to the steel products. The company was established (World Bank, 2011)[21] in 2006 and copper wire rods were sourced from both Neelkanth and ZAMEFA.

Entrepreneurship in Zambia

Empirical research into entrepreneurship and enterprise development in Zambia in the past decades has increased due to the failure of most industrial and economic reforms, leading to the need to supplement liberalization with proactive policies to remedy the situation (Mwaanga & Chewe, 2016)[23]. Since the privatization of the economy, entrepreneurship has been the backbone of the Zambian economy, with increasing numbers of people reducing their dependence on the government.

Small- and medium-scale enterprises play major roles in economic development in almost all countries. In both developing and developed countries, SMEs contribute an average of 60% to the manufacturing sector (Bhattacharya & Daouk, 2002)[24]. In African countries, the contributions of SMEs are far greater in the area of employment; SMEs account for about three – quarters of total employment in the manufacturing sector (Mwaanga & Chewe, 2016)[23].

This section of the literature review focuses on factors that impact the development of entrepreneurial growth in Zambia and the relevant challenges faced by entrepreneurs in Zambia.

Stages of Entrepreneurial Development

The entrepreneurial development stage has been identified as a potential hindrance to the growth and survival of enterprises. Several studies conducted in the field of entrepreneurship have observed that new enterprises have a high probability of

collapsing before transitioning into the next stage. For instance, Amoros and Bosma (2014)[25] in their book noted that due to the rate of economic activities of existing businesses, new businesses find it difficult to compete. Established entrepreneurial already had public support whereas startup entrepreneurs could fail to develop simply because despite the brilliant ideas, most are not too decided as to which possibilities to pursue, they lacked business plans as well as effort to envision the desirable future and to try visualizing its reality (Davidsson, 2006[26]; Dollinger, 2008[27])

It is interesting to associate the above levels or stages with Sugars (2008)[28] level of entrepreneurial development. As with most things in life, there are many different levels of entrepreneurship in business, and they identified five different types or levels of entrepreneurial mind-sets, patterns of thinking, and belief systems. According to Sugars (2008)[28], the basic level starts from being an employee to being a true entrepreneur, which is the fifth and last level of entrepreneurial development. An employee entrepreneur who lacked security would not be in a position to relinquish the job and pursue the autonomy that comes with self-employment; such an employee entrepreneur would not grow because s/he could not do without an employer. At the other end of the continuum, the true entrepreneur learns new things every step of the way and evolves through various stages of entrepreneurial accomplishment. Such entrepreneurs would experience a paradigm shift that involves idealization (imagination), visualization (picture the ideal as a reality), verbalization (putting into words the dream and talk as if it was happening), and materialization (things falling into place and ideas becoming real).

It is worth noting that the levels or stages of entrepreneurs help distinguish growing entrepreneurs from those who do not and help identify characteristics or traits that are common to entrepreneurs with a propensity to grow, such as confidence, sense of ownership, motivation, and ambition, not afraid to take risks and optimistic among others.

Education Level of Entrepreneurs

Education or training is considered an important cognitive factor in the development of entrepreneurs. It is the key constituent of the human capital needed to run or manage a business. Nkoniki (2010), in his study on factors limiting the success and/or growth of small businesses, pointed out that educated entrepreneurs could discharge their entrepreneurial responsibilities effectively, as they showed a more promising result of how their businesses were doing, could take and manage risks more easily, and had access to information regarding entrepreneurial activities. Another study by Sather (2012)[30] on small-scale aquaculture in rural Zambia indicated that a lack of business knowledge posed a serious hindrance to sustainable growth, as local entrepreneurs were not equipped rationally to provide the momentum and motivation needed for the business to remain successful. As could be expected, lack of education or training not only affect the efficiency of entrepreneurs but also affect the opening of new lines of businesses, restrains access to information as well as inhibits business knowledge such as keeping accounts or estimating costs and profits which subsequently affect operations. Therefore, education or training is a key issue to entrepreneurs' growth, as it guides the rate of development and guides which science, technology, and management style would be used. Thus, lack of basic education, knowledge, training (and experience) seriously affected the entrepreneurial growth as it was a barrier to expansion of business in all sectors such as processing, manufacturing or service (Nawaz, 2009)[31]

Entrepreneurs Experience

The characteristics of an entrepreneur's management know-how are considered important factors in the firm growth process. Management know-how was the possible outcome of many factors, such as having experience of paid employment in a similar business, or having previous management experience being the owner of some other business. Papadaki et al., (2000)[32], pointed out that individuals from families owning business were more inclined to start and grow entrepreneurial ventures by developing knowledge of how to run businesses. The study suggests that belonging to an entrepreneurial family augments the probability of survival.

Other studies have stated that related experience contributes positively to enhancing self-confidence among entrepreneurs and leads them to venture success (Delmar and Shane 2006)[33]. This was because it was obvious that such entrepreneurs would use past experiences to help them manage new ventures and take advantage of an already established network of customers, employees, investors, and suppliers, playing a crucial role in the success of a new business.

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3. RESEARCH METHODOLOGY

This section outlines the methodology employed to conduct the study, including the sampling technique, sample size, sample frame, and data analysis approach.

Purposeful sampling, specifically convenience sampling, was used to select participants for the study. Convenience sampling is a non-probabilistic sampling technique that selects individuals based on their accessibility and proximity to researchers. This technique was chosen because of its practicality and efficiency in obtaining data from participants in the copper value chain in Zambia.

The general sample size of this study was 79 participants. These participants were selected based on their involvement in and relevance to the copper value chain in Zambia. The sample frame comprises individuals working in various sectors of the copper value chain, including mining companies, processing units, transportation services, and market traders.

The data analysis for this study employed binary logistic regression, a widely used statistical technique to examine the relationship between a binary dependent variable and one or more independent variables. In this study, a binary logistic regression was employed to estimate the determinants of local participation downstream of the copper value chain in Zambia.

Binary logistic regression analysis allowed for the estimation of coefficients, odds ratios, and p-values to determine the significance and strength of the relationships between the independent variables and local participation outcomes. By analyzing these relationships, this study aims to identify the key determinants of local participation downstream of the copper value chain.

4. FINDINGS AND DISCUSSIONS

In estimating the factors affecting the participation of Zambian Entrepreneurs downstream of the copper chain in Zambia, a logistic regression was modeled with the dependent variable, whether there was innovation by local entrepreneurs in the value chain. After estimating, a number of tests were conducted to ensure that the model was fit for the purpose. With a log likelihood of 46.883, the Cox & Rex R-Square that the model had a goodness of fit of 0.535, indicating that 53.5% of the could be attributed to predicators. When the model was adjusted using Nagelkerke R square, the fitness of the model increased to 72%. The Homer-Lemeshow test was also carried out as an additional measure of goodness of fit; the results indicated a chi – square of 7.55 with a degree of freedom of 8, and a p-value of 0.478. Based on the test carried out, it indicated that the model was a good estimator of the variations.

Considering the various variables captured in the model, the results are presented in the table below

Table 1

Variable	Coefficient (B)	Exponentiated Coefficient Exp (B)	Standard Error (Se)	Significance (Sig)
Sex	1.414	4.111	0.916	0.123
Age	0.020	1.020	0.039	0.618
Education	0.328***	1.388	0.091	0.000
Occupation	-2.026*	0.132	1.200	0.091
Lack of financial support	-0.191	0.826	0.378	0.613
Lack of expertise	-0.880**	0.415	0.414	0.033
Lack of government support	-0.995**	0.370	0.464	0.032
International competition	-1.803***	0.165	0.503	0.000
Limited domestic market	-0.557*	0.165	0.323	0.085
Copper Price	-0.725**	0.484	0.338	0.032

A binary logistic model was employed to examine the factors influencing local participation in Zambia's downstream copper value chain. The model aims to determine respondents' perceptions of innovation in the downstream segment.

The dependent variable measured respondents' perception regarding the presence of innovation in Zambia's copper value chain downstream. Several explanatory variables were included: gender, years of schooling, occupation, presence of financial support, presence of expertise, presence of government support, competition from foreign firms, limited domestic markets, and copper prices. These variables were selected based on a comprehensive literature review of related studies of the copper value chain in Zambia.

Analysis of the data revealed that age, sex, and lack of financial support were not statistically significant, which is contrary to the findings of most studies. However, the nature of this relationship aligns with most previous studies. The following variables were statistically significant.

EDUCATION: The variable "Education" in the logistic regression analysis reveals a significant relationship with the outcome of local participation downstream of the copper value chain. The coefficient of 0.328 indicates that, as the level of education increases by one unit, the odds of participating in downstream activities also increase by a factor of 1.328. This suggests that individuals with higher levels of education are more likely to engage in downstream activities of the copper value chain, highlighting the importance of education as a determinant of local participation.

OCCUPATION: Based on the logistic regression analysis, the binary variable "Occupation" reveals a significant relationship with local participation downstream of the copper value chain. The coefficient of -2.026 indicates that being a business owner in the copper value chain significantly increases the odds of engaging in downstream activities compared with non-business owners. This finding suggests that individuals who are business owners in the copper industry are more likely to be involved in the downstream processes of the value chain. These findings underscore the importance of entrepreneurship and business ownership in facilitating local participation and engagement in the downstream sector of the copper industry.

LACK OF TECHNICAL EXPERTISE: Based on the logistic regression analysis, the variable "Lack of Expertise" shows a significant relationship with local participation downstream of the copper value chain in Zambia. The coefficient of -0.880 suggests that as the perception of a lack of technical expertise increases on a scale from 1 to 5, the likelihood of local entrepreneurs being engaged in downstream activities decreases. This indicates that perceived lack of technical expertise acts as a barrier to innovation and participation in the downstream sector of the copper value chain. These findings highlight the importance of addressing the skills gap and providing relevant technical support and training programs to enhance local entrepreneurs' capabilities and encourage their involvement in the downstream processes of the copper industry.

LACK OF GOVERNMENT SUPPORT: According to the logistic regression analysis, the variable Lack of Government Support exhibits a significant association with local participation downstream of the copper value chain in Zambia. The coefficient of -0.995 indicates that, as the perception of inadequate government support increases on a scale from 1 to 5, the likelihood of local entrepreneurs being involved in downstream activities decreases. This suggests that a lack of government support hinders local entrepreneurs' engagement in the downstream sector of the copper value chain.

INTERNATIONAL COMPETITION: The variable International Competitiveness in the logistic regression analysis demonstrates a significant relationship with local participation downstream of the copper value chain in Zambia. With a coefficient of -1.803, the findings indicate that, as the perception of low international competitiveness increases on a scale from 1 to 5 (from strongly disagree to strongly agree), the likelihood of local entrepreneurs being involved in downstream activities decreases. This implies that if local businesses perceive themselves as lacking competitiveness at an international level, they are less likely to participate in the downstream sector of the copper value chain. This finding suggests that improving the international competitiveness of local entrepreneurs is crucial for promoting their engagement in the copper value chain. Efforts should be made to enhance their skills, knowledge, technology, and access to markets, thus allowing them to compete effectively on a global scale. By strengthening international competitiveness, local entrepreneurs can seize opportunities in the downstream sector of the copper value chain and contribute to a country's economic growth and development.

LIMITED DOMESTIC MARKET: The variable "Ltd _ demand" (Limited Demand) in the logistic regression analysis reveals a significant association with local participation downstream of the copper value chain in Zambia. The coefficient of -0.557 indicates that, as the perception of limited demand for products or services in the downstream sector increases on a scale from 1 to 5 (from strongly disagree to strongly agree), the likelihood of local entrepreneurs engaging in the downstream activities of the copper value chain decreases. This suggests that, if local businesses perceive a lack of demand

for their products or services in the downstream sector, they are less inclined to participate. Addressing the issue of limited demand is crucial for encouraging local entrepreneurs to enter and thrive in the downstream segment of the copper value chain. Efforts should be directed towards stimulating demand through market development, promoting local products and services, and fostering partnerships between local entrepreneurs and downstream actors. By creating a favorable demand environment, local businesses are more likely to actively engage in the downstream activities of the copper value chain, leading to economic growth and development.

COPPER PRICES: The finding related to the variable "Copper _ px" (Copper Price) indicates that there is an international set price for copper that eliminates the geographical advantage for local entrepreneurs in Zambia. The coefficient value of -0.725 suggests that, as the perception of copper prices is unfavorable (from strongly disagree to strongly agree on a scale of 1 to 5) increases, the likelihood of local entrepreneurs participating in the downstream activities of the copper value chain decreases. This finding implies that local entrepreneurs in Zambia may face challenges in competing with international players because of the predetermined copper prices. The absence of a geographical advantage, where local entrepreneurs could potentially benefit from lower production or transportation costs, may hinder their participation in the downstream sector. This finding highlights the need for additional support and interventions to empower local entrepreneurs, such as providing access to technology, knowledge transfer, and capacity building, to help them overcome the disadvantage posed by international set prices. Additionally, efforts to advocate for fair pricing mechanisms and explore opportunities for value addition within the local context could enhance the competitiveness of local entrepreneurs in the copper value chain.

5. CONCLUSION

The study revealed that higher education levels significantly increased the likelihood of local participation in the copper value chain's downstream activities, emphasizing the importance of education in fostering engagement. Entrepreneurship and business ownership were also found to be crucial factors in facilitating local involvement in the copper industry's downstream sector. However, a perceived lack of technical expertise acted as a barrier to innovation and participation. Addressing the skills gap through training programs was suggested as a way to enhance local entrepreneurs' capabilities. Additionally, inadequate government support and international competition posed significant challenges for local participation, highlighting the need for improved governmental assistance and enhanced competitiveness.

In summary, the study underscores the importance of education and entrepreneurship in promoting local engagement in the downstream copper industry. It emphasizes the necessity of addressing the skills gap and providing relevant technical support to enhance local entrepreneurs' capabilities. Furthermore, enhancing government support and tackling challenges related to international competition, limited market demand, and unfavorable copper prices were identified as essential strategies to encourage and sustain local participation in the industry's downstream sector.

6. RECOMMENDATIONS

The study's key recommendations to enhance local participation in Zambia's copper industry's downstream segment are as follows: Firstly, prioritize education and access to relevant training programs to equip local entrepreneurs with the necessary skills and knowledge. Secondly, support entrepreneurship and local businesses by implementing policies that offer financial assistance, mentorship, and market access. Additionally, address the lack of technical expertise through training initiatives. Improve government support by collaborating on favorable policies and regulations, while also fostering international competitiveness through technology transfer and knowledge exchange. Encourage domestic market development and fair pricing mechanisms, while promoting collaboration and knowledge sharing among stakeholders. Regular monitoring and evaluation of interventions are suggested to gauge progress and impact on the downstream sector, thus empowering local entrepreneurs and promoting innovation in the copper industry's downstream activities.

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