Revitalizing Tanzania's Textile, Leather, and Sisal Industries

A Comprehensive Analysis, Challenges, and Sustainable Strategies for Growth

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ABSTRACT

This study examines Tanzania's leather, sisal, and textile industries amid the global shift towards sustainability and growing demand for natural fibres. The study employs a robust methodology, including a survey across 17 strategically chosen regions, addressing the critical issue of outdated industry data. The research unpacks the geographical, sectoral, and size-related dynamics of these industries, revealing concentrated clusters in the Eastern and Northern regions, with textiles dominating the Lake Zone. Analyses of skills and gender gaps provide insights into workforce capabilities and disparities, urging policy recommendations for region-specific strategies, vocational training, and diversity and inclusion policies. Raw material availability and quality challenges are explored, necessitating investment in modern farming practices and technology adoption. Sustainable waste management practices, crucial for industrial sustainability, are analysed, with the study recommending stringent regulations and incentives. Research needs aligning with national priorities emphasize technology adoption and productivity improvement. Variations in market growth potential globally, regionally, and locally necessitate tailored strategies. The manuscript concludes with recommendations for policymakers and industry stakeholders, advocating for collaborative initiatives, workforce training, and research on market dynamics and circular economy principles to ensure the long-term competitiveness, inclusivity, and sustainability of Tanzania's textile, leather, and sisal industries.

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CHAPTER ONE

INTRODUCTION

The global industrial landscape is undergoing a paradigm shift driven by heightened environmental consciousness and stringent regulatory frameworks, prompting industries to embrace sustainable and eco-friendly practices (Elseify et al., 2021; Maurya et al., 2022). As the world steers towards fossil-fuel-free products, the utilization of natural fibres such as cotton, leather, and sisal is gaining momentum (Dhir, 2022). The cotton, leather, and sisal sectors are emerging as focal points of transformation, with a growing preference for natural fibres over non-renewable resources in manufacturing (Singaraj et al., 2023). These fibres, known for their strength and biodegradability, have become attractive options in apparel and clothing industries globally (Leads, 2021; Nofal, 2023; Singaraj et al., 2023). Projections indicate that natural fibres are poised to constitute over 45% of worldwide sales in the foreseeable future, as reported by *Businesswire* in 2021.

According to Grand View Research of 2021, the global textile market was valued at USD 993.6 billion, with a compound annual growth rate (CAGR) of 4.0%. Key players include BSL Limited, INVISTA S.R.L., Lu Thai Textile Co., Ltd., Paramount Textile Limited, and Paulo de Oliveira, S.A. Similarly, the leather products market, valued at USD 407.92 billion in 2021, is anticipated to reach USD 743.50 billion by 2030. Major contributors to this market include Adidas AG, Nike, Inc., and Puma SE. Sisal, with a market worth of USD 1.27 billion in 2022, is projected to reach USD 1.97 billion by 2032, driven by companies like SFI Tanzania and Lanktrad GuangXi Sisal Group. The ascendancy of the textile, leather, and sisal industries is underpinned by various factors, including rising consumer disposable income, evolving fashion trends, and a global shift towards environmentally friendly materials. In response to this demand, industries are transitioning from synthetic fibres to biobased alternatives.

Tanzania's textile, leather, and sisal industries have played pivotal roles in the nation's industrial economy, leveraging abundant resources such as cotton, hides/skins, and sisal, making indispensable contributions to economic growth and development. Beyond their intrinsic role in providing essential products, these industries have served as catalysts for employment generation, fostering technological advancements, and facilitating global trade and commerce. The transformative impact of leather, sisal and textile industries on countries transitioning into manufacturing-led economies is particularly noteworthy, as they not only contribute significantly to GDP but also play a vital role in infrastructure development (Ruteri, 2023; Senkoro & Mkorongwe, 2018; Tsega et al., 2022). By intertwining with various facets of the economy, these industries stand as cornerstone elements in the trajectory of nations towards industrialization and economic prosperity.

Like other industries, the evolution of Tanzania's textile, leather, and sisal industries has been shaped by different phases of leadership, with policies ranging from import substitution to trade liberalization and sustainable industrial development (Msami & Wangwe, 2016). Several policies, acts, and regulations govern these industries, addressing taxation, environmental management,

investment promotion, and sector-specific concerns (Gray, 2013; Sansa, 2020). Tanzania, with its favourable climate, arable land, and abundant raw materials (USAID, 2022), stands at the cusp of becoming a significant source of textile, leather, and sisal products. Opportunities lie in local, regional, and global markets, and the government initiatives to stimulate industry growth (Lwesya, 2021; Tian et al., 2022; Walkenhorst, 2005).

However, despite historical growth and available growth opportunities, these industries face challenges and must adapt swiftly to global and regional economic dynamics (China et al., 2022; Muna, 2022; Ruteri, 2023). Historically prioritized for import substitution, Tanzania's textile and leather industries faced challenges after privatization in the mid-1980s, leading to the closure of many enterprises (Shrewsbury, 2007). Despite having the second-largest livestock population in Africa and being a leader in global cotton production, the industries currently produce leather only up to the wet blue stage and export 80% of raw cotton (Hira et al., 2022; Ruteri, 2023).

Limited exports for leather industry, ranging from $7 to $21 million in the past decade (Derick Msafiri, 2021), highlight the need for revitalization to meet domestic demand and tap into international trade opportunities. Introduced in 1893 by the Germany East Africa Company, sisal became Tanzania's "Green gold," reaching its peak as the world's largest exporter by 1961 (Kimaro et al., 1994). However, a decline occurred in 1967 due to the advent of cheaper synthetic nylon fibres (Beleko & Urassa, 2022). Efforts to revitalize these industries include government initiatives, strategic partnerships, and a focus on increasing cotton production (Coulson, 2016; Moses, 2016). The 1997 Sisal Industry Act and the creation of the Tanzania Sisal Board have stabilized the industry, with recent reports indicating a 176% increase in production from 22,180 tons to 61,216 tons between 1998 and 2024 (URT, 2025b).

Adding to all these historical challenges, these industries share one common challenge that makes the decision to revitalize them difficult. This is the outdated and inconsistent data pertaining to the three industries. This challenge has resulted in confusion among policymakers and development partners during decision-making processes, as the available data is neither up to date nor reliable. Consequently, this paper endeavours to address this critical issue by presenting the findings from a survey and analysis conducted in 2022 on the Tanzania textile, leather, and sisal industries. The objective is to provide updated and reliable data, fostering evidence-based decision-making in the strategic development plans for these industries. Through this initiative, the paper aims to contribute to the resolution of the data challenges and facilitate informed policymaking for the continued growth and development of these crucial industries.

CHAPTER TWO

METHODOLOGY

2.1. Study area

2.1.1. Geographic Context

This study was conducted in the United Republic of Tanzania, a country located in East Africa. Tanzania is renowned for its diverse economic activities, and this research focused specifically on regions where textile, leather, and sisal industries are prevalent. The 17 selected regions provide a representative cross-section of the country's industrial landscape. By focusing on these 17 regions, the study aims to provide insights into the specific challenges and opportunities faced by the textile, leather, and sisal industries within the context of diverse regional dynamics.

2.1.2. Selection of Regions

The choice of regions was based on the concentration and significance of textile, leather, and sisal industries. The selected regions are as follows:

i. Mara
ii. Geita
iii. Mwanza
iv. Simiyu
v. Shinyanga
vi. Tabora
vii. Singida
viii. Dodoma
ix. Morogoro
x. Pwani
xi. Dar es Salaam
xii. Tanga
xiii. Lindi
xiv. Mjini Magharibi (Zanzibar)
xv. Arusha
xvi. Kilimanjaro
xvii. Mbeya

These regions were strategically chosen to encompass a broad spectrum of economic, geographic, and cultural variations, ensuring a comprehensive understanding of the textile, leather, and sisal industries across Tanzania.

2.1.3. Relevance to National Economy

The chosen regions contribute significantly to Tanzania's economy, with the textile, leather, and sisal industries playing a crucial role in employment generation, export earnings, and overall economic growth. Understanding the importance of these industries in each region is paramount for informed policy decisions and sustainable development.

2.2. Data collection

2.2.1. Desk review

It was important to carryout desk review first to identify textile, leather and sisal industries registered in Tanzania, their locations and stakeholders. The sole aim of desk review was to generate the list of industries and their physical address for field survey. The review was based on the online websites of industries, reports, published articles and business licensing and regulatory authority's website. Only medium and large-scale industries were included in the list for field survey and mapping, because these industries have proven to be less volatile, (not easy to change unexpectedly and suddenly), as compared to micro and small industries.

2.2.2. Stakeholder Engagement

The consultation process involved in-depth interviews and discussions with key stakeholders. Representatives from relevant ministries, local government bodies, and industry associations were interviewed to gather insights into policy frameworks, regulatory environments, and industry challenges. This qualitative data enriched the overall understanding of industry dynamics.

2.2.3. Field survey

A comprehensive field survey was conducted on the medium and large textile, leather and sisal industries identified during desk review. Industrial characteristics data collected include company/ factory name, company registration number, number of employees (permanent and casual), physical address, geographical area/point (geospatial information and GPS coordinates), region, district, contact person, contact person phone, contact phone email, process operations category, source of raw materials, technology, production capacity, capital investment and markets. Data was collected through researcher-administered questionnaires and interviews. This approach was selected to ensure proper filling of the questionnaire and reduce data redundancy. Geospatial Information (GIS Data, specifically GPS coordinates) to show industries' locations were collected using special GPS Devices (GARMIN Etrex-10).

2.2.4. Ethical Considerations

Ethical guidelines were strictly adhered to throughout the research process. Informed consent was obtained from participating industries and stakeholders. Confidentiality of sensitive information was maintained, and the research adhered to the principles of integrity and respect for the rights of participants.

2.3. Data analysis

2.3.1. Data Validation and Quality Assurance

To ensure data reliability, a rigorous validation process was implemented. Data entry errors were minimized through double-entry verification, and consistency checks were performed to identify and rectify any discrepancies. Validation was also carried out through cross-referencing with external sources, such as regulatory bodies, to enhance data accuracy.

2.3.2. Data Analysis Techniques

Statistical analyses were conducted using SPSS and MS Excel to extract meaningful insights from the collected data. Descriptive statistics, such as mean, median, and standard deviation, were employed to summarize quantitative information. In addition, inferential statistics were used to identify correlations and trends within the dataset.

2.4. Limitations

It is important to acknowledge the limitations of the study. These may include potential biases in the data due to the exclusion of micro and small-scale industries, as well as any constraints encountered during the data collection process, such as time and resource limitations.

CHAPTER THREE

RESULTS AND DISCUSSION

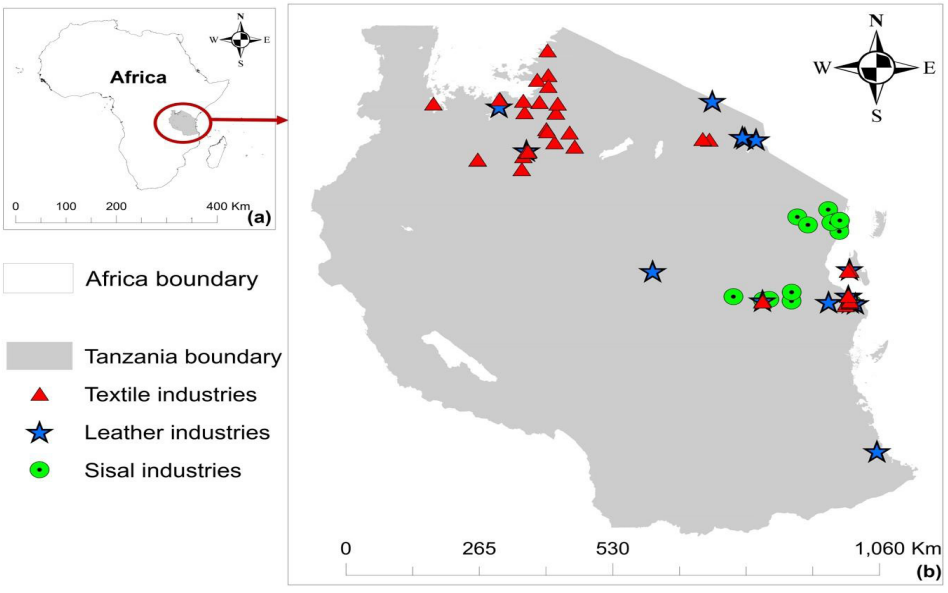
3.1. Industrial distribution

3.1.1. Spatial distribution

Figure 1 provides a comprehensive overview of the spatial distribution of textile, leather, and sisal industries in Tanzania, revealing a concentrated presence on the Eastern and Northern sides of the country. The textile sector is particularly prominent in the Lake Zone, a phenomenon attributed to the abundant cotton production in this region. Notably, a significant proportion of these textile industries are ginneries, located strategically in the cotton producing areas. However, a noteworthy observation emerges as textile and apparel industries appear to be clustered in the Northern and Eastern zones, presenting a geographical dispersion within the broader textile sector.

In the case of leather industries, their distribution appears sparser, predominantly located in the Northern and Eastern zones. This spatial pattern suggests a strategic consideration of factors influencing the leather industry's location, potentially tied to resource availability, market proximity, or other relevant considerations. Meanwhile, sisal industries exhibit a distinctive pattern, showing proximity and a more evenly distributed presence in the Northern and East zones.

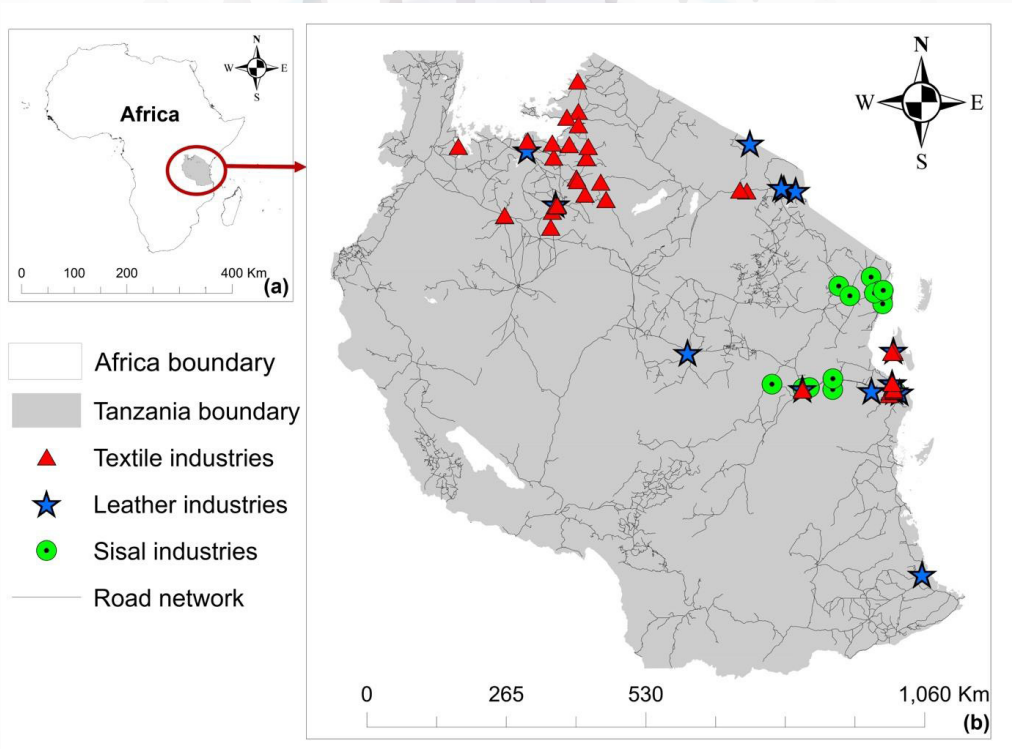
Figure 1: A Map Showing Spatial Distribution of Textile, Leather and Sisal Industries.



An essential factor influencing the spatial distribution of industries is the road network, as highlighted by Sohouenou (2022). Figure 2 underscores the significance of well-developed road networks in the areas where these industries are concentrated. The correlation between industrial locations and the quality of road infrastructure implies a strategic consideration of transportation logistics. A robust road network facilitates the mobility of raw materials and industrial goods, essential for the efficient functioning of these industries.

However, the presence of good road networks alone does not account for the entirety of industrial distribution. Some areas with favourable road networks lack corresponding industrial establishments. This observation suggests that the allocation of industries is a complex process, influenced by multifaceted factors beyond transportation infrastructure. Literature in the field underscores the importance of considering factors such as workforce availability, market access, and regulatory environments in addition to transportation networks when establishing industrial facilities (Haraguchi et al., 2019; Rahman & Kabir, 2019; Salimov & Arslanbekov).

Figure 2: Map Showing Road Networks in Relation to Location of the Textile, Leather and Sisal Industries



3.1.2. Sectoral distribution

The survey data in Table 1 show that the industrial landscape is characterized by a notable dominance of the textile sector, which commands a substantial 57.69% share of the overall distribution by sector. This industry encompasses various subcategories, with ginneries dominating the sector (57.78%). Textile manufacturing constitutes 22.22% and apparel manufacturing contributes 20.00%, signifying a diversified presence within the broader textile domain.

Simultaneously, the leather industry holds a significant position, comprising 20.51% of the total distribution. Within this sector, the distribution is diverse, with abattoirs leading at 43.75%, followed by tanneries at 18.75%, and leather product manufacturing at 37.50%. This diversity in contributions underscores the multifaceted nature of the leather industry in Tanzania.

The sisal industry, while constituting a share of 21.79%, showcases a clear focus on sisal decortication, which commands a substantial 58.82% of the overall distribution within the sector. Sisal spinning follows closely at 41.18%, emphasizing the importance of the processing of sisal fibres in the overall sisal industry.

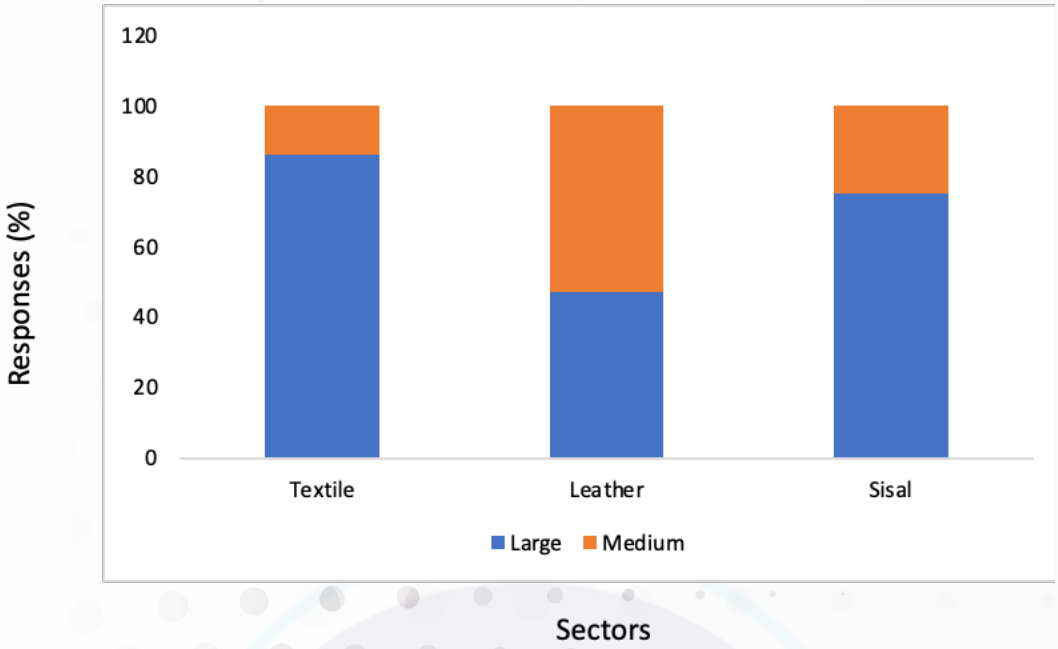
Table 1 Distribution of Textile, Leather and Sisal Industries by Sector

Distribution by sector (%)		Distribution by category (%)	
Textile	57.69	Ginnery	57.78
		Textile	22.22
		Apparel	20.00
Leather	20.51	Abattoir	43.75
		Tannery	18.75
		Leather products	37.50
Sisal	21.79	Sisal decortication	58.82
		Sisal spinning	41.18

3.1.3. Size dispersion

Based on the 2003 National SMEs policy, Tanzania's industries are classified into large, medium, small and micro. This survey examined textile, leather, and sisal industry distribution on large and medium scales only. According to the 2003 National SMEs Policy, capital investment and the number of employees were used to define the size of industries in this work. It was observed that each industry had major and medium-sized firms. Large firms make up 86% of the textile industry, followed by sisal (75%) and leather (50%) (Figure *3*).

Figure 3: Distribution of Textile, Leather and Sisal Industries by Size



3.2. Employment

In the context of developing nations, the significance of employment cannot be overstated, as it holds a pivotal position in shaping both economic advancement and social development (Haworth & Hughes, 2012; Wray, 2009). A sustainable and quality job is essential for financial independence, stability, and living a standard life (Auer, 2006; Egger, 2003; Frey, 2018). Therefore, to achieve and increase its economy, a country must develop effective policies and strategies that enable industries to absorb most of the market's labour force. This study examined how textile, leather, and sisal industries absorb market labour. With reference to the SDGs' Tanzania Human Development Dimensions (HDDs), the study sought to determine the number of employed Tanzanians, their employment status (permanent, casual, expatriate), skill level, and gender. These factors are important for the government to assess labour market inequalities, gender disparity, skills demand, and, most significantly, labour force contractual permanence (a crucial issue in a country with Industrial Development as its top priority) (Lauwo et al., 2022).

3.2.1. Employment by region

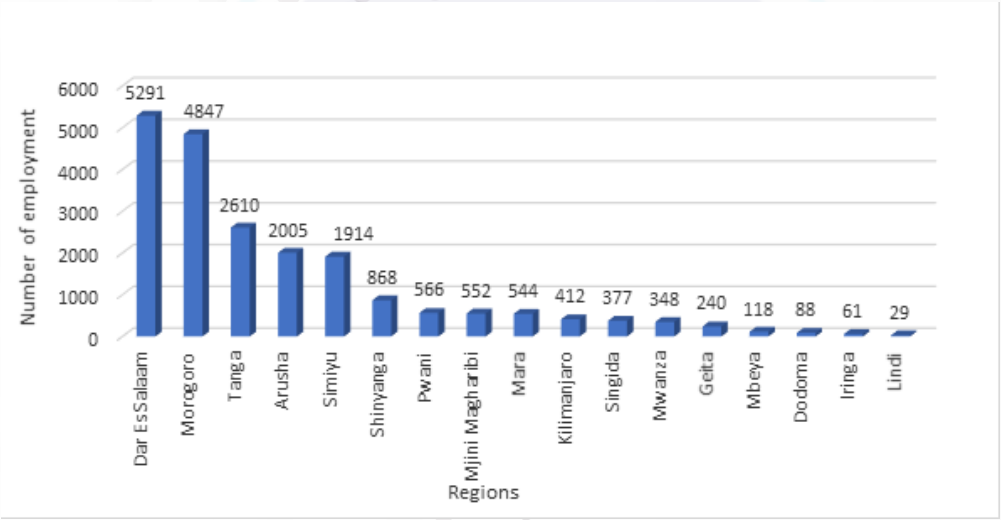
The distribution of employed individuals across various regions offers valuable insights into the regional dynamics of employment in the surveyed areas (Fig. 4). Some regions serve as key hubs for specific industries. Dar es salaam stands out with the highest number of employed people in the textile, leather and sisal industries, totalling 5,291.

This observation reflects the fact that Dar es Salaam is positioned as the economic and commercial hub of Tanzania with many industries and business along textile, leather and sisal industries. The city's status as a major centre for trade, finance, and various industries contributes to its attraction for a significant labour force. Morogoro is also leading after Dar es salaam in employing many people in textile, leather and sisal industries. Morogoro's prominence in employment may be attributed to various factors, such as its geographical location, economic activities, and the concentration of textile, leather and sisal industries.

Tanga and Arusha follow closely with 2,610 and 2,005 employed individuals, respectively. These regions are characterized by diverse economic activities, including agriculture, tourism, or manufacturing and it is concentrated with the textile and sisal industries. Economic diversification is a crucial factor in promoting stable employment across various sectors, contributing to regional development.

Other regions such as Lindi and Dodoma exhibit lower employment figures, with 29 and 88 individuals employed, respectively. These regions may experience unique challenges or opportunities that influence their employment landscapes. Studies on regional development could provide insights into the factors contributing to employment variations among these regions.

Figure 4. Distribution of employment



3.2.2. Employment by nationality

The data in Table 2 provides a comprehensive overview of employment based on nationality and sectors in the given context. Examining the nationality-wise distribution, Tanzanians play a dominant role across all sectors, representing 98.84% of the total employment. Foreign workers, in contrast, contribute minimally, constituting only 1.16% of the workforce. According to Ngaisah (2023), hiring foreign workers brings innovations, transfer new skills, new talents, and new knowledge from foreign countries already on track to improve the industrial performance.

Since the proportion of foreign workforce in Tanzania textile, leather and textile industries is minimal, there is a need to review work related policies to attract foreign workers from strategically selected countries in the relevant industries for improving its performance.

Table 2: Employment by nationality and sector

Sector	Tanzanians	Foreigners	Total	Percentage of Tanzanians Employed in Sector
Textile	13,875	218	14,093	98.45
Sisal	5,459	19	5,478	99.65
Leather	1,294	5	1,299	99.62
Total	20,628	242	20,870	98.84
Percentage	98.84	1.16	100	

3.2.3. Employment status by Contract type

The data presented in Table 2 offers an important perspective on the employment landscape within surveyed industries, delineating the number of persons employed based on contract types—permanent, casual, and expatriate—across different sectors. The distribution of contract types reveals a substantial commitment to long-term employment relationships, with 64.56% of the total workforce classified as permanent. This suggests stability and continuity in the labour force within the surveyed industries. In contrast, 34.28% of the workforce is engaged on a casual basis, indicative of a reliance on flexible and temporary employment arrangements. Expatriates constitute a relatively small fraction, accounting for 1.16% of the total employment, emphasizing a primary reliance on domestic labour.

Sector-wise examination unravels distinct employment compositions. The textile industry stands out with a predominant share of permanent jobs (79% of sector employment), aligning with the observation that textile activities often demand a more skilled and semi-skilled workforce.

In contrast, both leather and sisal employ regressively lower proportions of permanent workers at 49% and 36% respectively, highlighting a significant reliance on casual labourers. This may suggest a more seasonal or fluctuating demand for labour in the two processing industries.

Table 3: Employment by contract type

	Permanent		Casual		Total
	Quantity	**% of Sector Employment**	**Quantity**	**% of Sector**	
Textile	11089	79%	3004	21%	14093
Sisal	1992	36%	3486	64%	5478
Leather	634	49%	665	51%	1299

Source: Authors' Own

3.2.4. Employment by size

The study further examined employment by contract in the lenses of industries' size as displayed in Table 4. Large industries within surveyed textile, leather and sisal sectors in Tanzania emerge as the primary contributors to employment, employing 20,167 individuals. Within this category, the workforce is predominantly composed of permanent and casual employees, with expatriates (all of whom are permanent employees) representing a minimal percentage (1%). Similar to their larger counterparts, medium-sized enterprises exhibit a prevalence of permanent and casual employment, with only a minor representation of expatriates.

Table 4: employment by size

Size	Permanent	Casual	Expatriate	Total
Large	13,027	6,905	235	20,167
Medium	424	190	5	619
Total	13,451	7,095	242	20,788
Percentage	65%	34%	1%	100

3.3. Skills Gap Analysis

Skill gap is the qualitative mismatch between the supply or availability of human resources and the requirements of the labour market. Skills gaps exist where employers feel that their existing workforce have inadequate skill types and levels to meet their business objectives or where new entrants to the labour market are apparently trained and qualified for occupations but still lack a variety of the skills required (Říhová & Strietska-Ilina, 2015)

Tanzania is a youthful country. According to the National Bureau of Statistics', about 47.5% of Tanzanian population is aged between 10-35 (URT, 2025a) . This is a resourceful population with much potential to the country's industrial growth. The youth group has a unique opportunity to aspiring Tanzania's industrialized economy which is driven by the development of sectors such as agri-business and agro processing (Agwanda, 2014). Despite the opportunity, a large group of youth do not possess enough and relevant skills for the country's industrialization development. Evidence ascertains that approximately only 10% of the workforce were employed in the formal sector, the rest are unemployed due to, among others, the inability of the educational and training system to produce appropriate skills for employability and self-employment (Forum, 2020; NACTE, 2020).

3.3.1. Skill gap by region

The data on the skill gap in the textile, leather, and sisal sectors across various Tanzanian regions (Figure 5) provides valuable insights into the regional disparities in workforce capabilities. This analysis sheds light on the implications and potential policy considerations. Regions such as Arusha, Kilimanjaro, Singida, Dodoma, Iringa, and Dar es Salaam exhibit a surplus of skilled workers, as indicated by positive values ranging from 63 to 478.

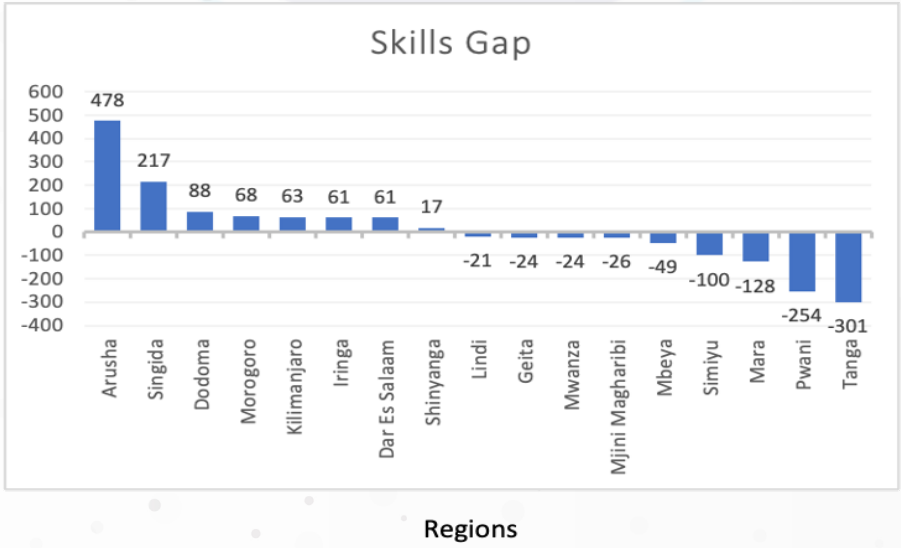
This surplus suggests a potential advantage for these regions in attracting and sustaining industries in the specified sectors. However, caution is warranted, as a surplus might also signal underutilization of skilled labour resources, which aligns with literature emphasizing the importance of efficiently matching skill supply with demand (Valiente et al., 2020).

Conversely, Tanga, Simiyu, Pwani, Mara, Mwanza, Geita, Mbeya, Lindi and Mjini Magharibi face a skill deficit, with negative values ranging from -301 to -24. This shortage indicates a challenge in meeting the demand for skilled workers, potentially hindering the growth of industries in these regions. Existing literature on labour market dynamics highlights the critical role of education and training in addressing skill gaps and promoting economic development, underscoring the need for targeted interventions (Horton, 2018; Mishra et al., 2019; Urquía-Grande & Perez Estebanez, 2020).

The disparities observed in the skill gap can mostly be attributed to the availability of educational institutions. Currently, Tanzania has few universities and technical institutes offering courses on textile, leather industries and none offers programmes related to sisal industry. In addition, most of the time the curricula don't support the achievement of the required skills in the labour market of these three industries. This situation creates skill shortages as identified.

In terms of policy considerations, the findings call for region-specific strategies. Policymakers should explore initiatives such as investing in vocational training programmes, fostering collaboration between industries and educational institutions, and providing incentives for businesses to establish in regions facing skill deficits. This aligns with the literature advocating for tailored policies that address the unique challenges and opportunities presented by different regions (Koettl et al., 2015; Říhová & Strietska-Ilina, 2015; Unni, 2016).

Figure 5. Skill gap by region



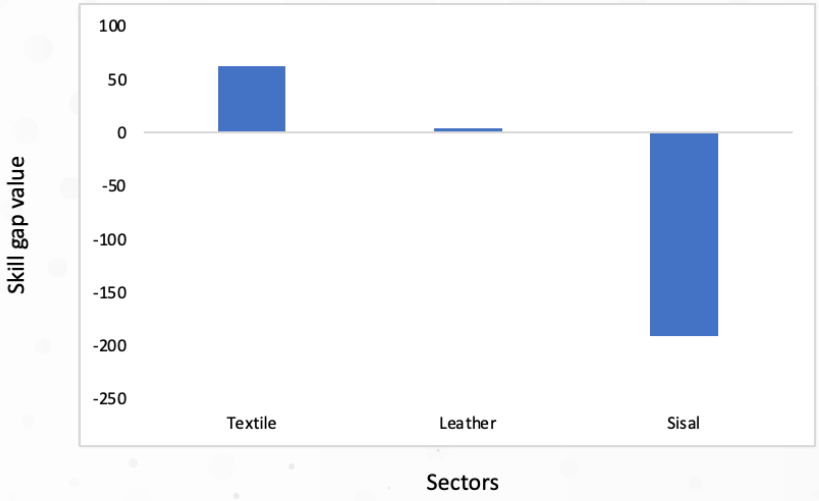
3.3.2. Skill gap by industry sector

The data provided in figure 6 offers a glimpse into the skill gap landscape within the textile, leather, and sisal sectors across surveyed industries. This analysis provides insights into the potential implications and policy considerations arising from the observed data. In the textile sector, there exists a surplus of skilled workers, indicative of a situation where the demand for skills is not fully met. This surplus, while presenting an opportunity for expansion, also raises questions about the optimal utilization of skilled labour resources. The leather sector, with a smaller surplus of skilled workers, reflects a more balanced scenario where the supply of skilled labour is closer to meeting industry demands. However, this surplus may still suggest opportunities for further optimization and growth. Research by Valiente et al. (2020) highlights the importance of continuously assessing skill supply and demand to ensure industry competitiveness. In contrast, the sisal sector faces a significant deficit of skilled workers. This deficit implies a shortage of skills critical for the growth and development of the industry. Addressing such skill gaps is paramount for sustained industry productivity and competitiveness.

Policymakers and industry stakeholders should consider sector-specific strategies to bridge skill gaps. In the sisal sector, for instance, investing in vocational training programmes, fostering partnerships with educational institutions, and offering incentives to attract skilled workers could be instrumental. This aligns with the findings of studies such as those by Corradini et al. (2023), emphasizing the role of targeted policies in addressing industry-specific skill challenges.

Monitoring and addressing skill gaps in specific sectors contribute not only to the immediate productivity of industries but also to their long-term sustainability. Industries with surpluses may need strategies for optimal resource utilization, while those with deficits should prioritize attracting and developing the necessary skills for growth and competitiveness. This aligns with the broader literature on workforce development, which underscores the significance of aligning skills with industry needs for economic prosperity (Madonsela, 2022; Panagiotopoulos & Karanikola, 2017).

Figure 6: skill gap by sector

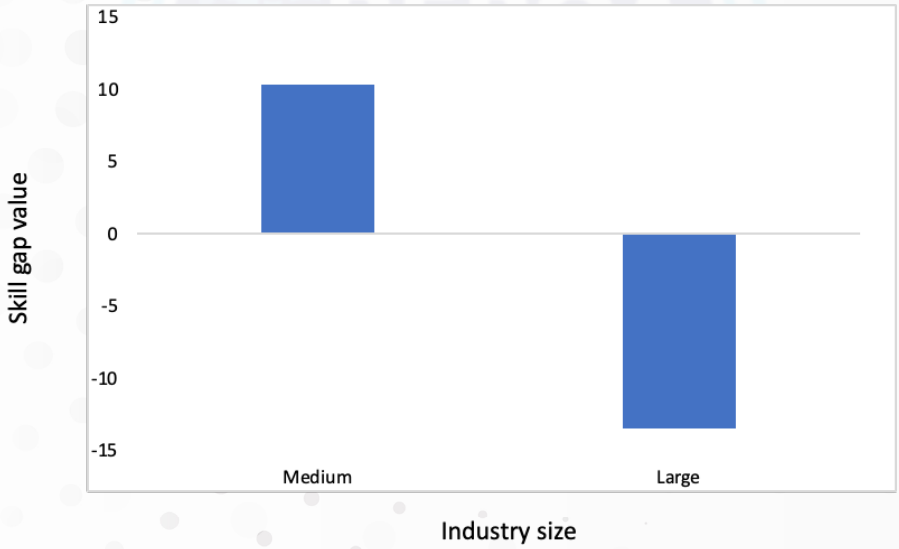


3.3.3. Skill gap by industrial size

The results for skill gap by industry size are presented in Figure 7. In medium-sized industries, a surplus of skilled workers is observed. This positive balance implies that these enterprises, on average, have a slightly higher supply of skilled labour than the demand in the specified sectors. Such a surplus can be seen as a positive indicator, potentially signalling a conducive environment for skill development and utilization within medium-sized enterprises. As highlighted by Yusnandar et al. (2019), maintaining a surplus of skilled workers can contribute to innovation, productivity, and overall competitiveness in the industry. Conversely, large industries face a deficit of skilled workers, indicating a shortage in the availability of skilled labour. This deficit raises concerns about the ability of larger enterprises in the textile, leather, and sisal sectors to attract and retain skilled talent. As discussed in previous studies (Morris et al., 2020; Tan et al., 2016), a skill deficit in large industries can hinder their optimal functioning and growth, impacting overall economic competitiveness.

Policy considerations must consider the unique challenges faced by different-sized enterprises. For large industries, strategic interventions are crucial. Investments in training programmes, collaboration with educational institutions, and incentives to attract skilled workers could help bridge the skill gap. Tailored policies should be designed to address the specific needs of large industries in fostering a skilled workforce.

Figure 7: skill gap by industry size



3.4. Gender Gap Analysis

The gender gap, denoting disparities between men and women across various life aspects such as income, education, health, and politics, is a focal point of concern (Kynclova, 2023; Quaye et al., 2019).

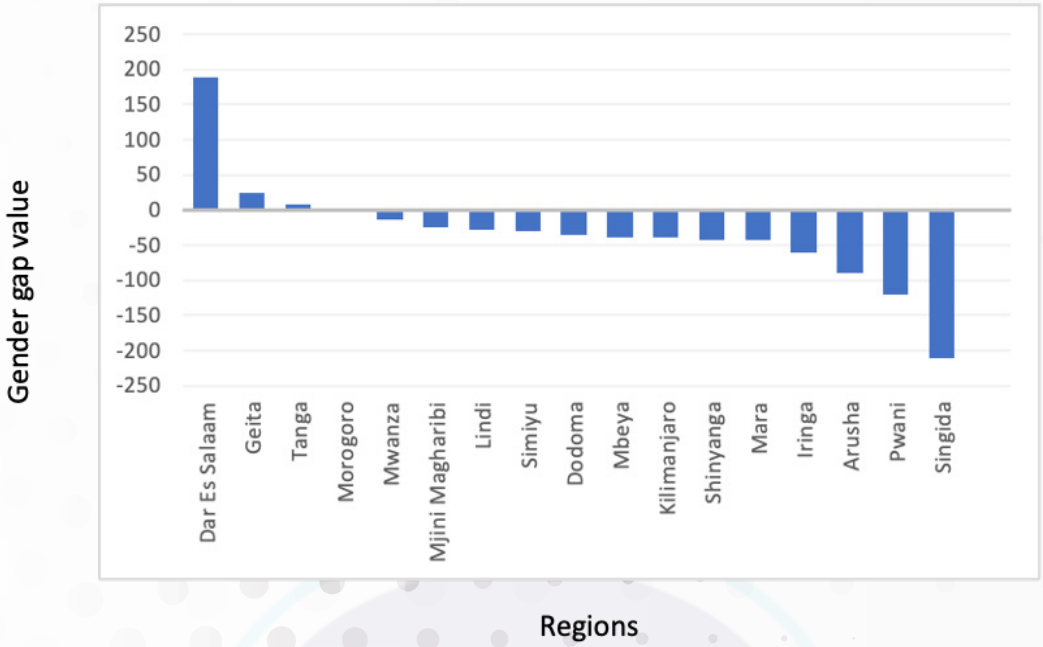
According to the World Economic Forum's 2021 Global Gender Gap Report, the gender gap in Economic Participation and Opportunity stands out as the second largest among four key gaps areas, namely, Economic Participation and Opportunity, Educational Attainment, Health and Survival, and Political Empowerment (Mundial, 2021). In places with a high concentration of industries, sectors requiring educated workers and companies requiring professionals to operate sophisticated machinery, the gender gap analysis will likely appear. Addressing gender inequalities in industry and harnessing women's full potential as leaders and economic agents of change and thereby transforming economies and generating inclusive growth requires reliable data and statistics (Kynclova, 2023). This survey compared the number of men and women textile, leather and sisal workers in the surveyed regions to get the insights of the gender gap for informing policy on initiatives to close gender in the industrial sector.

3.4.1. Gender gap by region

The data on the gender gap in the textile, leather, and sisal sectors across various Tanzanian regions presented in Figure 8 offers an important perspective on employment distribution, revealing distinct disparities between male and female workers in various regions of Tanzania. Dar es Salaam, Geita, and Tanga emerge as regions with a surplus of male workers, indicating a notable preponderance of male employment in the specified sectors. The economic dynamism of urban centres like Dar es Salaam may contribute to the observed male surplus, reflecting trends of gender-based occupational segregation.

Conversely, the majority of regions, including Morogoro, Mwanza, Mjini Magharibi, Lindi, Simiyu, Dodoma, Mbeya, Kilimanjaro, Shinyanga, Mara, Iringa, Arusha, Pwani, and Singida, demonstrate a surplus of female workers. The prevalence of a surplus of female workers in these regions may be attributed to several interconnected factors. One potential influencer is the dominance of specific industries, particularly textile and leather, which traditionally attract a higher number of female workers due to the nature of activities such as sewing and garment production (Bose et al., 2012; Mukhopadhyay, 2019). In In addition, the historical gender norms, cultural preferences, and societal expectations may guide occupational choices, steering women towards industries considered more suitable (Adya & Kaiser, 2005). The regional variations in the gender gap underscore the need for a context-specific understanding of social, economic, and cultural factors shaping employment dynamics. Policies addressing gender imbalances should consider the unique regional contexts to be effective and sustainable.

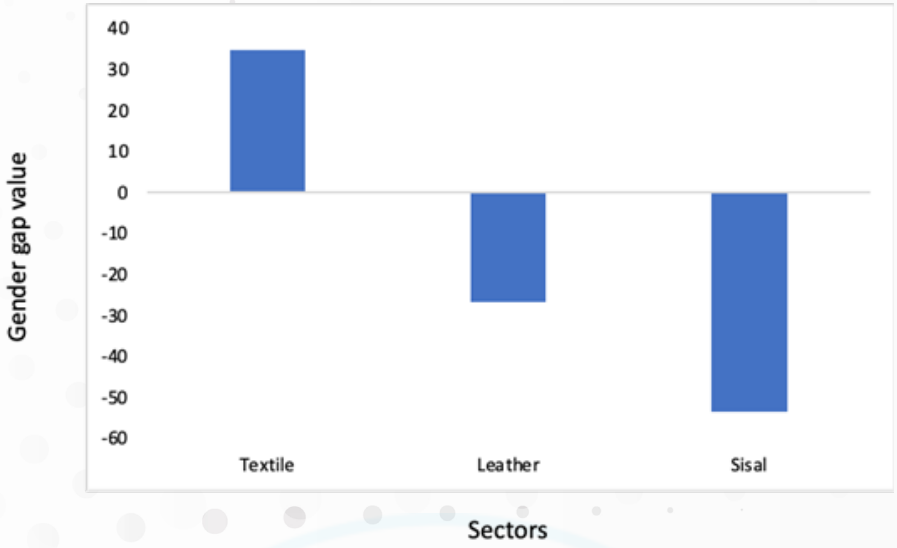
Figure 8: gender gap by region



3.4.2. Gender gap by sector

The examination of gender gaps across three prominent sectors—textile, leather, and sisal—reveals distinctive patterns of disparity between men and women within these industries (Fig. 9). In the textile sector, a positive gender gap points to a concentration of men, suggesting potential imbalances in roles or leadership positions. The leather sector on the other hand displays a negative gender gap, indicating a favouring of women in this industry, possibly reflecting a predominant female workforce or concentration in specific roles. The sisal sector exhibits a substantial negative gender gap as well, signalling a notable favouring of women. Understanding the dynamics of these gender gaps is pivotal for crafting tailored strategies that promote equality, challenge stereotypes, and ensure fair opportunities for career advancement within the respective sectors. Such initiatives can contribute to cultivating inclusive and diverse workplaces across these industries.

Figure 9: gender gap by sector

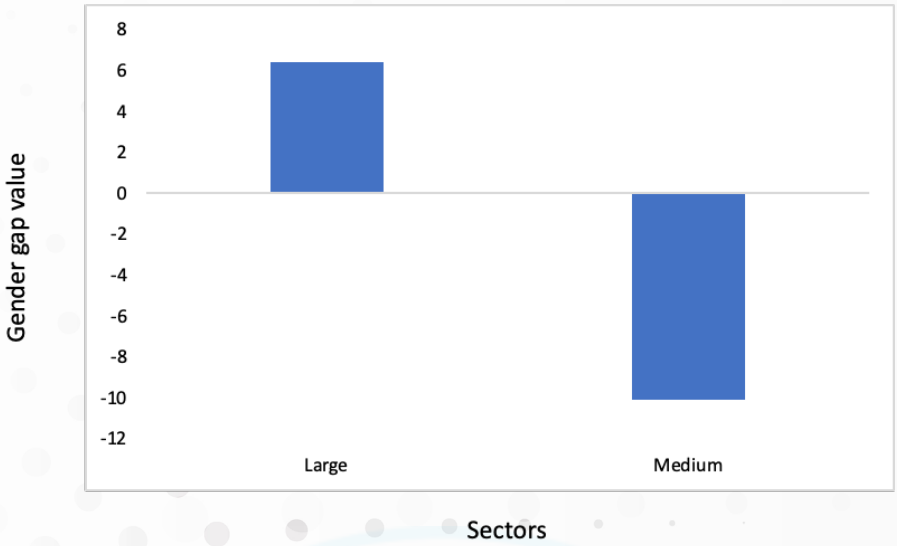


3.4.3. Gender gap by size

The analysis of gender gaps in different industry sizes reveals distinct patterns in gender representation (Fig. 10). In larger industries, characterized by a positive gap, men appear to have a relative advantage in terms of workforce representation than in medium industries that show a negative gap. This could be indicative of historical biases, entrenched occupational segregation, or specific challenges that hinder women's participation in larger industrial settings. According to Hartmann (1976), higher paying jobs are dominated by male. For this case it is most likely that men's domination in large industries might be because large industries pay more salaries than medium industries, that directly attracts more men than women as observed in the results. To address this imbalance, targeted policies fostering diversity and inclusion may prove instrumental in ensuring equal opportunities for both genders within larger industries.

Conversely, medium-sized industries exhibit a contrasting scenario with a negative gap, implying a higher representation of women compared to men. This phenomenon may be influenced by various factors, including the nature of work, skill requirements, or deliberate efforts to promote gender inclusivity. Understanding the unique dynamics of medium-sized industries is pivotal for designing interventions that leverage the existing gender balance and create a supportive and equitable work environment.

Figure 10: gender gap by industry size



3.4.4. Raw Materials availability and accessibility

In industrial processes, raw materials serve as the building blocks for transforming inputs into finished goods. This foundational role extends beyond mere production, impacting economic growth and job creation. Abundant and diverse raw materials not only fuel industries but also contribute significantly to employment opportunities, forming a cornerstone of economic development (Van Dam et al., 2005).

The data on textile, leather, and sisal production across different regions in Tanzania, as indicated in Figure 11, provides valuable insights into the availability and accessibility of raw materials in these key industries. Simiyu emerges as a significant contributor to the textile sector, followed closely by Shinyanga. Dar es Salaam and Mjini Magharibi also play notable roles. In the leather industry, Dar es Salaam takes the lead, while Shinyanga, Kilimanjaro, and Simiyu also contribute, albeit to a lesser extent. Sisal production is concentrated in Tanga, followed by Pwani and Morogoro.

The data reflects regional specialization, with certain areas excelling in specific industries. Simiyu stands out in textiles, Dar es Salaam in leather, and Tanga in sisal. The finding is in alignment with the fact that Simiyu and Tanga are currently leading in production of cotton and sisal, respectively. Dar es Salaam's emergency as a leader in supply of raw materials for leather is due to the presence of large abattoir (Vingunguti), which supply hides and skins for leather industries. Moreover, most of related industrial inputs are outsourced from Dar es Salaam, including those imported through the port. However, the limited diversification in some regions highlights opportunities for collaboration and resource-sharing to enhance overall industrial diversity and resilience. Regions with untapped potential could explore strategies for industry development, recognizing the economic benefits associated with a diversified industrial landscape. This understanding of regional dynamics is crucial for informed policymaking, fostering industry growth, and promoting balanced development across Tanzania.

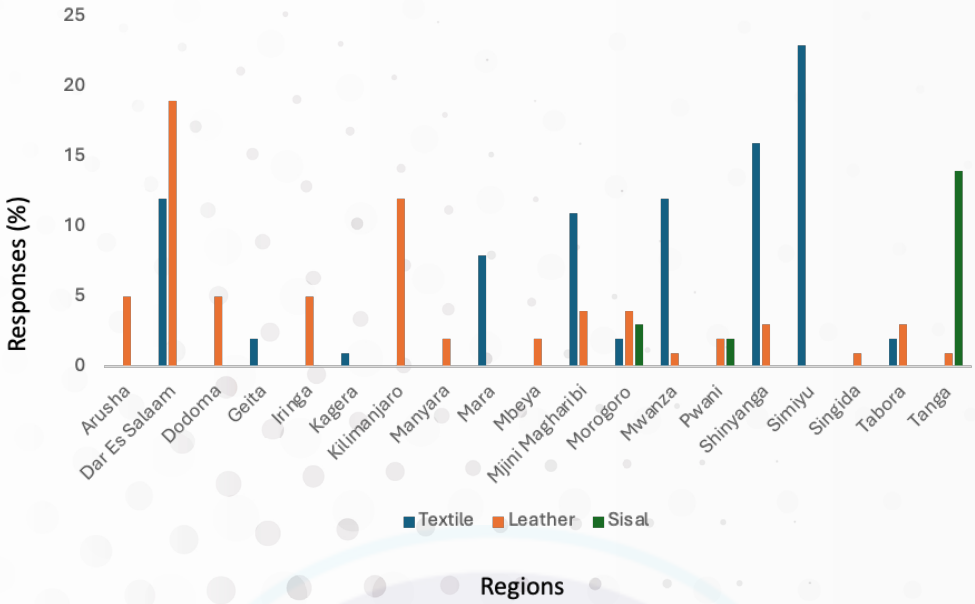
Despite the abundant availability of raw materials for the textile, leather, and sisal industries across various regions in Tanzania, the quality of these inputs poses a significant challenge. In the leather industry, primary raw materials, namely hides and skins, exhibit defects attributed to poor animal husbandry practices, the absence of modern flaying equipment, and the involvement of unskilled flayers. Similarly, the textile industry faces quality concerns, particularly with cotton fibres, as farmers resort to misconduct by purposefully adding sand to increase weight, aiming for higher profits in the market. This compromise in quality reflects systemic issues in agricultural practices. The persistence of such challenges underscores the need for comprehensive interventions in the Tanzanian textile, leather, and sisal industries to enhance the quality of raw materials, ultimately promoting the overall sustainability and competitiveness of these vital sectors.

Notwithstanding inherent quality challenges in the supply chains in the textile, leather, and sisal industries in Tanzania, numerous opportunities exist for improvement in the supply chain. A crucial avenue involves investing in modern farming practices, encompassing sustainable cultivation methods for cotton, hides, and sisal. The adoption of advanced technologies, particularly in animal keeping and abattoirs, can mitigate defects in hides and skins caused by poor animal husbandry practices and the use of outdated flaying equipment. Research and development initiatives offer the prospect of discovering improved varieties of cotton and sisal, resistant to common issues[1], thereby enhancing the quality of raw materials in these industries.

Capacity building and training programmes for farmers and other stakeholders present opportunities to enhance skills and implement best practices, contributing to improved raw material quality. Establishing quality assurance programmes, public-private partnerships, and market incentives for high-quality products can further encourage adherence to standards. In In addition, exploring alternative sources of raw materials and promoting eco-friendly practices aligns with global trends and fosters sustainability. Government support through policies incentivizing quality improvements and providing subsidies for modern equipment can create a conducive environment for elevating raw material standards. In essence, addressing raw material quality challenges presents a pathway for positive transformations, contributing to the overall competitiveness and sustainability of the Tanzanian textile, leather, and sisal industries.

[1] Includes tearing resistance, durability, and improvement of microbial resistance which are crucial for meeting the growing demands of customers for long-lasting performance and reliability in leather products.

Figure 11: raw materials availability and accessibility



3.5. Research Needs

Research improves industrial performance and economic development. Research gives industries new technologies and better methods to compete. This section explores topics that need more research to find answers that will improve Tanzania's leather, textile, and sisal industries. It facilitates innovation and inventions, leading to improving quality of manufacturing and updating existing technologies (Hosono, 2022; Khan, 2015).

3.5.1. Research needs by sector

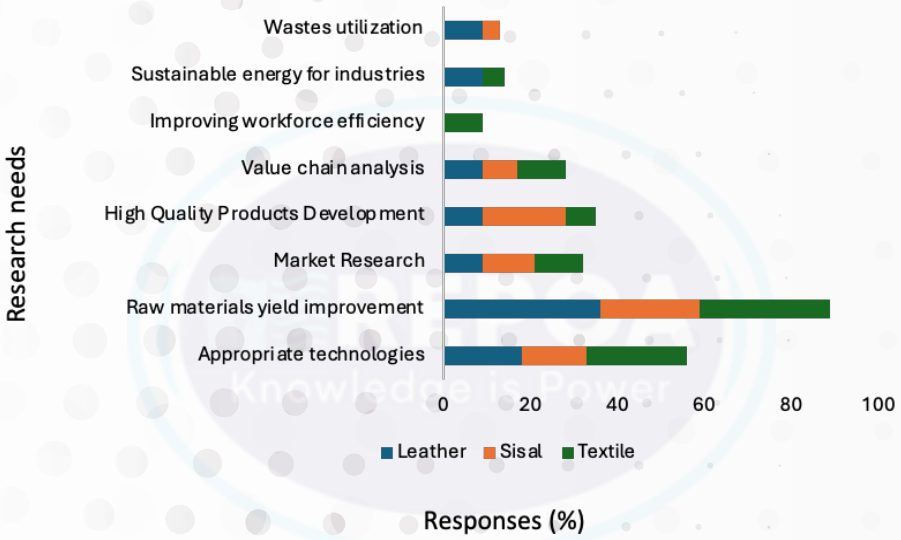
The research needs across Tanzania's textile, leather, and sisal industries, as indicated in Figure 12, underscore distinctive priorities within each sector. In the textile industry, while waste utilization is not currently a focus, there is a notable interest in sustainable energy solutions (5%) and a strong emphasis on improving yield (30%). Value chain analysis (11%) and market research (11%) are recognized as crucial, revealing a strategic approach towards understanding and optimizing production and market dynamics. High-quality product development (7%) also holds significance.

In the leather industry places a considerable emphasis on waste utilization (9%), sustainable energy solutions (9%), and improving workforce efficiency (9%). Yield improvement stands out as a top priority (36%), reflecting a strong commitment to enhancing productivity. Like textiles, value chain analysis (9%) and market research (9%) are deemed essential, along with a focus on high-quality product development (9%).

In the sisal industry, there is a modest interest in waste utilization (4%), and value chain analysis (9%) is considered important. High-quality product development emerges as a top priority (19%), showcasing a significant commitment to improving product standards. Market research (12%) and yield improvement (23%) also feature prominently on the research agenda.

While there are shared priorities, such as value chain analysis and market research, the sector-specific emphasis on aspects like waste utilization in leather, yield improvement in textiles, and high-quality product development in sisal reflects the challenges and opportunities unique to each industry. These identified research needs signal avenues for focused exploration, innovation, and strategic development to foster sustainable growth within Tanzania's textile, leather, and sisal sectors.

Figure 12: research needs by sector



3.5.2. Research needs by size

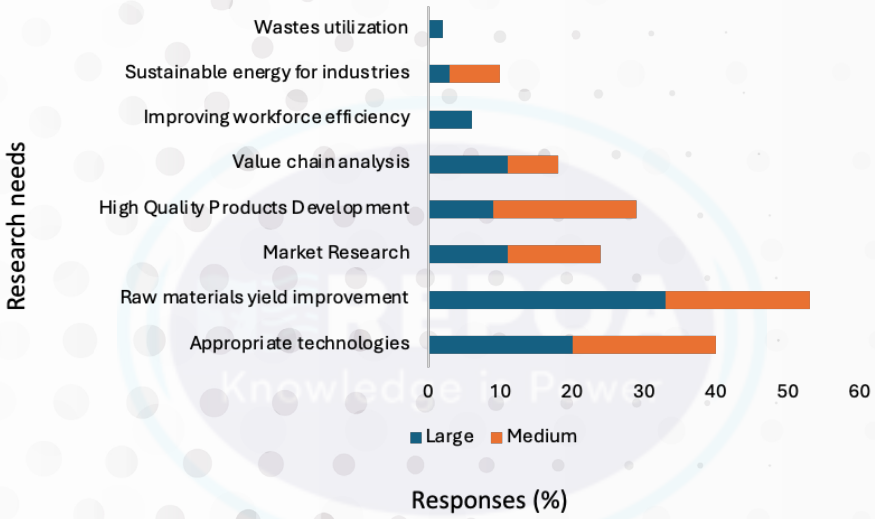
The research needs within large and medium-sized industries, as delineated in Figure 13, illuminate distinct priorities and strategic focuses within each category. In large industries, waste utilization emerges as a moderate priority (3%), reflecting an acknowledgment of the importance of sustainable waste management practices. Notably, there is a modest interest in sustainable energy solutions (4%) and a strong commitment to improving workforce efficiency (7%). Large industries also prioritize value chain analysis (10%), high-quality product development (9%), market research (10%), yield improvement (32%), and the adoption of appropriate technologies (20%).

Conversely, medium-sized industries currently do not emphasize waste utilization (0%), suggesting potential avenues for exploration in sustainable waste management practices. Notably, there is a significant interest in sustainable energy solutions (8%) and high-quality product development (19%), showcasing a commitment to environmental sustainability and product excellence.

Market research (22%) stands out as a crucial priority, emphasizing a strategic focus on understanding market dynamics and consumer preferences. Like large industries, medium-sized industries prioritize yield improvement (20%) and the adoption of appropriate technologies (20%).

While both large and medium-sized industries share common priorities such as yield improvement and high-quality product development, differences exist. Large industries place a higher emphasis on waste utilization, improving workforce efficiency, and value chain analysis, reflecting a more comprehensive approach to production processes. In contrast, medium-sized industries exhibit a heightened focus on market research, emphasizing a strong market orientation. These insights provide valuable guidance for tailored research and development initiatives, ensuring that strategic efforts align with the specific needs and priorities of large and medium-sized industrial sectors.

Figure 13: research needs by size



3.5.3. Matching identified research needs with the 2021-2025 National Research Priorities

The alignment between research needs identified in the surveyed textile, leather, and sisal industries and the 2021-2025 national research priorities, as shown in Table 5, reveals a cohesive agenda that spans critical facets of industrial development. The emphasis on appropriate technologies signifies a shared commitment to adopting advanced and suitable innovations within the surveyed industries and aligns seamlessly with the broader national drive for technological advancement. In addition, Further, the focus on raw materials yield improvement echoes a mutual interest in enhancing productivity and output, underscoring the significance of increasing efficiency in these key sectors, both at the industry-specific and national levels.

Market research emerges as a common priority, reflecting a shared recognition of the paramount importance of understanding market dynamics and consumer preferences. This synergy between industry-specific and national priorities highlights a strategic approach to decision-making and planning that incorporates a deep understanding of market trends. Furthermore, the joint emphasis

on high-quality product development and value chain analysis underscores a commitment to ensuring excellence in product offerings and optimizing the entire production and distribution process.

While most research needs align with national priorities, the divergence in emphasis on improving workforce efficiency at the industry level suggests a potential area for further exploration and discussion. Overall, this harmonization in research priorities signifies a concerted effort towards sustainable and technologically driven development in the textile, leather, and sisal industries, contributing to the overarching national goals of economic growth and innovation.

Table 5: national research priorities matching with identified research needs

Research priorities	Matching	Reference page
Appropriate technologies	1	21
Raw materials yield improvement	1	25
Market Research	1	20
High-Quality Products Development	1	20
Value chain analysis	1	20
Improving workforce efficiency	0	-
Sustainable energy for industries	1	18
Wastes utilization	1	21

3.5.4. The emerging research needs and their significance

In addition to research needs identified by surveyed industries, there are a number of emerging research needs that are important for sustainability. Sustainability takes centre stage, demanding exploration into eco-friendly materials and processes, such as bio-based and recycled alternatives, while also assessing the environmental impact of manufacturing techniques. The integration of technology into textiles, with a focus on smart fabrics and wearables, presents new avenues for functionality and connectivity.

Digitalization, including the adoption of Industry 4.0 technologies, emerges as a key research area to streamline production processes and enhance efficiency. Circular economy principles become imperative to minimize waste, urging investigations into innovative recycling methods and closed-loop systems. Sustainable and cruelty-free leather alternatives, bioengineered through plant-based or synthetic materials, demand exploration. Supply chain transparency and ethical practices, as well as enhanced processing techniques for sisal, round out the crucial areas of research. Addressing these needs is paramount for ensuring the industries' long-term sustainability, fostering innovation, and meeting the demands of an evolving global market.

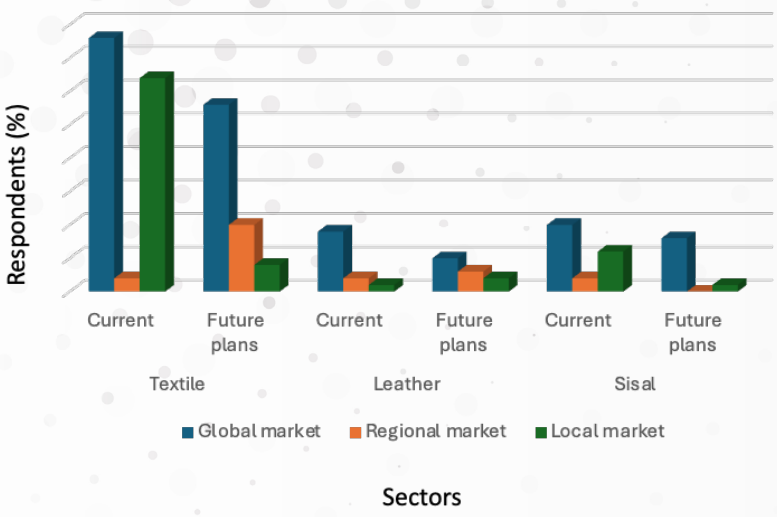
3.5.5. Market Growth Potential Opportunities

The market growth potential for the textile, leather, and sisal industries reveals nuanced trajectories across global, regional, and local markets (Fig. 14). In the global landscape, the textile industry currently commands a substantial market growth potential of 80%, with a modest decline anticipated to 75% in the future. In contrast, the leather industry, holding a noteworthy 25% global market growth potential, anticipates a slight reduction to 18%. The sisal industry, with a more modest 28% global market growth potential, foresees a marginal decrease to 22%. These variations indicate diverse challenges and opportunities on the global stage.

Regionally, the textile industry exhibits a significant growth potential, with its market share projected to rise from 10% to 28%. In contrast, the leather industry anticipates a decline from 15% to 13%, suggesting a need for strategic measures to navigate regional challenges. The sisal industry faces a substantial reduction from 12% to 5% in regional market share, signalling potential challenges that require adaptive strategies. The anticipated fall in regional opportunities might be contributed by the regional trade blocs' challenges such as lack of industrial capacity, high cost of doing business, slow implementation of agreements, and lack of private sector participation, geographical proximity, and presence of institutional frameworks (Tanyanyiwa & Hakuna, 2014).

At the local level, the textile industry, currently holding a dominant 70% market share, projects a noteworthy decline to 15%, indicating shifts in consumer preferences or competitive factors. The domestic market is flooded with imported fashion textiles, which are of great preference by consumers as domestic industries have failed to keep pace with innovations in products and processes reflective of evolving consumer preferences (Ben Shepherd, 2019). Similarly, the leather industry expects a moderate increase from 10% to 12% in the local market, while the sisal industry foresees a substantial reduction from 20% to 10%. These local market dynamics emphasize the importance of tailored strategies to address evolving consumer trends.

Figure 14: Market growth potential opportunities



3.5.6. Waste Management

Environmental management is one of three pillars of industrial sustainability. (Schoenherr, 2012). It is indispensable for industries as it ensures sustainable practices, regulatory compliance, and corporate responsibility (Adae et al., 2021; Sendawula et al., 2021). By minimizing environmental impact, industries contribute to resource conservation, reduce emissions, and enhance overall efficiency. Beyond compliance, effective environmental management enhances brand image, attracts environmentally conscious consumers and investors, and positions industries for long-term market resilience (Chen et al., 2016).

Waste disposal practices in Tanzania Textile, leather and sisal industries has remained to be challenge. Industries are still relying on outdated methods of disposing wastes such as landfilling and indiscriminate dumping, which pose environmental risks, particularly with hazardous materials like chromium-containing leather waste (Bidu et al., 2021; China et al., 2022; Yhdego, 2015). The industries face the critical task of transitioning to recommended disposal methods, emphasizing waste segregation for recovery and reuse, to align with environmental regulations and mitigate the impact of carcinogenic substances present in leather waste, as outlined in The Environmental Management Act of 2004.

3.5.7. Wastes Management by Sector

The data on waste management methods employed by surveyed industries in the textile, leather, and sisal sectors displayed in the Figure 15 provides a comprehensive snapshot of current practices in these industries. In the textile sector, 29% of industries prioritize recycling and reuse as their primary waste management method. This signifies a commendable commitment to sustainable practices (Barbir & Dabić, 2024; Pronti & Zoboli, 2024). However, 52% of industries resort to dumping, a method that raises environmental concerns due to potential pollution and health hazards (Ali et al., 2014; Dong et al., 2023). In addition, 16% textile industries rely on landfilling, which is somehow better than dumpling as disposal of waste on the piece of land is regulated by the government. Although it provides a regulated framework for waste disposal, the environmental implications associated with landfilling underscore the importance of exploring more sustainable alternatives in the textile sector. (Iqbal et al., 2021; Khasawneh et al., 2021; Malek & Shaaban, 2008; Vaverková, 2019).

Comparatively, the leather industry exhibits a higher inclination towards sustainable practices than the textile sector, providing valuable insights for policymakers aiming to enhance waste management strategies across diverse industries. The data reveals a substantial commitment to sustainable waste management practices, with 45% of surveyed industries prioritizing recycling and reuse. This emphasis aligns with the growing environmental awareness within the leather industry (Kanagaraj et al., 2015; Karuppiah et al., 2023; Maliha et al., 2023). While 39% still engage in dumping, a lower proportion compared to the textile sector, challenges persist, emphasizing the need for eco-friendly practices. In addition, 17% of leather industries employ landfilling, indicating

a nuanced waste management landscape within the sector. This finding, despite the overall sustainability focus, underscores the importance of comprehensive approaches to minimize the ecological footprint of leather industries.

Within the sisal sector, the data presents an encouraging picture of sustainable waste management practices. Notably, 41% of surveyed industries prioritize recycling and reuse, demonstrating a commitment to eco-friendly methods. This emphasis aligns with global efforts to reduce the environmental impact of industrial waste (Sharma et al., 2022; Singh et al., 2014). However, it's crucial to note that 17% of sisal industries resort to dumping, revealing a substantial portion still engaging in environmentally detrimental practices. The prevalence of dumping in the sisal sector underscores the need for a more comprehensive shift towards sustainable waste disposal methods. In comparison to both the textile and leather sectors, the sisal industry exhibits a commendable commitment to recycling and reuse, but the presence of dumping indicates room for improvement in achieving holistic sustainable waste management practices. Policymakers can draw insights from the sisal sector's successes and challenges to formulate strategies that promote environmentally conscious waste management practices across various industries.

Generally, the data underscore the need for greater emphasis on sustainable waste management practices in the textile sector, where dumping and landfilling are more prevalent. Policymakers should take note of the variations among sectors and consider implementing incentives for industries to adopt environmentally friendly practices, drawing from successful strategies observed in the leather and sisal sectors.

Figure 15: methods of waste management by sector



3.5.8. Waste management by size

Figure 16 presents the data on waste management methods practiced in large and medium scale industries. The waste management methods for large and small scales, with a particular focus on

sisal, reveal insightful trends in environmental practices. In the realm of recycling and reuse, both large and small-scale operations demonstrate a balanced commitment, each allocating 50% to this environmentally friendly method. Notably, sisal waste receives special attention with a substantial 41%, indicating a concerted effort to maximize recycling and reuse for this specific material.

However, a cause for concern emerges in the realm of dumping, especially on a larger scale, where a staggering 60% of waste finds its way into uncontrolled disposal. This emphasizes the need for heightened measures to curb indiscriminate dumping, as it poses environmental risks and undermines sustainable waste management practices. On a positive note, the sisal waste dumping percentage is comparatively lower at 17%, suggesting a more responsible disposal approach for this particular material.

Landfilling, a method associated with environmental degradation, is utilized to a lesser extent. Large-scale operations allocate 20% of waste to landfills, while small-scale operations allocate 10%. Remarkably, sisal waste shows a complete avoidance of landfilling, emphasizing a conscious effort to steer clear of environmentally detrimental practices for this specific type of waste.

Figure 16: Methods of waste management by industry size



3.6. Strategies for sustainable waste management

Sustainable waste management is imperative for mitigating environmental impact, and several key strategies can contribute to this goal. Initiatives to reduce and reuse waste, including minimizing disposable items and designing products for durability, are fundamental (Petzet & Heilmeyer, 2012). The promotion of comprehensive recycling programmes, coupled with public awareness campaigns, encourage responsible waste disposal practices (Bohm et al., 2010; Domina & Koch, 2002). Composting organic waste is essential for diverting biodegradable materials from landfills and creating nutrient-rich compost (Singha & Singha, 2024).

The exploration of waste-to-energy technologies contributes to energy recovery from non-recyclable waste (Dadario et al., 2023; Gatto, 2023; Nanda et al., 2023). Extended Producer Responsibility (EPR) programmes and circular economy principles emphasize product lifecycle considerations and recyclability (Ezeudu, 2024; Shooshtarian et al., 2021; Vermeulen & Campbell-Johnston, 2024).

Green public procurement policies, community engagement, innovation, and robust legislation further support sustainable waste management, creating a comprehensive framework for environmental responsibility and resource conservation (Hu et al., 2024; Rawat & Raju, 2024; Sönnichsen & Clement, 2020).

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CHAPTER FOUR
CONCLUSION AND RECOMMENDATIONS

4.1. Conclusion

The study presents a comprehensive analysis of Tanzania's textile, leather, and sisal industries, uncovering key findings crucial for policymakers, stakeholders, and researchers. The textile sector emerges as a significant contributor to employment, particularly for Tanzanians, while the leather industry displays a more equitable distribution of jobs. However, the sisal sector faces challenges with lower employment percentages. Gender gap analysis reveals sector-specific patterns, emphasizing the need for tailored interventions to promote workplace equality. Raw material availability varies regionally, and addressing quality issues requires investment in modern farming practices and technology adoption.

Waste management practices, though showing a commitment to recycling, highlight some challenges, especially in the textile sector. Research needs align with national priorities, emphasizing technology adoption and productivity improvement. Market growth potential varies globally, regionally, and locally, necessitating tailored strategies. Environmental management challenges, particularly in outdated waste disposal methods, underscore the importance of sustainable practices for industry resilience. Overall, the study underscores the need for sector-specific and region-specific interventions to foster economic development, address skills gap and gender equality, raw material quality improvement, sustainable waste management and environmental sustainability in Tanzania's textile, leather, and sisal industries.

The implications of the study for Tanzania's textile, leather, and sisal industries are multifaceted. Economically, the significant role of the textile sector in providing employment underscores the need for sustained development initiatives. The equitable job distribution in the leather industry suggests opportunities for balanced economic growth. However, challenges in the sisal industry's employment rates call for targeted interventions. Socially, gender gap patterns emphasize the importance of fostering inclusive workplaces through policies promoting gender equality. Regional employment disparities point to the necessity of tailored regional strategies for social development. Environmentally, outdated waste disposal methods in the textile sector necessitate a shift towards sustainable practices. The prevalence of dumping and landfilling in larger industries signals the need for stricter regulations. Quality challenges in raw materials underscore the importance of technology adoption. Aligning research needs with national priorities emphasizes the role of innovation in industry development. Market growth variations highlight the need for adaptive strategies.

4.2. Recommendations

This study underscores the need for a coordinated and forward-looking policy and institutional framework to enhance sustainability, productivity, and inclusivity across the relevant sectors. First, policymakers should prioritize the implementation of stringent regulatory measures alongside targeted incentives to promote sustainable waste management practices. Particular emphasis should be placed on encouraging recycling and reuse, which are critical for reducing environmental degradation and improving resource efficiency.

In parallel, there is a pressing need to design and enforce gender-responsive policies that ensure equal opportunities for men and women, especially in leadership and decision-making roles. Addressing regional disparities is equally important; tailored, region-specific interventions are necessary to reduce employment imbalances and stimulate economic growth in areas with lower job creation and productivity levels.

At the industry level, stakeholders should actively embrace technological innovation to improve production efficiency and enhance product quality. However, such adoption must be supported by an enabling policy environment that provides adequate incentives, infrastructure, and technical support. Complementing this, investment in workforce training programmes is essential to build a skilled, adaptable, and competitive labour force. Strengthening collaboration among industry actors can further facilitate knowledge exchange, resource sharing, and collective resilience in the face of economic and environmental challenges.

Looking ahead, future research should focus on tracking evolving market dynamics, undertaking comprehensive environmental impact assessments, and identifying strategies to improve the quality and sustainability of raw materials. In particular, exploring the feasibility and practical benefits of adopting circular economy principles within the textile, leather, and sisal industries offers significant potential for minimizing waste, enhancing sustainability, and accelerating the transition to greener production systems.

Finally, fostering collaborative initiatives, such as public–private partnerships and stronger industry associations, will be critical for pooling resources, sharing expertise, and addressing common challenges. Such partnerships can also play a vital role in advocating for and shaping policies that support long-term sustainable development.

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