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**Contribution of Air Transport on Improving the Livelihood of the small-scale business  
A Case of Fish Market in Mwanza city, Tanzania**

By

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**Abstract**

**Purpose:** This study examined the contribution of the transport sector pecifically air transport toward improving the livelihoods of small-scale fish business operators. It focused on assessing the influence of airport infrastructure on market access, evaluating the effect of airport accessibility on income levels, and determining the role of airport operations in generating employment opportunities.

**Design/Methodology/Approach:** A cross-sectional research design was employed. A total of 167 fish processors were selected using purposive and simple random sampling techniques. Data were analyzed using descriptive statistics and logistic regression to explore the relationship between airport infrastructure, accessibility, and livelihood outcomes.

**Findings:** The results indicated that 65.3% of fish processors had access to cold storage facilities, improving product preservation and quality, while 71.3% reported that cold-chain services facilitated access to new markets. Additionally, 73.1% stated that airport-linked buyers offered higher prices than local markets. Logistic regression findings revealed that fishing experience exceeding five years ( $p = 0.002$ ;  $OR = 22.261$ ), airport accessibility ( $p < 0.001$ ;  $OR = 0.03$ ), government or NGO support ( $p = 0.029$ ;  $OR = 0.25$ ), and increased job opportunities arising from airport operations ( $p < 0.001$ ;  $OR = 0.10$ ) significantly influenced improved livelihoods. Gender, age, and education were not significant predictors.

**Originality/Value:** This study provides empirical evidence on how air transport infrastructure and operations an understudied area in fisheries livelihood research directly enhance market expansion, income opportunities, and employment among small-scale fish processors.

**Practical Implications:** The study highlights the need to strengthen airport infrastructure, improve accessibility, and enhance financial and technical support systems for small-scale fish processors. These efforts can boost income stability, market competitiveness, and value-chain efficiency within the fisheries sector.

**Social Implications:** Improved airport operations and accessibility can reduce poverty, promote equitable market participation, and create more employment opportunities, thus contributing to sustainable community development in fishing areas.

**Keywords:** Airport infrastructure; Market access; Fisheries livelihoods; Air transport; Small-scale fish processors; Logistic regression; Income improvement; Employment opportunities.

**1.0 INTRODUCTION**

The transport sector has experienced substantial transformations over the past decades, driven by globalization, technological advancement, and policy reforms aimed at enhancing mobility and economic integration. Globally, transport systems have evolved from traditional road and rail infrastructure to include more integrated, efficient, and diverse modes of movement (Rodrigue, 2024).

Innovations such as digital tracking, intermodal logistics, and sustainable transport solutions have contributed to the sector’s dynamism, enabling faster and more reliable connections between production and consumption centres (World Bank, 2017). In developing regions, transport has been central to unlocking economic opportunities by improving access to markets, social services, and employment (UNCTAD, 2021). Transport sector especially air transport is recognized as a

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critical driver of economic development globally, providing essential connectivity for fishermen (Zhang & Graham, 2020).

In the cargo sector, air transport is particularly important for high-value, perishable, or time-sensitive goods such as fresh fish, pharmaceuticals, electronics, and agricultural products. The industry supports global supply chains by providing fast, reliable, and secure movement of goods, which traditional land or sea transport cannot achieve within the same timeframe (Button, 2010). Efficient air transport infrastructure, including airports, cargo terminals, and cold-chain facilities, directly influences the competitiveness of businesses and access to international markets. Consequently, air transport facilitates economic diversification and provides opportunities for small and medium enterprises to expand their operations beyond local markets.

In developing nations, the majority of processors are women, who play a central role in household income and nutrition, while men are often involved in fishing and transport operations (Béné et al., 2016). Small-scale processors typically operate with limited capital, minimal mechanization, and constrained access to modern technology, which affects their productivity and the quality of products reaching the market (Mbilinyi & He, 2017).

The livelihoods of small-scale fish processors are often characterized by vulnerability and uncertainty. Factors such as seasonal fluctuations in fish availability, poor market access, lack of cold storage facilities, and limited transportation infrastructure constrain income stability (Afoakwa et al., 2018).

Additionally, processors face challenges related to inadequate financial services, insufficient technical training, and limited institutional support, which impede their ability to scale operations or access higher-value markets. Despite these constraints, small-scale fish processors remain resilient by diversifying income sources, adopting traditional preservation methods, and participating in informal market networks (Béné et al., 2016; FAO, 2020).

Infrastructure development, particularly in transport and storage systems, is increasingly recognized as a key factor in enhancing the livelihoods of small-scale processors. Improved roads, cold-chain facilities, and access to air transport can reduce post-harvest losses, improve product quality, and expand access to distant and higher-paying markets (Mwansasu & Maleko, 2023). Furthermore, institutional support from governments and non-governmental organizations (NGOs) through training, credit provision, and market linkages can strengthen the capacity of small-scale processors to increase income, secure employment, and achieve more sustainable livelihoods (Afoakwa et al., 2018). Overall, understanding the livelihood dynamics of small-scale fish processors is essential for designing policies and interventions that enhance economic resilience and food security in developing countries.

Also, small-scale fish processing remains a vital livelihood activity in many developing countries, especially in sub-

Saharan Africa where women make up the majority of processors. Through drying, smoking, salting, and filleting, small-scale fish processors add value to fresh fish, enhance food security, and support household income stability. Their contribution to rural and lake-based economies has been widely recognized as essential for nutrition and economic resilience (FAO, 2020; Lokina & Ntamba, 2022).

Fish products are highly perishable, and the ability to maintain freshness significantly influences market value. Weak road transport, long travel distances, and unreliable cold chains often increase post-harvest losses. Air transport infrastructure offers faster movement of fresh and chilled fish, thereby reducing spoilage and increasing access to high-value domestic and export markets. Studies show that improved aviation logistics, including cold storage and perishables handling, are central to ensuring competitive supply chains for fish and seafood products (IATA, 2021; Njaya, 2023).

Similarly, in Tanzania, airports facilitate the transportation of fish and fish products to international markets such as Europe and the Middle East (Busungu, 2022). In recent years, the Tanzanian government, with support from development partners such as the OPEC Fund for International Development, has initiated the Airport Expansion Project, which includes the construction of a new terminal, runway upgrades, and improved cold storage facilities (OPEC Fund, 2023). The goal is to improve cargo handling efficiency, reduce logistical bottlenecks, and stimulate economic activity in the region (Guasch, 2022).

Regardless of the development of air transport in Tanzania, there is limited empirical research that explores at what extent airports impact the livelihoods of the community. In particular, it remains unclear at what extent the airport has influenced market access, income levels, and employment opportunities in the community (Stevens et al., 2014). These aspects are vital for understanding the socio-economic benefits of transport infrastructure beyond passenger services (Abdul Quyum, 2019). Moreover, understanding these linkages is important for guiding investment and policy decisions aimed at strengthening the fisheries sector and improving rural livelihoods (Stacey et al., 2021). Despite substantial literature on small-scale fish processing livelihoods, very limited research integrates air transport infrastructure as a determinant of livelihood outcomes, indicating a clear gap addressed by this study

### 1.1 Specific Objectives

To examine the extent to which cold chain logistics facilitates access to fish markets for small-scale business in Mwanza.

### 1.2 Definition of Key Terms

- i. **Small-Scale fish processor:** This includes individuals who process fish on a small scale, usually for local or small export markets, often facing limited access to resources (Mbilinyi & He, 2017).
- ii. **Livelihood:** Livelihood refers to the capabilities, assets (including both tangible and intangible resources), and activities required for a person or

community to make a living. In this study, it particularly refers to how fishing communities sustain and improve their standard of living through access to resources such as markets, income-generating opportunities, and infrastructure especially air transport services provided by airport (DFID, 1999).

- iii. **Infrastructure:** is the set of facilities and systems that serve a country, city, or other area, and encompasses the services and facilities necessary for its economy, households and firms to function. Hard infrastructure: physical systems needed for operation. Soft infrastructure: institutions needed for operations. Critical infrastructure: hard or soft infrastructures critical to operations (Buhr, 2003).

## 2.0 LITERATURE REVIEW

### 2.1 Theoretical Literature Review

The current study utilized the sustainable livelihoods framework theory in explaining the contributions of the air transport to the livelihood of small scale fish processors. The review of the theory and its justification in analyzing the contributions of the air transport to the livelihood of small scale fish processors is explained in the following subsection.

#### 2.1.1 Sustainable Livelihoods Framework (SLF)

The Sustainable Livelihoods Framework (SLF), developed by the UK Department for International Development (DFID, 1999), provides a holistic, people-centered approach to understanding how individuals and communities sustain and improve their well-being. The framework is based on the assumption that people require access to five types of capital human, natural, physical, financial, and social to pursue strategies that lead to desirable livelihood outcomes such as increased income, reduced vulnerability, enhanced food security, and sustainable resource use.

It assumes that people are central to development processes, that their livelihoods are dynamic and responsive to external trends, shocks, and seasonal factors, and that institutions and policies significantly shape access to and control over these capitals. Furthermore, the framework posits that achieving sustainable livelihoods goes beyond income generation and includes resilience, equity, and environmental sustainability.

In this study, the SLF is used to analyse the extent to which air transport infrastructure contributes to the improvement of livelihoods among fishing communities. The airport is viewed as a crucial component of physical capital that enhances connectivity to domestic and international markets, reduces post-harvest losses, and creates income-generating opportunities.

The presence of efficient air transport is also linked to improved financial capital through access to high-value markets, which increases the earnings of fishermen and small-scale processors. Moreover, the framework facilitates the examination of how institutional structures and policy interventions influence the community's ability to benefit

from this infrastructure. It supports an understanding of how fishing communities adapt to new market dynamics, diversify income sources, and reduce their dependence on seasonally unstable local markets.

However, the SLF also has certain limitations. It can be complex to apply empirically, particularly when trying to measure and relate all five capitals within a single study. The framework may underemphasize structural barriers such as market monopolies, trade regulations, or unequal power relations that affect access to livelihood resources.

Additionally, it assumes that improvements in capital access automatically led to better outcomes, which may not always be the case in practice.

#### 2.1.2 Limitations of the Sustainable Livelihoods Framework (SLF)

Despite its usefulness in understanding livelihood systems, the Sustainable Livelihoods Framework (SLF) has several conceptual and practical limitations. One major limitation is that the framework tends to oversimplify complex social, cultural, and political interactions by categorizing them into asset "capitals," which may not fully capture the realities of marginalized groups such as small-scale fish processors (Scoones, 1998; DFID, 1999). The framework assumes that these assets are uniformly understood and accessible, yet in many contexts, individuals experience unequal access due to gender roles, social norms, or power imbalances. As a result, the SLF may overlook the nuanced ways in which cultural practices, institutional discrimination, and community hierarchies shape people's livelihood strategies and outcomes (Bebbington, 1999).

A second major limitation is the framework's insufficient attention to structural and macro-level factors. While SLF acknowledges vulnerability and institutional processes, it does not adequately integrate broader political economy dynamics such as market fluctuations, trade policies, corruption, or climate-related governance issues, all of which heavily affect livelihood sustainability in fisheries (De Haan & Zoomers, 2005). For example, small-scale fish processors often face unstable market prices, limited bargaining power, and policy changes that restrict access to resources—factors that exceed the micro-level focus of SLF.

The framework's emphasis on individual and household resilience may unintentionally shift attention away from systemic barriers that require structural reforms rather than asset-based interventions.

## 2.2 Empirical Literature Review

### 2.2.1 Market Access

Access to markets is a crucial factor in the economic prosperity of small-scale producers, particularly those involved in perishable products like fish. Numerous studies indicate that air transport infrastructure significantly enhances market access efficiency and broadens the geographic scope for small producers.

Jabati (2023) examined how air transport affects agricultural markets in rural Africa and discovered that areas with operational airports experienced a 30% rise in market access for perishable goods, especially fish. The research found that airports decreased travel times and spoilage rates, enabling fish producers to access more profitable markets.

Raihan et al. (2024) carried out a study on regional airports and their impact on seafood export performance in South Asia. The findings showed that air transportation enhanced the freshness of seafood items and contributed to a 22% rise in export quantities. This was primarily due to quicker delivery times, enhanced packaging technologies, and the capacity to uphold cold-chain logistics during the shipping process. The authors observed that access to air cargo services has enabled small-scale fishers and processors to penetrate previously unreachable export markets, enhancing their income and business sustainability.

In Tanzania, Lupindu (2016) highlighted the importance of Julius Nyerere International Airport in promoting fish exports from Lake Victoria. The research showed that fish products sent via the airport can arrive in European markets within 24–36 hours post-harvesting, minimizing spoilage and boosting profits.

However, most of these studies focused on general agricultural exports or broad fisheries markets and did not specifically examine how airport-based cold-chain systems influence market access for small-scale fish processors, which this study addresses.

### 2.2.2 Income Levels

Airport infrastructure facilitates market access and directly influences the earnings of small-scale producers.

Kipkemboi and Handa (2023) evaluated how Kisumu International Airport affected the incomes of local fishers in Kenya and found that fishers who used the airport for exporting fish to European markets experienced a 28% rise in their earnings. The presence of export pathways led to increased demand and elevated prices for their fish, particularly Nile perch and tilapia. The research indicated that fishers transitioned from conventional drying and smoking methods to exporting chilled and fresh fish, which fetched better prices.

Reports by REPOA (2022) have indicated that Mwanza Airport affects the earnings of fishers in Tanzania, suggesting that enhancements to its infrastructure could lead to a substantial increase in income for those fishing near Lake Victoria. Quicker and more dependable transportation alternatives would decrease spoilage and enable fishers to market their products in high-end markets. These results highlight the essential connection between infrastructure and income production in communities reliant on fisheries.

The capacity to utilize air transport, especially quick and refrigerated logistics, is crucial in deciding if small-scale producers can access high-value markets and achieve higher prices for their goods.

Despite these findings, existing studies do not clearly demonstrate how airport accessibility directly affects the income levels of small-scale fish processors, leaving a gap that the present study seeks to fill.

### 2.2.3 Employment Opportunities.

The impact of Airport development on job creation is a widely recognized field of study. Airports are labour-heavy venues that generate jobs in aviation, logistics, security, and hospitality industries. Additionally, they create indirect employment in related sectors like fish processing, packaging, storage, and transportation. Adeleke and Adebayo (2015) examined the employment multiplier effect of new airports in West Africa and discovered that each direct airport job generated 2.5 additional jobs in associated sectors, particularly in fisheries, agriculture, and logistics.

In Tanzania, Lupindu (2016) observed that the growth of JNIA stimulated the establishment of fish processing and cold storage facilities, creating employment opportunities for numerous youth and women. Despite being smaller, Mwanza Airport's closeness to fishing communities in the Lake Victoria area offers significant potential for comparable job opportunities. Mteki et al. (2017) stated that enhancements in air transport in the Lake Victoria region would foster job growth in both formal and informal employment sectors, particularly for at-risk communities.

REPOA (2022) likewise anticipated that enhancing Mwanza Airport would facilitate temporary jobs in construction and permanent jobs in the supply chain particularly in cold storage, packaging, cargo logistics, and export compliance services.

Nevertheless, most reviewed studies analyze airport operations at national or regional levels, with limited attention to how such operations create employment specifically for small-scale fish processors, which this research investigates.

### 2.2.4 Airport Infrastructures

Airport infrastructure plays a crucial role in facilitating trade and improving the efficiency of small-scale businesses, particularly those involved in perishable and export-oriented goods.

Cargo handling facilities are component influencing airport performance and trade efficiency. Efficient cargo terminals equipped with modern handling systems reduce delays, minimize product damage, and enhance the competitiveness of exporters (Mwangi & Wanjohi, 2019).

According to the International Air Transport Association (2022), streamlined cargo operations at airports increase throughput capacity and improve service reliability, thus supporting both large and small-scale enterprises engaged in international trade.

Lastly, flight frequency and cargo routes are vital in determining the accessibility and timeliness of goods delivery. Frequent flights and diversified cargo routes improve connectivity between production regions and global markets,

which in turn increases trade volume and enhances business opportunities (ICAO, 2022).

Hence, the efficiency of airport-related logistics services significantly contributes to improving livelihoods and promoting sustainable economic development.

### 2.2.5 Accessibility of the airport

Accessibility of airports has been identified as a major driver of local economic development and livelihood improvement, particularly for small-scale businesses. Improved airport accessibility reduces travel time and transportation costs, making it easier for traders to reach broader markets and access essential logistics services (World Bank, 2021).

Empirical studies show that airport-induced business growth leads to higher demand for goods and services, resulting in improved household income and livelihood standards for local communities (Kibona & Mjema, 2022). Therefore, improved airport accessibility contributes significantly to employment creation, income generation, and the overall economic well-being of small-scale business operators.

While prior research links airport accessibility to business growth in general terms, little is known about how improved airport access influences income stability and financial outcomes among small-scale fish processors, which forms a key focus of this study.

### 2.2.5. Airport Operations

Airport operations play a critical role in regional economic development, job creation, and the transformation of local livelihood systems. Airports are recognized as economic multipliers because they generate direct, indirect, and induced employment opportunities (Dimitriou & Sartzetaki, 2022). Direct employment arises from airport authorities, airlines, security services, and ground-handling agents. Indirect employment emerges from supply chains, including logistics, catering, transportation, construction, and retail services. Induced employment results from the spending of airport workers within local communities. Studies consistently show that airports significantly stimulate local economies and contribute to regional productivity growth, with medium and large airports sustaining thousands of jobs annually (Castillo & Lopez, 2021).

Evidence indicates that airport expansions contribute to short-term construction employment while long-term operations sustain skilled and unskilled jobs in security, cargo management, retail, and customer service.

### 2.2.6 Livelihood of Small Scale Fish Processors

Similar findings were reported by Chai et al. (2021) in Southeast Asia, where small-scale processors depend heavily on fish smoking, drying, and salting activities for daily household sustenance. These studies highlight the sector's importance in absorbing low-skilled labor and offering income opportunities to marginalized communities.

According to Bene et al. (2016) documented that processors often face constraints such as inadequate processing facilities, post-harvest losses, and fluctuating fish availability.

In Tanzania and Kenya, Mmasa and Msuya (2018) observed that poor access to improved technologies such as modern kilns, cold storage, and hygienic processing units reduces productivity and diminishes income potential. These constraints directly affect livelihood outcomes by lowering product quality, shrinking market access, and reducing bargaining power in local and export value chains.

Research from Medard et al. (2019) in Lake Victoria revealed that women dominate fish processing activities but often operate under limited capital, weak market linkages, and exploitative middlemen. Despite these limitations, women processors significantly contribute to household income diversification and poverty reduction. Their engagement in processing, trading, and value addition increases their economic autonomy and bargaining power within communities and households.

## 2.3 Conceptual Frame Work

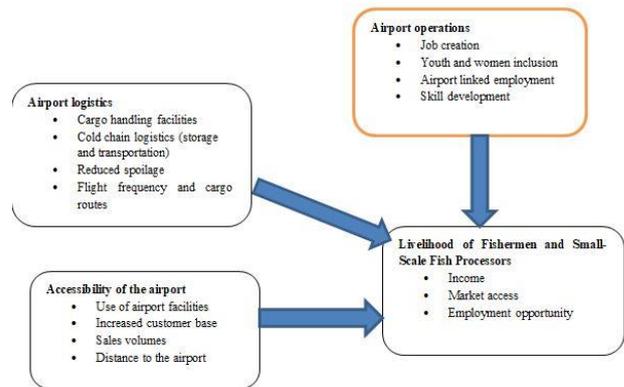


Figure 2. 1 Conceptual Framework

## 3.0 METHODOLOGY

### 3.1 Research Approach

This study employed a quantitative research approach, which is suitable for systematically collecting and analyzing numerical data. The primary data were collected by using structured questionnaires in which papers were distributed to small scale fish processor in order to gather specific quantitative data on various aspects, including income levels, market access, and employment opportunities. This approach allowed statistical analysis including descriptive such as frequency and percent and inferential statistics in which logistic regression model was applied to provide a robust framework for addressing the research questions.

### 3.2 Research Design

Survey research designs are procedures in quantitative research in which investigators administer a survey to a sample or to the entire population of people to describe the attitudes, opinions, behaviours, or characteristics of the population. In this procedure, survey researchers collect quantitative, numbered data using questionnaires and statistically analysed the data to describe trends about responses to questions and to test research questions.

Descriptive research is an appropriate choice when the research aim is to identify frequencies and categories. The

rationale for selecting Mwanza is because is the crucial hub for fish production, also it is near with water body in which fish processors depend on it and it has received various funds for infrastructure improvement from Central Government as well as Development Partners. There will be application of descriptive design through qualitative and quantitative methods.

### 3.3 Target Population

Population under study represents individuals taken from the general population who are having the common characteristics and it is within the group where a sample under study is drawn.

According to a community census conducted by market officers in April 2025, there are 286 small-scale fish processors across four markets: 20 in Ilogazara, 28 in Mwaloni kwa Kishimba, 208 in Tampele, and 30 in Soko la Mwaloni.

### 3.4 Sample Size and Sampling Techniques

#### 3.4.1 Sample Size

In this study, the sample size was determined using Yamane’s (1967) formula, which is appropriate when the total population is known. According to a community census conducted by market officers in April 2025, there are 286 small-scale fish processors across four markets: 20 in Ilogazara, 28 in Mwaloni kwa Kishimba, 208 in Tampele, and 30 in Soko la Mwaloni. Therefore, formula is expressed as;

$$n = \frac{N}{1+Ne^2}$$

Where;

n- Represent sample size

N- Entire population

e- Sampling error preferred to be 5%

Thus, the sample size for this study was 168 fish processors.

#### 3.4.2 Sampling Design

This study employed a stratified random sampling design. This method was justified as it allowed the population to be divided into distinct subgroups, or strata, based on their market locations (Ilogazara, Mwaloni kwa Kishimba, Tampele, and Soko la Mwaloni). This ensured that each market was adequately represented in the sample. The distribution of sample was as follows; Iloganzara 12 individuals, Mwaloni kwa kishimba 16 individuals, Tampele 121 individuals, and Soko la mwaloni 18 individuals.

**Table 3.1 Sample size Distribution**

Market	Size (H <sub>0</sub> )	Sample size (n <sub>k</sub> = $\frac{n_0 * H_0}{N}$ )
Iloganzara	20	12
Mwaloni kwa kishimba	28	16
Tampele	208	121
Soko la Mwaloni	30	18

Total	N=286	n=167
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### 3.5 Sampling Procedures

This study employed a purposive sampling procedure to select respondents from the target population of small-scale fish processors.

#### 3.5.1 Purposive Sampling

This study employed a purposive sampling procedure to select respondents from the target population of small-scale fish processors. Purposive sampling was used to select wards and participants who are directly involved in fish processing activities and are knowledgeable about at what extent Mwanza airport contribute their livelihoods.

These participants may include experienced fishermen and fish processors. The selection was based on their relevance to the research objectives and their ability to provide information on the contribution of air transport.

#### 3.6 Variable Relationship

The table 2 visually organizes the variables, their definitions, and their interrelationships in clear format.

**Table 3.2 Variable Relationship Among Key Variable**

Independent variables	Dependent variables	Key indicators
Cold chain logistics	Market access	<ul style="list-style-type: none"> <li>- Access to cold storage</li> <li>- Reduced fish spoilage</li> <li>- Shelf-life improvement</li> <li>- Lower transportation costs</li> <li>- Product quality and customer satisfaction</li> </ul>
Airport accessibility	Income level.	<ul style="list-style-type: none"> <li>- Use of airport facilities</li> <li>- Increased customer base</li> </ul>
Airport operation	Employment opportunities	<ul style="list-style-type: none"> <li>- Job creation</li> <li>- Fair wages</li> <li>- Youth and women inclusion</li> <li>- Skill develop</li> </ul>

Source: researcher (2025)

### 3.7 Research Instruments

This study employed questionnaires as a primary tool for collecting quantitative data. The questionnaires with both closed and open-ended questions used in which the open-ended questions were coded after data collection in order to meet quantitative analysis.

### 3.8 Data Collection Procedures

The data collection process began with obtaining ethical clearance and permission from relevant local authorities and



institution to access participants and conduct the research in the study area.

Once approvals were secured, the researcher administered 167 structured questionnaires to purposively selected fishermen and small-scale fish processors. Printed questionnaires were distributed with the assistance of two research assistants to ensure proper data collection.

### 3.9 Data Analysis

Quantitative information gathered via structured questionnaires will be analysed with the Statistical Package for Social Sciences (SPSS) version 27 to produce descriptive statistics, frequencies, percentages and pie chart to describe the categorical variables.

Inferential statistics also used in which binary logistic regression model applied in order to estimate the contribution of air transport infrastructures to the small fish processors livelihood.

The dependent variable was market demand which was used to measure the livelihood of the small-scale fish processors, market demand was coded as YES=1 for those who said there is demand of market of the processed fish product due to the presence of airport, and NO=0 for those who said there is no market demand of the processed fish product in order to meet the assumption of the logistic regression model. Independent variables were categorical variables, since there were no variables which collected numerically although in logistics model both variables can be used.

#### Logistics regression model

In logistic regression, a logistic transformation of the odds (referred to as logit) serves as the depending variable:

$$\text{logit } p = \beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_nx_n + \varepsilon$$

Whereby;

P= market demand (1=YES, 0=NO), Exp = the exponential function,  $\beta_0$  = the constant or intercept,  $\beta_1, \beta_2, \dots, \beta_n$  = the coefficient (or slope) of the predictor variables.

$x_1$ = Age

,  $x_2$ = Gender,

$x_3$ =Education level,

$x_4$ = Marital status,

$x_5$ =Household size,

$x_6$ = Years in fishing process,

$x_7$ = Accessibility to airport,

$x_8$ =Support from the government or NGOs and

$x_9$ = increase of job opportunity,

$\varepsilon$ = Error term.

The logistic regression model applied by considering all assumption as follows First, logistic regression does not require a linear relationship between the dependent and independent variables. Second, the error terms (residuals) do not need to be normally distributed. Third, homoscedasticity is not required. Finally, the dependent variable in logistic regression is not measured on an interval or ratio scale.

### 3.10 Reliability and Validity of the Research Instrument.

#### 3.10.1 Validity

Validity is the extent to which an instrument measures what it is supposed to measure and performs as it is designed to perform. It is rare, if nearly impossible, that an instrument be 100% valid, so validity is generally measure of degrees. As a process, validation involves collecting and analysing data to assess the accuracy of an instrument. There are numerous statistical tests and measures to assess the validity of quantitative instruments, which generally involves pilot testing.

#### 3.10.2 Reliability

The extent to which results are consistent over time is referred to as reliability and if the results of a study can be reproduced under a similar methodology, then the research instrument is considered to be reliable.

In order for reliable data to be collected, the researcher designed the questionnaires through an elaborated procedure which involved a series of revisions under the guidance of the study supervisors to ensure that fieldwork conducted by using high quality data collection tools. In order to measure internal consistency, researcher used checklist of questions during in making personal interviews with respondents so as to achieve data consistency and completeness. Reliability can be thought of as consistency. Its look whether the instrument will consistently measure what it is intended to measure.

#### 3.11 Ethical of Consideration

Ethical concerns are crucial to maintain the integrity, confidentiality, and respect for the participants engaged in this research. Before collecting data, the researcher will secure ethical approval and a research permit from pertinent authorities, such as the University and Ilemela Municipal Council.

All participants will receive complete information regarding the study's purpose, procedures, and the voluntary aspect of their involvement, and their informed consent will be acquired either in writing or orally prior to their participation. To safeguard privacy, individual identities will remain undisclosed, and answers will be handled with utmost confidentiality. Participants can exit the study at any point without encountering any repercussions.

## 4.0 INTERPRETATION AND DISCUSSION OF FINDINGS

### 4.1 Introduction

This chapter presents and discusses the findings of the study on the contribution of air transport infrastructure to improving the livelihoods of small-scale fish processors at Mwanza. The analysis is based on quantitative data collected through structured questionnaires administered to 167 respondents across selected fish markets influenced by Mwanza Airport operations. The chapter begins with a presentation of demographic characteristics of respondents, followed by

findings related to the specific research objectives namely, assessing access to cold storage and market opportunities.

## 4.2. Cold Chain Logistics and Market Access

### 4.2.1 Access to Cold Storage

Table 1 shows that 65.3% of small-scale fish processors have access to cold storage facilities, while 34.7% do not. This indicates that most processors can preserve fish products for longer periods, maintaining quality and reducing post-harvest losses. Those without access may face higher spoilage risks and limited market opportunities, highlighting disparities in resource availability within the sector.

**Table 4.1 Distribution of Respondents To Access Cold Storage Facilities**

Access to Cold storage facilities	Frequency	Percent
Yes	109	65.3
No	58	34.7

Source: researcher (2025)

### 4.2.2 Cold storage used

Table 2 shows that among small-scale fish processors with access to cold storage, the majority (67.7%) use refrigerated storage, while 32.3% use chilling rooms. This indicates a preference for more advanced refrigeration systems, likely due to their greater capacity to preserve fish quality and extend shelf life. Chilling rooms, while still beneficial, may offer limited temperature control and storage space, which could affect product freshness and marketability. The distribution highlights the varying levels of cold storage technology adoption within the sector.

**Table 4.2 Distribution of Respondent on Cold Storage**

Type of cold storage currently used	Frequency	Percent
Chilling rooms	54	32.3
Refrigerated storage	113	67.7

Source: researcher (2025)

### 4.2.3 Distances from Processing Area To Airport

Table 3 shows that nearly half of the small-scale fish processors (47.9%) are located 5–10 km from the airport, while 46.7% live more than 10 km away, and only 5.4% are within 5 km. This indicates that most processors are moderately to far from airport facilities, which could influence their ability to quickly transport fish products and access high-value markets. Those closer to the airport may benefit from reduced transportation time, lower post-harvest losses, and easier market linkages, whereas processors farther away may face higher logistics costs and limited access to airport-related opportunities.

**Table 4.3 Distribution Distance of Respondents to Airport**

Distance from processing area to airport	Frequency	Percent
Less than 5km	9	5.4
5-10 km	80	47.9
more than 10 km	78	46.7

Source: researcher (2025)

### 4.2.4 Fish stored in Cold Storage

Table 4 shows that the majority of fish processors store Tilapia (45.5%) and Nile perch (44.9%) in cold storage, while only 10.2% store Catfish. This indicates that high-demand and commercially valuable species like Tilapia and Nile perch are prioritized for preservation, likely due to their marketability and potential for higher income. Catfish, being less commonly stored, may either have lower market demand or be processed and sold more quickly, reflecting product-specific storage preferences among processors

**Table 4.4 Type of Fish Stored In Cold Storage**

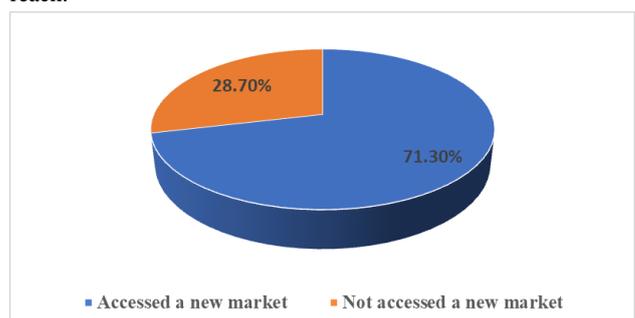
Type of fish you store in cold storage	Frequency	Percent
Tilapia	76	45.5
Nile perch	75	44.9
Catfish	17	10.2

Source: researcher (2025)

### 4.2.2 Impact of Cold Chain on Market Access

#### 4.2.2.1. Access New Market Based on Cold Chain.

Fig.1 shows that 71.30% reported that cold chain services have enabled them to access new markets, while 28.70% unable to access new market, underscoring the transformative role of airport-linked infrastructure in expanding market reach.



**Figure 4.1 Rate of respondents Access New Market Based Cold Chain**

Source: researcher (2025)

#### 4.2.2.2 Variation of prices from airport-linked buyers better than local Market

The findings in fig.2 indicate that the majority 73.1% agreed that prices offered by airport-linked buyers are better than those in the local market. Only 25.7% reported that airport prices are not better, while 1.2% believed the prices are about

the same. This suggests that airport-linked markets generally offer higher and more competitive prices, potentially enhancing income opportunities for sellers compared to local markets.

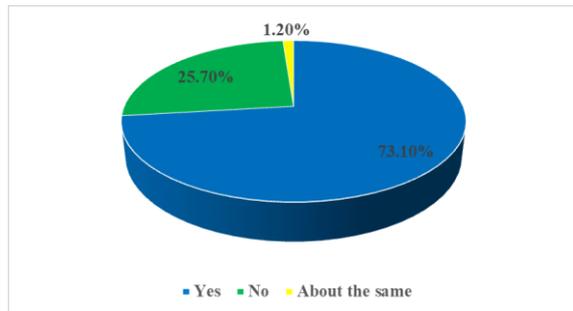


Figure 4.1 Price from Airport-Linked Buyers Better Than Local Market

Source: researcher (2025)

4.2.2.3 Perceptions on cold chain to the market access

The researcher explored the effect of how small-scale fish processors perceive the influence of airport’s cold-chain logistics on their ability to access and benefit from broader markets by giving different statements that were rank in a time-point Likert scale as follows; 5= strongly agree, 4= agree, 3= agreed moderately (neutral), 2= disagree, 1 = strongly disagree.

The results in Table 5. show a strongly positive perception of the airport’s role in enhancing fish preservation, market expansion, and profitability. A large proportion of respondents (46.7%) agreed and 3.6% strongly agreed that the availability of cold storage facilities has improved their ability to preserve fish products (mean = 3.2, SD = 1.019), suggesting that airport cold storage significantly reduces post-harvest losses and maintains product quality. Similarly, 67.7% agreed that cold storage enables them to sell fish to distant

markets (mean = 3.46), highlighting the essential role of cold-chain systems in expanding market reach.

Moreover, 63.4% of respondents agreed that they can now access new markets that were previously unreachable (mean = 3.56), demonstrating that airport infrastructure promotes trade diversification and connects local processors to regional and international buyers. Confidence in the reliability and accessibility of airport cold storage facilities was moderately high (mean = 3.37), though responses also suggest that some small-scale processors may still face logistical or affordability challenges when using these facilities.

In terms of product quality and pricing, 46.7% agreed that availability of cold-chain facilities improved fish product quality (mean = 3.46), while an even higher 80.2% agreed or strongly agreed that they can sell fish at higher prices when using airport services (mean = 4.15). This shows that air transport enhances competitiveness and enables processors to reach high-value markets, thereby improving their profit margins. Respondents also expressed that airport operations have raised quality standards (mean = 4.2) and attracted more customers (mean = 3.72), confirming that market confidence and consumer demand increase when products are handled under efficient cold-chain conditions.

Additionally, 72.4% agreed that access to the airport helps diversify markets (mean = 3.96), reflecting expanded trade options beyond local buyers. Furthermore, most respondents (54.5%) believed that cold storage at the airport helps preserve fish quality (mean = 3.37), and 59.3% agreed that airport services have reduced transportation costs (mean = 4.02).

These findings collectively emphasize that cold-chain logistics introduced by airport play a transformative role in improving product quality, market accessibility, and cost efficiency

Table 4.5 Perception of the Respondents based on cold chain to the Market

Statement	SD	D	N	A	SA	Mean	S. D
	N (%)	N (%)	N (%)	N (%)	N (%)		
Cold storage improved ability to preserve fish product	10(6.0)	37(22.2)	36(21.6)	78(46.7)	6(3.6)	3.2	1.019
Cold storage enables to sell fish to distant markets	33(19.8)	11(6.6)	10(6.0)	72(43.1)	41(24.6)	3.46	1.438
Ability to reach new markets	32(19.2)	6(3.6)	23(13.8)	49(29.3)	57(34.1)	3.56	1.471
Cold storage are reliable and accessible	3(1.8)	46(27.5)	42(25.1)	39(23.4)	37(22.2)	3.37	1.158
Cold chain has improved fish product quality	1(0.6)	45(26.9)	43(25.7)	32(19.2)	46(27.5)	3.46	1.176
The price is higher because of airport.	0(0.0)	11(6.6)	22(13.2)	65(38.9)	69(41.3)	4.15	0.889
Airport increases the standards of product	5(3.0)	2(1.2)	30(18.0)	48(28.7)	82(49.1)	4.2	0.977
Many customers since the airport improved	0(0.0)	15(9.0)	34(20.4)	101(60.5)	17(10.2)	3.72	0.767
Diversification of markets	0(0.0)	18(10.8)	28(16.8)	63(37.7)	58(34.7)	3.96	0.975

Reduction of transportation costs	31(18.6)	12(7.2)	25(15.0)	68(40.7)	31(18.6)	4.02	5.704
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Source: researcher (2025)

SD=Strong Disagree, D=Disagree, N=Neutral, A=Agree and SA=strong agree

### 4.3 Determinants of Improved Livelihood among Small Scale Fish Processors

Results in table 6 identify key predictors of improved livelihoods among small-scale fish processors. The logistic regression model was statistically significant,  $\chi^2(4) = 27.402$ ,  $p < .0005$ . The model explained 53.0% (Nagelkerke  $R^2$ ) of the variance in improved livelihoods and correctly classified 71.0% of cases.

Among the socio-demographic factors, years in fishing above five years (Odds=22.261,  $p = 0.002$ ) significantly influence livelihood outcomes, suggesting that experience enhances the ability to utilize airport-related opportunities effectively.

Moreover, accessibility to airport (Odds=0.03,  $p = 0.000$ ) has the strongest positive relationship with livelihood improvement, confirming that proximity and utilization of airport facilities substantially increase income stability and market participation. Support from government or NGOs (Odds=0.25,  $p = 0.029$ ) also shows a statistically significant effect, emphasizing the importance of institutional backing in enabling processors to benefit from infrastructure investments.

Additionally, job growth due to airport operations (Odds=0.1,  $p = 0.000$ ) is a significant determinant, reinforcing the airport's role in fostering employment and economic empowerment. In contrast, factors such as gender, age, education, marital status, and household size show no significant influence, indicating that airport-related benefits cut across demographic lines when access and support structures are present.

**Table 4.6 Logistics Regression Model shows the Impact of Air Transport Infrastructure to Livelihood**

Improved likelihood	Odds	S.E.	Wald	df	Sig.
<b>Age group of respondents</b>					
• 18-29 years					
• 30-44 years	3.035	0.81	1.878	1	0.171
• above 59 years	2.196	0.761	1.069	1	0.301
• 45 and above years	1.847	0.804	0.582	1	0.445
<b>Gender of the respondent</b>					
• Male					
• Female	2.714	0.635	2.476	1	0.116
<b>Education level</b>					
• Non-formal education					
• Primary education	0.175	1.47	1.41	1	0.235
• Secondary education	0.231	1.459	1.007	1	0.316
• Tertiary education	0.174	1.466	1.426	1	0.232
<b>Marital status of respondents</b>					
• Single					
• Married	0.802	0.679	0.106	1	0.745
• Divorced/separated	0.228	1.155	1.638	1	0.201
• Widow/widower	0.491	1.187	0.359	1	0.549
<b>Household size</b>					
• 1-3 members					
• 4-7 members	0.257	0.794	2.919	1	0.088
• Above 7 members	0.33	0.872	1.616	1	0.204

Years in fishing process					
• Less than 1 year					
• 2-5 years	2.005	0.837	0.69	1	0.406
• Above 5 years	22.261	1.017	9.308	1	0.002
Accessibility to airport					
• Yes					
• No	0.03	0.678	26.988	1	0.000
Support from the government or NGOs					
• Yes					
• No	0.25	0.635	4.755	1	0.029
Opportunity increasing					
• Yes					
• No	0.1	0.647	12.65	1	0.000
<b>Constant</b>	25.495	1.486	4.752	1	0.029

Source: researcher (2025)

## 4.2 Discussion of Findings

### 4.2.1 Cold Chain Logistics and Market Access

The findings reveal that access to cold storage facilities is a crucial determinant of efficiency and profitability among small-scale fish processors operating near the airport. 65.3% reported access to cold storage, demonstrating the growing reliance on temperature-controlled systems to maintain fish quality (Lwanga, 2018).

The dominance of refrigerated storage 67.7% over chilling rooms 32.3% indicates a shift toward modern preservation technologies that reduce spoilage and extend product shelf life, aligning with global trends in cold-chain development (FAO, 2020). The proximity of most processing areas within 5–10 km from the airport 47.9% reflects logistical convenience and reduced transportation costs, which are essential for handling perishable goods efficiently (Mteki et al., (2017). The high representation of Tilapia 45.5% and Nile Perch 44.9% in cold storage use highlights their economic importance in both domestic and export markets, consistent with findings by Mwaipopo and Kihombo, (2022), who emphasized that the cold-chain system is vital in sustaining the commercial value of high-demand fish.

The results on market access and pricing demonstrate that airport-linked cold-chain infrastructure significantly enhances business opportunities for small-scale fish processors. Over 71% of fish processors confirmed that cold-chain services enabled them to access new markets, illustrating the transformative impact of improved logistics in expanding trade networks (Daily News, 2023). Similarly, 73.1% acknowledged that airport-linked buyers offer better prices than local markets, suggesting that air transport connectivity

enhances market competitiveness and income generation (FreshPlaza, 2023). The positive perceptions expressed by most respondents regarding product preservation, quality improvement, and market diversification affirm that the cold chain has strengthened the value chain from production to export. Higher mean scores on variables such as increased prices (mean = 4.15), improved standards (mean = 4.2), and reduced transport costs (mean = 4.02) further underscore the socio-economic benefits of airport operations.

These findings are consistent with those of UNCTAD (2020) and ICAO (2022), which concluded that efficient cold-chain logistics promote higher product quality, expand market access, and improve household incomes among small-scale producers engaged in export-oriented fisheries.

### 4.2.2 Determinants of Improved Livelihood among Small-Scale Fish Processors

The logistic regression results indicate that several key factors significantly influence the improved livelihood of small-scale fish processors. Notably, years of experience in fish processing above five years was a strong predictor of improved livelihoods (Odds = 22.261,  $p = 0.002$ ). This finding aligns with previous studies, which have shown that experienced fish processors are better able to manage post-harvest handling, adopt innovative processing techniques, and navigate market dynamics (Medard et al., 2019; Jeckoniah, & Massawe, 2023). Experience provides both technical knowledge and social capital, enabling processors to leverage infrastructure such as airports to access high-value and distant markets efficiently.

Accessibility to airport infrastructure had the strongest positive relationship with livelihood improvement (Odds = 0.03,  $p < 0.001$ ), suggesting that proximity and the ability to utilize airport facilities significantly enhance income stability and market participation. This is consistent with empirical

evidence from East Africa indicating that improved transport connectivity, including air transport, reduces post-harvest losses and expands market reach for perishable commodities such as fish (Mwansasu & Maleko, 2023).

Airports serve as vital nodes that allow processors to sell products to urban centers or export markets where demand and prices are higher, ultimately improving household income. Support from government or non-governmental organizations (Odds = 0.25,  $p = 0.029$ ) also emerged as a significant determinant of livelihood improvement.

Institutional support, including training programs, credit facilities, and technical assistance, has been widely documented as critical for enhancing the capacity of small-scale processors (Lwezaura & Kaliba, 2022). Such support enables processors to adopt improved technologies, meet quality standards, and effectively integrate into broader value chains, highlighting the importance of policy interventions alongside infrastructure development.

The variable “job growth due to airport operations” (Odds = 0.1,  $p < 0.001$ ) was another significant predictor, reinforcing the role of airport-related employment in economic empowerment. Empirical studies in aviation and regional development show that airport expansions can create direct and indirect employment opportunities, providing alternative income sources for local communities, including small-scale processors who may engage in logistics, packaging, or transport services (Castillo & Lopez, 2021; Moyo & Tichaona, 2022).

Interestingly, demographic variables such as age, gender, education, marital status, and household size did not significantly influence livelihood outcomes. This indicates that, when access to airport facilities and institutional support are available, benefits from air transport infrastructure are broadly distributed across demographic categories. This finding supports the notion that infrastructure and institutional interventions can reduce socio-economic disparities, providing equitable opportunities for income improvement irrespective of traditional demographic constraints (Bennett, & Muhonda, 2023).

## 5.1 Conclusion

The study concludes that air transport infrastructure, particularly through facilities such as cold storage, cargo handling, and improved airport accessibility, serves as a critical driver of livelihood improvement among small-scale fish processors. Access to cold-chain systems has played a pivotal role in reducing post-harvest losses, maintaining the quality and freshness of fish products, and enabling processors to expand their reach to regional, national, and international markets. These improvements have not only increased income levels but have also encouraged the adoption of value addition and export-oriented activities, allowing processors to diversify their income sources and strengthen their economic resilience.

## 5.2 Recommendations

Based on the findings of this study, several recommendations are proposed to enhance the contribution of air transport infrastructure to the livelihoods of small-scale fish processors and to strengthen the fisheries sector in general. First, the government, through the Tanzania Airports Authority (TAA) and the Ministry of Livestock and Fisheries, should continue to expand and modernize airport-based facilities, particularly cold-chain storage and cargo handling systems. Improved infrastructure will help reduce post-harvest losses, maintain fish quality, and facilitate access to regional and international markets, thereby increasing income and economic resilience for small-scale processors.

Second, strengthening partnerships with non-governmental organizations (NGOs), cooperatives, and private investors is essential. Such collaborations can provide financial support, technical training, and quality-control assistance to small-scale fish processors. Access to credit and capacity-building initiatives will enable processors to adopt better storage, preservation, and transport practices, enhance product marketability, and sustain profitable operations over the long term.

Third, policy frameworks should prioritize the integration of air transport logistics with sustainable fisheries management. Coordinated policies that link infrastructure development with sustainable fishing practices, resource management, and market access will stabilize fish supply, reduce post-harvest losses, and enhance food security. Aligning air transport investments with fisheries policies ensures that infrastructure benefits are maximized and that environmental and social sustainability are maintained.

Fourth, inclusive employment programs should be encouraged, with particular focus on women and youth who constitute a large proportion of the small-scale processing workforce. Targeted programs can provide vocational training, facilitate access to formal and informal markets, and promote equitable participation in income-generating activities. Inclusive initiatives will enhance social equity and ensure that the benefits of air transport development are broadly shared within fishing communities.

Finally, research and monitoring systems should be established to continually assess the socioeconomic impact of air transport infrastructure on the fisheries sector. Continuous evaluation will enable policymakers and stakeholders to identify gaps, measure progress, and implement evidence-based interventions. By monitoring trends in income, employment, and market access, the government and development partners can ensure that airports remain effective catalysts for livelihood improvement, regional economic growth, and sustainable development within fisheries-dependent communities.

## 5.3 Further Study

While this study provides valuable insights into the contribution of air transport infrastructure to the livelihoods of small-scale fish processors, further research is recommended

to explore additional dimensions and contexts. Future studies could examine the long-term effects of airport accessibility on income stability, market expansion, and resilience to environmental or economic shocks. Comparative studies across different regions or countries would also help to identify best practices and contextual factors influencing the effectiveness of air transport in supporting fisheries-based livelihoods.

Additionally, research focusing on the role of technology, digital platforms, and supply chain innovations in complementing airport infrastructure could provide deeper understanding of how modern logistics systems enhance the competitiveness and sustainability of small-scale fish processing enterprises.

## REFERENCES

1. Ababio, K., & Adjei, J. (2020). Livelihood strategies of small-scale fish processors in coastal Ghana. *Journal of Rural Studies*, 78, 134–142.
2. Abdul Quium, A. S. M. (2019). Transport corridors for wider socio-economic development. *Sustainability (Switzerland)*, 11(19). <https://doi.org/10.3390/su11195248> Agriculture Organization. Association.
3. Bene, C., et al. (2016). Poverty, vulnerability and small-scale fisheries: Empirical evidence from developing countries. *World Development*, 79, 41–54.
4. Buhr, W. (2003). *What is infrastructure?* (No. 107-03). Volkswirtschaftliche Diskussionsbeiträge.
5. Busungu, C. (2022). Social and Economic Contributions of Air Tanzania Limited as a National Carrier. *International Journal of Social Sciences*, 35(1), 12–22.
6. Chai, N., Sari, N., & Abdullah, R. (2021). Small-scale fish processing and household welfare in Southeast Asia. *Marine Policy*, 129, 104–121. Cold Storage Upgrades. OPEC Fund for International Development.
7. Daily News. (2023, October 16). *TPA eyes boosting perishable produce shipment*. <https://dailynews.co.tz/tpa-eyes-boosting-perishable-produce-shipment-2/>
8. Department for International Development (DFID). (1999). *Sustainable Livelihoods Framework*. London: DFID. development. World Bank.
9. Dimitriou, D., & Sartzetaki, M. (2022). Criticality of a regional airport development to mitigate covid-19 economic effects. *Case Studies on Transport Policy*, 10(1), 581-590.
10. Duggan, D. E., & Kochen, M. (2016). Small in scale but big in potential: Opportunities and challenges for fisheries certification of Indonesian small-scale tuna fisheries. *Marine Policy*, 67, 30–39. <https://doi.org/10.1016/j.marpol.2016.01.008>
11. FAO. (2020). *Post-harvest loss reduction in fisheries and aquaculture*. Food and Agriculture Organization. <https://www.fao.org>
12. FAO. (2020). *Sustainable small-scale fisheries and post-harvest development*. Food and Agriculture Organization.
13. FAO. (2023). *Fish loss and waste in aquatic food value chains in Tanzania*. Food and Agriculture Organization of the United Nations.
14. Ferdowsi, M. A. (2010). UNCTAD–United Nations conference on trade and development.
15. Fredrick, B., & Odula, O. (2024). *UNLOCKING THE MARITIME POTENTIAL OF LAKE. May*.
16. FreshPlaza. (2023, November 28). *Tanzania: New airport cold storage to boost fresh ports*. <https://www.freshplaza.com/north-america/article/2160736/tanzania-new-airport-cold-storage-to-boost-fresh-exports/>
17. Griggs, G. (2020). Coastal Airports and Rising Sea Levels. *Journal of Coastal Research*, 36(5), 1079–1092. <https://doi.org/10.2112/JCOASTRES-D-20A-00004.1>
18. IATA. (2023). *The Economic Value of Air Transport 2023*. International Air Transport in
19. ILO. (2021). *Women in aviation: Gender gaps and opportunities*. International Labour Organization. <https://www.ilo.org>
20. In *A Concise Encyclopedia of the United Nations* (pp. 698-705). Brill Nijhoff. *Journal of Transportation*, 6(2), 105–120.
21. Kaiser, N., & Barstow, C. K. (2022). Rural transportation infrastructure in low-and middle-income countries: a review of impacts, implications, and interventions. *Sustainability*, 14(4), 2149.
22. Kipkemboi, J., & Handa, P. (2023). *The impact of Kisumu International Airport on local fishers' livelihoods in Kenya*. *African Journal of Transport and Logistics*, 5(2), 88–102.
23. KMFRI. (2024). *Impact of Airport Connectivity on Nile Perch Exports*. Kenya Marine
24. Lupindu, R. (2016). *Air logistics for fisheries exports: Case of Lake Victoria*. East African
25. Lwanga, J. (2018). *The contribution of Entebbe International Airport to Uganda's fish export value chain*. *East African Journal of Economics and Development*, 10(3), 55–67.
26. Lwezaura, D., & Kaliba, A. (2022). Role of financial inclusion in improving small-scale fish processors' livelihoods in Tanzania. *African Journal of Economic Review*, 10(2), 56–72.
27. Lwezaura, D., & Kaliba, A. (2022). Role of financial inclusion in improving small-scale fish processors' livelihoods in Tanzania. *African Journal of Economic Review*, 10(2), 56–72.
28. McCash, J. Hall. (2012). *Plum Orchard: a novel of Cumberland Island*. 2(1), 361.
29. Medard, M., et al. (2019). Gendered participation and livelihood outcomes in the Lake Victoria fisheries. *Fisheries Research*, 211, 1–9. <https://doi.org/10.1016/j.fishres.2019.01.012>

30. Medard, M., et al. (2019). Gendered participation and livelihood outcomes in the Lake Victoria fisheries. *Fisheries Research*, 211, 1–9.
31. Mmassa, J., & Msuya, E. (2018). Constraints faced by small-scale fish processors: Evidence from Tanzania. *International Journal of Fisheries and Aquatic Studies*, 6(2), 45–52.
32. Moyo, T., & Tichaona, B. (2022). Training, certification, and workforce performance at African airports. *International Journal of Aviation Studies*, 14(1), 88–104.
33. Mramba, F., & Mkude, D. (2022). Fish handling, value addition, and market chain dynamics
34. Muganda, A., & Kirema-Mukasa, C. (2017). Market access and income among small-scale fish workers in East Africa. *Development Studies Research*, 4(1), 45–55.
35. Muringai, R. T., Mafongoya, P., Lottering, R. T., Mugandani, R., & Naidoo, D. (2022).
36. Mwansasu, A., & Maleko, D. (2023). Cold-chain logistics and market access for small-scale fish processors in East Africa. *African Fisheries Science Review*, 18(2), 77–95.
37. Nga, M. T. T. (2010). *Enhancing quality management of fresh fish supply chains through improved logistics and ensured traceability* (Issue June).
38. Oduor, O., Mulyungi, P., & Were, R. (2020). Transport systems and livelihood outcomes of small-scale fish processors. *Journal of Development and Agricultural Economics*, 12(4), 205–214.
39. OPEC Fund. (2023). Tanzania Airport Expansion Project: Terminal, Runway, and
40. RATIN. (2024, January 15). *Cold-chain investments in Tanzania boost export competitiveness*. [https://ratin.net/site/news\\_article/15552](https://ratin.net/site/news_article/15552)
41. Report, A. (2021). *IDU0a0f612fd04dd504b880866e0b851ba17ff30-2*.
42. Reznik, V., Gurina, G., & Hryhorak, M. (2023). *Intellectualization of logistics and supply chain management*. *Journal of Transport and Logistics Studies*, 19(3), 45–61.
43. Reznik, V., Gurina, G., & Hryhorak, M. (2023). *Intellectualization of logistics and Supply Chain Management # 19 - 2023. July*.
44. Rice, E. D., Bennett, A. E., & Muhonda, P. (2023). Gendered inequities in small-scale fish trade: Evidence from Malawi. *Maritime Studies*, 22, 46. <https://doi.org/10.1007/s40152-023-00337-x>
45. Roche, A. G., Jeckoniah, J. N., & Massawe, F. A. (2023). Empowering women: Small-scale fish business in Mwanza, Tanzania. *Business Excellence and Management*, 13(4), 68–84.
46. Rodrigue, J. P. (2024). The geography of transport systems. *The Geography of Transport Systems*, 1–402. <https://doi.org/10.4324/9781003343196>
47. Stacey, N., Gibson, E., Loneragan, N. R., Warren, C., Wiryawan, B., Adhuri, D. S., Steenbergen, D. J., & Fitriana, R. (2021). Developing sustainable small-scale fisheries livelihoods in Indonesia: Trends, enabling and constraining factors, and future opportunities. *Marine Policy*, 132, 104654. <https://doi.org/10.1016/j.marpol.2021.104654>
48. Stevens, K., Irwin, B., Kramer, D., & Urquhart, G. (2014). Impact of increasing market access on a tropical small-scale fishery. *Marine Policy*, 50(PA), 46–52. <https://doi.org/10.1016/j.marpol.2014.05.007>
49. Tanzanian fisheries. *Journal of African Fisheries*, 17(1), 1–18.
50. Tobias, M. H., Helmersen, S., & Tamssaouet, K. (2021). *An investigation in Norwegian seafood air cargo operations A cross-sectional study of Oslo Airport Gardermoen*.
51. UNCTAD. (2021). Trade and Development Report 2021: From Recovery to Resilience.
52. United Nations Conference on Trade and Development.
53. United Republic of Tanzania (URT). (2023). *National Transport Master Plan 2022–2030*. Ministry of Works and Transport, Dodoma.
54. Unlocking the potential of fish to improve food and nutrition security in sub-saharanafrica. *Sustainability (Switzerland)*, 14(1), 1–15. <https://doi.org/10.3390/su14010318>
55. World Bank. (2017). Mobility results brief: Promoting sustainable transport and economic
56. Zhang, F., & Graham, D. J. (2020). Air transport and economic growth: A review of the impact mechanism and causal relationships. *Transport Reviews*, 40(4), 506–528. <https://doi.org/10.1080/01441647.2020.1738587>
57. Zreik, M., Iqbal, B. A., Hassan, M., & Syed Marzuki, S. Z. (2024). Infrastructure development, inequality, and employment in Sub-Saharan Africa from the professional perspectives of Kenya, Ghana, and Tanzania. *Discover Global Society*, 2(1), 78.