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**Szkoły Głównej Gospodarstwa Wiejskiego w Warszawie**

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**Mohammed Sanusi Sadiq<sup>1✉</sup>, Muhammad Makarfi Ahmad<sup>2</sup>, Emmanuel Nkwie Gama<sup>3</sup>,  
Abbas Aliyu Sambo<sup>4</sup>**

<sup>1,3,4</sup> Federal University Dutse, Jigawa State, Nigeria

<sup>3</sup> Bayero University, Kano, Nigeria

## **Morbidity Cost and Willingness to Pay for Healthcare Insurance among Wheat Farmers in Jigawa State of Nigeria**

**Abstract.** The study determined the costs of morbidity and farmers' willingness to pay for health insurance in the Jigawa State of Nigeria using a cross-sectional data collected from 284 farmers through a multi-stage sampling technique. Using an easy-route cost approach, a well-structured questionnaire coupled with interview schedule was used for data collection. Besides, the collected data was then analysed using both descriptive and inferential statistics. Empirically, the majority of farmers utilised an accumulation strategy for livelihood sustenance, alongside enterprise diversification – which acted as a catalyst in increasing their stocks and consumption outcomes, thus smoothing their income and consumption. However, financial and, at worst, physical livelihood capitals posed challenges that affected farmers' livelihood assets in the study area. Furthermore, malaria emerged as the major health issue affecting livelihoods; consequently, slightly over half of the sampled population agreed to the notion of a social health insurance scheme for a healthy livelihood. However, this inclination was largely influenced by the overlooked or nearly neglected social learning aspect of extension service delivery. Therefore, as a method to reduce public capital expenditure on healthcare for livelihoods in the study area, the study recommends that policymakers expand the healthcare scheme to include the farming community, going beyond formal organisations, thereby enhancing farm family livelihoods specifically and overall economic growth and development in general. Nonetheless, enhance institutional factors, alongside social extension, financial and infrastructural facilities are recommended.

**Keywords:** healthcare, insurance, livelihood, morbidity, farmers, Nigeria

**JEL Classification:** D31, D81, I13, I15, I18, I31, I38

### **Introduction**

Due to farmers' poor health and climate change, the agricultural sector may be under additional stress. Understanding that farmers' health negatively impacts the industry, with noticeable effects on productivity, is concerning. If farmers' ill-health is not properly addressed, food crop production will continue to be significantly affected in developing nations in Africa (Adewuye et al., 2021). Without prompt actions taken, along with appropriate legislation to improve farmers' health, the situation is expected to deteriorate in the near future. According to Adewuye et al. (2021), those who are ill or in poor health bear a heavy load of responsibility. Although challenging to quantify, individuals who are

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<sup>1</sup> Department of Agricultural Economics and Extension, FUD, P.M.B. 7156, Dutse, Nigeria, e-mail: sadiqsanusi30@gmail.com; <https://orcid.org/0000-0003-4336-5723>; Corresponding author

<sup>2</sup> Department of Agricultural Economics and Extension, BUK, Kano, Nigeria; <https://orcid.org/0000-0003-4565-0683>

<sup>3</sup> Department of Agricultural Economics and Extension, FUD, Dutse, Nigeria; <https://orcid.org/0000-0003-4532-7982>

<sup>4</sup> Graduate Student, Department of Agricultural Economics and Extension, FUD, Dutse, Nigeria; <https://orcid.org/0009-0006-2977-4968>

seriously ill can experience significant welfare losses, particularly in underdeveloped countries with limited social security and healthcare infrastructure (Njie et al., 2023). Severe illness can impose a substantial financial burden on households, leading them to the point where they may need to sell assets, accrue substantial debts and fall deeper into poverty (Kalyango et al., 2021). These households are often compelled to shorten necessary treatment periods due to inadequate social security and low income levels. This has lasting consequences on the health and poverty levels among the workforce, as well as on economic growth, labour productivity and social welfare. A high disease burden, however, is likely to have an adverse impact on a nation's productivity, growth and, ultimately, economic development (Sadiq et al., 2017). To address the threat of poverty, particularly in developing nations, there is a need for strong health systems and productive agriculture, as low productivity resulting from farmers' poor health not only affects their income, but also exacerbates the prevalence of poverty and ill health.

Self-expenditure on health causes an estimated 100 million people to enter poverty each year and adds 1.2 billion more individuals to the world's population currently living in poverty (Busyra et al., 2023). Annually, a total of 150 million individuals in 44 million households experience financial ruin as a result of directly paying for healthcare and an estimated 13 billion individuals worldwide lack the opportunity to receive effective and inexpensive healthcare (Omotowo et al., 2016; Anbesu et al., 2022). Access to necessary financing continues to be a major barrier to development for many developing nations. It is no longer acceptable for certain people to endure suffering or pass away due to a lack of accessibility to basic healthcare as a result of the development of medical technology and the rise in living standards (Cheno et al., 2021). Under objective 3.8 of the Sustainable Development Goals (SDGs), governments and the global community are tasked with achieving universal health coverage (UHC) (Nzowa et al., 2023). Governments must shift from an out-of-pocket healthcare financing model predominately used in Africa to a prepayment model to achieve UHC (Abu-Zaineh et al., 2022). Despite global pressure and numerous national and regional efforts, many African nations still have poor levels of health insurance coverage (Bolarinwa et al., 2021).

In recent years, many low- and middle-income countries have placed high importance on having access to high-quality healthcare, with achieving universal health coverage being a key component (Kado et al., 2020). Concerns about the needy and vulnerable having limited access to excellent healthcare is still a problem in low- and middle-income countries (Haile et al., 2019). In contrast to industrialised nations, access to healthcare as a fundamental need is constrained in developing nations due to underfunded healthcare systems (Wang and Zhang, 2019; Busyra et al., 2023). Financial limitations severely restrict access to high-quality treatment and the World Health Report emphasises that financial equality is an essential element of the effectiveness of the health system. The health industry has frequently encountered situations when its budget has significantly decreased in real terms for a variety of reasons. Major development issues in Africa, particularly in Nigeria, include poverty and inadequate accessibility to healthcare resources (Sadiq et al., 2017). Policymakers are fully aware of the need for a strong healthcare system to ensure that everyone has access to sufficient medical care. Budgets for healthcare have decreased as a result of the economic downturn in some developing nations (Mekonne et al., 2020). Therefore, the government's top priority is finding a different way to effectively finance healthcare.

According to Babatunde et al. (2016), rural households often forgo high-value care while still paying significant amounts for subpar care. These high healthcare costs lead to short-term health crises and can result in debt, the selling of assets and the expulsion of children from school, ultimately leading to a long-term increase in poverty. Concerns for the nation and other low- and middle-income African nations have been raised by the catastrophic effect of this healthcare finance structure on the region's poor and often rural population. As a result, proponents have been in favour of creating alternative financing plans to handle the unpredictable nature of healthcare expenses to protect poor rural residents. Health insurance is one method through which a community can be financially safeguarded from unforeseen health risks (Busyra et al., 2023). According to Chen et al. (2002), health insurance is commonly viewed as a way to shield against financial risk and provide access to healthcare for low-income families. Health insurance helps spread the financial risk across all insured members, enhancing access to medical treatments (Anbesu et al., 2022). This is accomplished by preventing patients from directly paying for services out of pocket. By pooling risks across various demographic segments, it significantly reduces the financial burden that catastrophic illnesses place on individuals.

Social insurance and community-based insurance are the two different types of health insurance systems (Jofre-Bonet and Kamara, 2018). Social health insurance primarily targets individuals with jobs in the government and private sectors (Abbas et al., 2019). The World Health Organisation has promoted the widely adopted social health insurance programme as a means to increase access to healthcare services and ensure that everyone is covered by the healthcare delivery system (Wolff et al., 2020; Baillon et al., 2022). However, since a significant portion of the population works in the informal economy, middle- and low-income countries rarely implement this approach. Therefore, the main sources of finance for healthcare are out-of-pocket expenses and general income (Miti et al., 2021). Typically, individuals or families use their own labour or resources to pay for healthcare providers. Out-of-pocket expenses account for approximately 40% of all healthcare costs in sub-Saharan Africa, imposing a heavy financial burden on the underprivileged (Kado et al., 2022). When governments are unable to directly support healthcare costs for the poor, a contributory system like community-based health insurance (CHI) is a particularly likely means to achieve widespread health insurance coverage (Cheno et al., 2021).

Additionally, as employees in the informal sector and households in rural parts of low-income nations have erratic income, Anbesu et al. (2022) state that community-based health insurance systems are the most suitable insurance models for these groups. It has been established that CHI, which consists of mandatory and/or voluntary health programmes, provides access to health insurance coverage for people who are unable to immediately take advantage of a social insurance programme or a private health insurance programme (Cheno et al., 2021). Governments and donor organisations in a number of developing nations are now implementing CHI schemes as a social safety net and an alternative strategy to achieve universal health coverage in response to dwindling budgets and other institutional challenges in the provision of high-quality, reasonably priced healthcare services.

According to Azhar et al. (2018), the market-based healthcare system is financed significantly by health insurance. The wisest solution, presently and in the future, might not solely rely on paying taxes or out-of-pocket expenses. With medical costs rising rapidly, it

is necessary to receive support from health insurance plans, specifically to pay for expensive medical care, lessen the financial burden on the healthcare system and lower catastrophic health costs for the rural poor. Farmers face difficulties in receiving basic medical care due to the out-of-pocket payment system, which also excludes those unable to pay the fees.

Policymakers in Nigeria need to focus on ideas for health insurance for the underprivileged considering the high level of out-of-pocket healthcare expenses, the desire to enhance the efficiency and equality of healthcare funding and the standard of care provided and other factors. It is unequivocal that social protection increasingly plays a crucial role in poverty reduction efforts to reduce susceptibility to socioeconomic, natural and other shocks, particularly among rural residents. A study on the actions taken by wheat farmers in Nigeria's Jigawa State to achieve better and more sustained health was necessary. The capacity and willingness to pay for health insurance have been associated with improvements in public health, including better healthcare services accessibility, a healthier population and financial protection from health risks. Consequently, this research aimed to determine the wheat farmers' morbidity cost and willingness to pay for healthcare insurance in Nigeria's Jigawa State. The specific objectives were: to determine the livelihood status of the farmers; identify the morbidity affecting the farmers' livelihood; estimate the economic cost of morbidity; assess the farmers' willingness to pay for health insurance; identify the key driving force behind farmers' willingness to pay for health insurance in the study area.

## **Theoretical framework**

S.V. Ciriacy Wantrup initially proposed the contingent valuation method of willingness to pay theory in 1947 as a technique for extracting market valuation of a non-market product using the open-ended protocol. Davis and Randal put it into practice in 1963 and 1974, respectively (Azhar et al., 2018). The contingent valuation method, based on a fictitious market scenario, is frequently used to gauge public willingness to pay. It is also commonly employed in cost-benefit analyses in health economics. The fact that welfare economics serves as the methodology's theoretical underpinning is a notable aspect of WTP's (willingness to pay) approach to economic evaluation. According to Abbas et al. (2019), "welfarism valuation methods, such as willingness to pay", have their theoretical roots in the methods used to estimate quality-adjusted life year (QALY) methods. One of the most popular participative approaches for determining the total economic value (TEV) of different categories of environmental goods and services that are difficult to exchange on the open market is the contingent valuation method (CVM). Because of the simplicity of reading the results of CVM, it is enticing.

Neoclassical welfare economics, rooted in two well-known monetary metrics of welfare changes, serves as the theoretical cornerstone of the method; specifically, the Hicksian Equivalent Variation (EV) and Compensating Variation (CV) measurements of changes in welfare. Let's use the welfare modifications to a person (consumer) brought about by a new proposed policy plan (such as environmental improvement) as an example. Let  $W_i^0$  represent welfare prior to policy intervention (or the status quo) and  $W_i^1$  represent welfare following policy intervention. Additionally, let  $W_i^0 = (y_i^0, P^0)$  and



$W_i^1 \equiv (y_i^1, P^1)$  reflect, respectively, the budgets that gauge the prices (p) and incomes (y) that consumer i will encounter under the new policy plan. Therefore, the change from the status quo level to the level following the implementation of the policy is just the variation in the indirect utility denoted by:

$$v(y_i^1, P^1) - v(y_i^0, P^0) \dots\dots\dots (1)$$

If  $v(y_i^1, P^1) - v(y_i^0, P^0) > 0$ , the consumer i will consent to the modification brought on by the new insurance plan. On the other hand, if  $v(y_i^1, P^1) - v(y_i^0, P^0) < 0$ , the customer will reject the proposal. The constraint on participation is represented by this. It is typically convenient to use a money metric technique to measure the resultant change in welfare; however, the majority of policymakers are mainly interested in the actual financial value of a planned novel legislation intervention (Fonta et al., 2018). The most straightforward strategy is to use the lowest expenditure function, which, as stated in Fonta et al. (2018), is dual to the indirect utility function. In other words,  $m(q; y, P)$  tells us how much money a particular person, i, would require at a vector of pricings, q, in order to be well off as they would be facing prices, P, while having income, y. As a result, Equation 1 can be expressed as follows:

$$m(q; y_i^1, P^1) - m(q; y_i^0, P^0) \dots\dots\dots (2)$$

If the sole difference between the pre-policy intervention and post-policy intervention levels is a price shift, such as  $q = P^0$  or  $q = P^1$ , this results in the CV and EV indicators of welfare changes, respectively. They are each defined as follows:

$$EV = m(P^0; y_i^1, P^1) - m(P^0; y_i^0, P^0) = m(P^0; y_i^1, P^1) - y_i^0 \dots\dots (3)$$

$$CV = m(P^1; y_i^1, P^1) - m(P^1; y_i^0, P^0) = y_i^1 - m(P^1; [P^0, y]_i^0) \dots\dots\dots (4)$$

The Hicksian Equivalent Variation (EV) metric for measuring a change in welfare is found in equation (3). It improves welfare when it is more than zero, and it does the opposite when it is less than zero. To put it another way, if  $EV > 0$ , equation (3) reflects the sum of money that a person is ready to accept from the policy planner in exchange for forgoing a boost from  $W_i^0$  to  $W_i^1$ . If EV is less than zero, equation (3) shows how much a person is prepared to spend to avoid moving to the ex-post decreasing welfare level  $W_i^1$ . A welfare change's Hicksian Compensating Variation (CV) metric is represented by equation (4). In order to make consumer i indifferent between  $W_i^0$  and  $W_i^1$ , it reveals how much money would be withdrawn from her wages at her new welfare level,  $W_i^1$ . Equation (4), when expressed in absolute terms, reflects the consumer's Willingness to Pay (WTP) to be at  $W_i^1$  or the amount of money the customer is Willingness to Accept (WTA) from the policy planner to maintain the previous, declining level of welfare  $W_i^1$ .

Typically, the valuation issue at hand or the type of proposed policy intervention heavily influences the technique chosen to be used. The CV is the most suitable welfare metric if the new policy plan's objective is to establish a compensation system at the new price  $P^1$ . The EV measure, however, is the best choice if the objective is to establish a benefit plan at the current price (Fonta et al., 2018). Table 1 depicts this connection.

Table 1. Relation between EV, CV, WTP and WTA

Items	EV measure	CV measure
Utility increases	WTA	WTP
Utility decreases	WTP	WTA

Source: Fonta *et al.* (2018); Haab and McConnell (2002).

WTP recognises individual preferences throughout the decision-making process and captures the broader advantages of health, such as the non-health benefits of related health outcomes. In nations where citizens are expected to pay a sizable portion of healthcare expenses, its importance is amplified. Similarly, the level of desire for health-related products is a crucial indicator for choosing wisely between competing health programmes that may be supported by the public. Other benefits of utilising WTP as an outcome measure include the need for information, the usefulness of the process, the value of the options and the altruistic value.

## Research methodology

The State is one of the 36 States in the country that shares common borders with Kano State and Katsina State border to the West, Bauchi State to the East and Yobe State to the Northeast. The State has a shared international border with the Zinder Region of the Republic of Niger to the north, which presents a special possibility for cross-border trade activity (Jigawa State Government (JSG), 2017). It is located in the country's Northwestern region between latitudes 11°N and 13°N and longitudes 8°E and 10.15°E Greenwich meridian time. It is the eighth most populous state in terms of ethnic composition, with a predominance of Hausa and Fulani residents (JSG, 2017). Rainfall volume normally varies between 600 and 1000 millimetres during the rainy season, which runs from May to September, according to Sadiq and Sani (2022). The province's southern region has a heavier rainfall than its northern region does (Sadiq and Sani, 2022). The State's overall land area is about 22,410 square kilometres, and the estimated population is 4,361,002 (National population Commission (NPC), 2017), with a current projection of 4,884,322 million people at a 3% growth rate. Sand dunes of varied sizes that extend several kilometres in some areas of the state add to its undulating geography. The Hadejia, Kafin-Hausa, and Iggi Rivers are the primary rivers, and other tributaries in the state's northeast feed large marshlands. The Hadejia and Kafin-Hausa Rivers traverse the state from the west to the east through the Hadejia-Nguru wetlands before emptying into the Lake Chad Basin. The state's economy is still heavily dependent on agriculture, and because of its semi-arid climate, workers frequently migrate to nearby states like Kano State in search of seasonal work (JGS, 2021). One of the state's most valuable natural resources is its large tracts of lush arable land, to which nearly all tropical crops may adapt. A large portion of the Sudanese savannah vegetation zone consists of grazing areas that are ideal for raising livestock.

Using a multi-stage sampling technique, a total of 283 selected active wheat farmers were used to elicit farm survey data. Firstly, given that wheat production cut across all the agricultural strata of the state, the saturated sampling frame of the stratified Jigawa State

Agricultural and rural development Agency (JARDA) zones, namely, Zone I (Birnin-Kudu), Zone II (Hadejia), Zone III (Gumel) and Zone IV (Kazaure) was taken. Secondly, the major producing Local Government Areas (LGAs) in each of the zone were purposively selected. The selected LGAs in Zones I, II, III and IV were: Jahun, Ringim, Hadejia and Kazaure, respectively. Thirdly, from each of the selected LGAs, three (3) villages were randomly selected, thus giving a total of 12 selected villages. Lastly, based on the sampling frame obtained from JARDA and reconnaissance survey (Table 2), a Krejcie and Morgan formula (Equation 1) was used to determine the representative sample size for the study. Thus, a total of 283 active wheat farmers were randomly selected. Using an easy cost-route approach, farm survey data of the 2022 wheat production season were collected with the aid of a well-structured questionnaire coupled with an interview schedule. Objectives I, III and V were achieved using the livelihood index, cost of morbidity technique and Tree regression model, while objectives II and IV were achieved using descriptive statistics and the contingent valuation method.

Table 2. Sampling frame of wheat farmers in the study area

Zones	LGAs	Villages	Population	Sample size
Birnin Kudu Zone (Zone I)	Jahun	Harbo Tsohuwa	134	16
		Harbo Sabuwa	149	18
		Jama'a	137	17
		Ringim Town	130	16
Gumel Zone (Zone II)	Ringim	Gabarin	143	18
		Dabi	198	24
		Sunamu	178	22
Hadejia Zone (Zone III)	Hadejia	Mai Alkama	258	31
		Hago	184	23
		Farin Daba	321	39
Kazaure Zone (Zone IV)	Kazaure	Gada	230	28
		Tudun Wayo	250	31
		<b>Total 4</b>	<b>4</b>	<b>12</b>

Source: Reconnaissance survey, 2021; Jigawa State Agricultural and Rural Development (JARDA), 2021.

$$n_p = \frac{N(X)}{X+(N-1)} \dots\dots\dots (5)$$

$$X = \frac{Z^2 \cdot x \cdot P(1-P)}{e^2}$$

n = Sample size; N = Population size; e = Acceptable sampling error; X= Finite sample size; and, P = Proportion of the population.

## Model specification

### Livelihood indexes

Before specifying the indexes, the preamble steps for generating the composite indexes viz. minimum normalization measure (Equation 6) and dimension index (Equation 7) are presented below:

$$I = \frac{I_i - I_{min}}{I_{max} - I_{min}} \dots\dots\dots (6)$$

Where, 'I' is the indicator index,  $I_i$  is the value of the  $i^{th}$  indicator;  $I_{min}$  is the minimum value of the  $i^{th}$  indicator; and,  $I_{max}$  is the maximum value of the  $i^{th}$  indicator.

$$D_i = \sum_{l=1}^{n=0} \left( \frac{w_i * I_i + \dots + w_n * I_n}{w_i + \dots + w_n} \right) \dots\dots\dots (7)$$

Where,  $D_i$  is the dimension index of  $i^{th}$  households and  $w$  is the weight of  $i^{th}$  Indicator index.

$$LSI_i = \frac{H+N+S+F+P}{w_H+w_N+w_S+w_F+w_P} \dots\dots\dots (8)$$

Where,  $LSI_i$  is the Livelihood strategy index of  $i^{th}$  households;  $w$  is the weight of  $i^{th}$  dimension.

The livelihood capital assets' classification (Sadiq and Sani, 2022): < 20% = very poor; ≥ 20% = poor; ≥ 40% = moderate; ≥ 60% = good; ≥ 80% = very good.

The livelihood strategy classification is: < 1 = survival strategy, ≥ 1 = coping strategy, ≥ 2 = adaptation strategy, ≥ 3 = accumulation strategy (four-scale) (Morris *et al.*, 2001); < 1 = survival strategy, ≥ 1 = coping strategy, ≥ 2 = adaptation strategy, ≥ 3 = consolidation and ≥ 4 = accumulation strategy (five-scale).

### Livelihood assets

The household's livelihood may be constructed on a foundation that is represented by the assets accessible for generating income. The five categories listed below serve as representations of these assets in the DFID framework (Table 3a).

**Natural capital (N):** refers to the stocks of natural resources that provide resource flows necessary for subsistence (such as land, water, animals, biodiversity, and environmental resources);

**Human capital (H):** refers to the abilities to work, learn, and maintain good health, all of which are necessary for pursuing a variety of livelihood options;

**Physical capital (P):** includes production machinery and tools that allow individuals to pursue their livelihoods, as well as essential infrastructure (transportation, housing, water, energy and communications);

**Social capital (S):** the social assets (networks, group membership, trust-based relationships and access to larger institutions of society) that people rely on to support themselves,

**Financial capital (F):** the available financial resources that enable people to choose from a variety of sources of income, such as savings, credit, regular remittances, or pensions.

These assets include both intangible resources more commonly studied by sociological and anthropological research, such as social capital, health and educational status and

tangible productive resources more commonly linked with economic studies, such as land, labour, capital and stocks.

Table 3a. Livelihood assets

Dimension	Indicator	Dimension	Indicator
Human capital	Farming knowledge	Financial capital	Income
	Farming skills		Savings
	Farming experience		Assistance / Subsidies
	Health		Individual Credit
	Household size		Credit from Credit Institutions
	Other business skills		Remittances
	Other business experiences		Access to transportation and ICT
Natural capital	Land fertility	Physical capital	Production facilities
	Irrigation water sources		Infrastructures
	Climate suitability		Working equipment
	Farm production		Accessibility to institutions
Social capital	Community Organizations		
	Social Networking		
	Mutual cooperation		
	Trust		

Source: modified from Illu *et al.* (2021); Sadiq and Sani (2022).

### ***Livelihood strategy***

Among others, Devereaux (1993) and Davies (1996) have distinguished between survival, coping, adaptive, and accumulative strategies (Table 3b). In response to an opportunity, accumulative techniques boost asset stocks and consumption results. Adaptive strategies aim to disperse consumption failure risk in response to foreseen negative trends. This could be achieved by expanding into new activities or by intensifying current livelihood methods. Coping mechanisms involve lowering consumption and depleting assets in order to lessen the effects of a negative shock. In the absence of respite, coping may result in survival tactics. In an effort to avoid poverty and death, survival methods not only dramatically cut back on consumption but also significantly, and most frequently irreparably, deplete household assets.

Table 3b. Typology and examples of different livelihood strategies

Livelihood strategy	Internal livelihood system component		
	Change to assets	Strategies	Consumption outcomes
Accumulative	Increased asset stock. Increased flexibility across asset base.	As for adaptive	More income. Better nourishment. Increased security.
Adaptive	Altering the mix of assets. Prudently preserving money and other assets.	Extensification (cultivation of more land). On-farm & off-farm diversification (e.g. change in cropping mix, wage labour). Intensification of cash cropping. Investments in social capital. Migration.	Consumption and income smoothing Lowering of risk Spreading of risk. smoothing of labor
Coping	Increased livestock sales Calling down impromptu claims (for instance, via kin networks).	Farm labor, piecework Temporary migration Youngsters being taken out of school.	Reduced meal frequency, size, and quality. Use where available of relief food. Less social and ceremonial duties.
Survival	Selling of useful assets (like bicycles and land). Sale of furniture and other home items.	Illicit behavior. Begging.	Permanent out-migration Poverty and starvation.

Source: Morris *et al.*(2001); Davies (1996); Devereaux (1993).

**Cost of morbidity technique**

Following Oparinde et al.(2018) and Abaoba (2020), the costs of morbidity technique was used to estimate the economic burden of mortality among farm families.

$$FC = \sum_{i=0}^n (F_d + F_m + F_t + F_{fd}) \dots\dots\dots (9)$$

$$T = \sum_{i=0}^n (Ts * as * w) + (Tc * ac * w) \dots\dots\dots (10)$$

$$E = \sum_{i=0}^n (FC + T + P) \dots\dots\dots (11)$$

Where,

FC= Total financial cost of health care during the farming season (₦);

F<sub>d</sub> = Financial cost of drugs, herbs etc (₦);

F<sub>m</sub> = Financial cost of medical consultancy (₦);

F<sub>t</sub>= Financial cost transportation (₦);

F<sub>fd</sub>= Financial cost of feeding (₦);

T = Total time cost (days of forgone production);

Ts = Time cost of the sick person(s) (days of forgone production);

Tc = Time cost of the care giver(s) (days of forgone production);

w = Daily wage rate of sick person/care giver (₦);

as = Age coefficient of sick person(s);

ac = Age coefficient of care giver(s);  
 P= Preventive cost.

According to Sauerborn et al. (1996), an individual's financial production rises from their very early 20s to roughly age 40 and gradually declines after that. This information was used to determine the value of the age coefficient "a". The values of coefficient "a" were as follows:

Age ≤ 17 years = 0.5; Age ≥ 18 = 1; Age ≥ 41=0.75; Age ≥ 56 = 0.67; Age > 65 = 0.45

**Contingent valuation method (CVM)**

In non-marketed commodities like health insurance, CVM is frequently used to evaluate WTP modifications (Gidey et al., 2019; Ogundeji et al., 2019; Njie et al., 2023). According to research by Njie et al. (2023), double-bounded dichotomous choice (DBDC) questions with a follow-up approach are more effective because they allow respondents to share more details about their WTP. Arithmetic mean was utilised to estimate WTP in both the present and ideal case scenarios to determine the average WTP required to pay for healthcare insurance. The following formula is used to calculate the average WTP:

$$\text{Average WTP} = \frac{\sum_{i=1}^n \text{bidding amount}}{\sum_{i=0}^n \text{number of respondents who are WTP}} \dots\dots\dots (12)$$

**Tree regression**

$$WTP_i = f(X_1, X_2, \dots, X_n) \dots\dots\dots (13)$$

$$WTP_i = \beta_0 + X_1\beta_1 + \dots + X_n\beta_n + \varepsilon_i \dots\dots\dots (14)$$

Where,  $WTP_i$  = Willingness to pay (yes =1, no=0);  $X_1$ = Age [young aged adult (< 31) =0, middle-aged adult (>= 31) =1, old-aged adult (> 45) =2];  $X_2$ = Gender (male =1, otherwise=0);  $X_3$  = Marital status (single =0, married =1);  $X_4$ = Education (non-formal =0, primary =1, secondary=2, tertiary=3);  $X_5$ = Household size (small= 0, moderate =1, large=2);  $X_6$ = Farming experience (small= 0, moderate =1, high=2);  $X_7$ = Extension service (yes= 1, no=0);  $X_8$ = Credit access (yes =1, no=0);  $X_9$ = Co-operative membership (yes =1, no=0);  $X_{10}$ = Agricultural holding [marginal (< 1) = 0, small (>= 1) = 1, semi-medium (>=2) =2, medium (>=3) = 3, large (>=4) =4];  $X_{11}$ = Operational holding [marginal (< 1) = 0, small (>= 1) = 1, semi-medium (>=2) =2, medium (>=3) = 3, large (>=4) =4];  $X_{12}$ = Income (small = 0, semi-medium =1, medium = 2, large =3);  $X_{13}$ = Initial bidding (IBID) (yes =1, no=0);  $X_{14}$ = Livestock ownership (small= 0, moderate =1, large=2);  $\varepsilon_i$  = Noise;  $\beta_0$ = Intercept; and,  $\beta_{1-n}$ = Regression parameters.

**Results and discussion**

**Livelihood activities, assets and strategy of the farmers**

The results in Figure 1 showed crop production (CP) to be the major livelihood activity undertaken by most (42.4%) of the respondents, followed by craft work (CW) (38.6%) and then non-timber forest products (NTFPs) activity (13.7%). Nevertheless, the proportions of participation in other livelihood activities in the study area were marginal, as

evident by their respective percentages that were less than one percent. These findings justified the earlier results that showed farming to be the major primary and secondary occupations undertaken by the respondents in the study area. Therefore, as suggested earlier with regard to the findings on occupations, there is a need to sensitise and encourage the farmers to diversify their enterprises to boost their income stream and as a measure against risks and uncertainty that affect livelihoods.

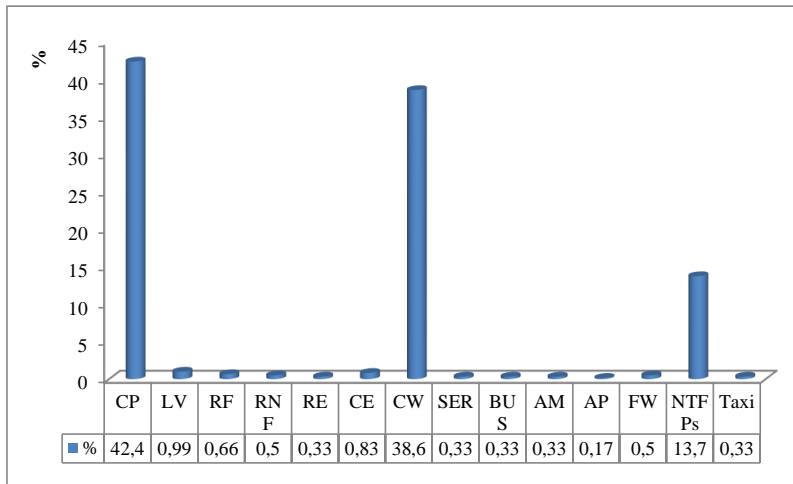


Fig. 1. Distributions of livelihood's activities of the respondents

Source: Authors' own research.

Furthermore, on average, the empirical evidence showed that the statuses of human (80.19%), natural (65.13%) and social (62.24%) livelihood capital assets in the study area were good, while those of financial and physical capital assets were moderate (50.02%) and poor (-218.55%), respectively (Figure 2). By implication, it can be inferred that most of the farmers had good possession of human, natural and social livelihood capital assets, while possession of financial and physical capital assets was poor. The moderate status of financial asset may be attributed to poor supply of credit facilities and a low income base. However, the poor physical asset is attributed to poor access to institutions, inadequate working implements, poor production facilities, inadequate provision of infrastructural facilities – such as public commodities like poor feeder road networks, social amenities, etc. – and poor access to transportation and information and communication technology. Therefore, the study advises policymakers to address the challenges that affected the livelihood's financial and physical capital assets to avoid jeopardising the good statuses of the three livelihood capital assets, thus containing the near likelihood of livelihood vulnerability of



most of the respondents to shocks and stresses, especially those caused by weather-induced extremities in the study area.

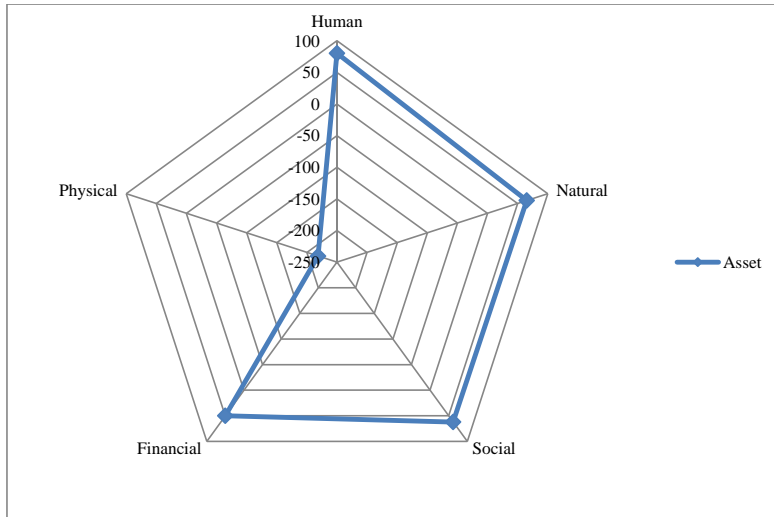


Fig. 2. Livelihood's capital assets distribution of the respondents

Source: Authors' own research.

Moreover, the results in Figure 3a (five-dimension, modified) showed that the majority (51.9%) of the respondents adopted a consolidation strategy for livelihood sustenance, 31.8% used an accumulation strategy and 2.5% adopted an adaptive strategy, while 9.2% and 4.6%, respectively, resorted to coping and survival strategies for livelihood sustenance. On the four-dimension, the majority (71%) of the farmers adopted an accumulation strategy for livelihood sustenance, while a handful of 14.1%, 8.1% and 6.7%, respectively, used adaptive, coping and survival strategies for livelihood sustenance (Figure 3b). Generally, it can be inferred that in response to opportunities, the majority of the respondents adopted strategies (accumulation and consolidation) that increased their stocks and consumption outcomes. Nevertheless, for those that adopted the adaptive strategy, it can be concluded that in response to anticipated adverse trends, they tend to spread their risks of consumption failure. However, for those that adopted coping, it can be inferred that in order to absorb the impact of adverse shocks, they draw down their assets and reduce consumption. For those that were caught in the survival strategy, it can be concluded that the respondents not only cut down consumption drastically, but their household's assets were extensively, most often irreversibly eroded in an attempt to ward off destitution and mortality.

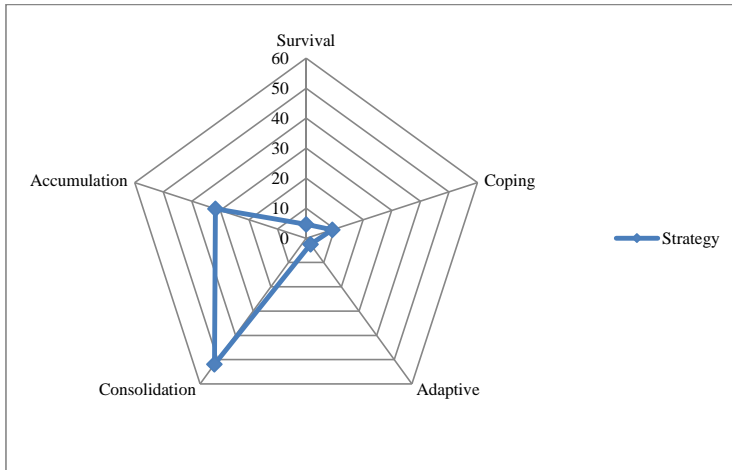


Fig. 3a. Distribution of the respondents based on livelihood strategies  
Source: Authors' own research.

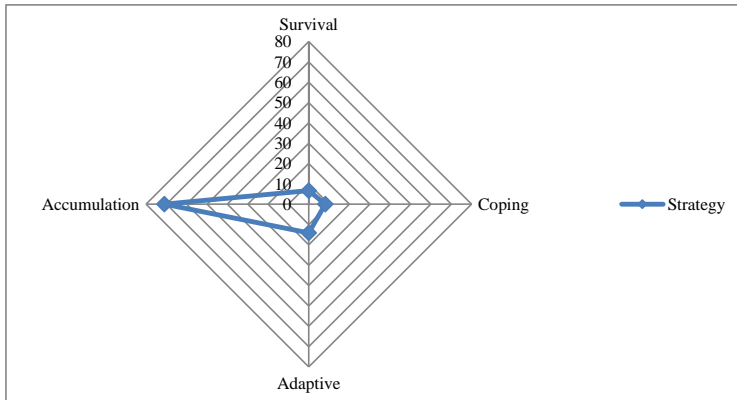


Fig. 3b. Distribution of the respondents based on livelihood strategies  
Source: Authors' own research.

***Types of morbidity suffered by the farmers***

A cursory review of the results showed that malaria disease was the most prevalent morbidity suffered by the farmers (44%), followed by typhoid/yellow fever (22%) and then catarrh at a rate of 10% (Table 4). However, the least common morbidities suffered by the farmers in the study area were tuberculosis and guinea worm, each at a proportion of 1%. By implication, malaria remains a threat in the study area despite government and non-governmental interventions aimed at eradicating the disease. This could be linked to the pathogen's mutation resistance to the antidote and the poor utilisation of insecticide-treated nets. Additionally, the farmers have reported adverse reactions on their skin and eyes due to the use of these nets. Therefore, the study urges policymakers to intensify their efforts to address malaria and typhoid fever in the study area.

Table 4. Distribution of morbidity suffered by the farmers

Disease	Frequency	Percent
Catarrh	28	0.10
Malaria	125	0.44
Typhoid/Yellow fever	62	0.22
Measles	6	0.02
Cholera/Diarrhea	14	0.05
Stomach ache	11	0.04
Waist pain	11	0.04
Back pain	14	0.05
Rheumatism	6	0.02
Tuberculosis	3	0.01
Guinea worm	3	0.01
Total	283	100.00

Source: Field survey, 2022.

***Cost of morbidity among farmers***

On the average, the incurred economic cost of morbidity in the study area was N6,809.59k while the financial, timing and preventive costs were N3,611.05, N2,548.04 and N650.50k respectively (Table 5). Of the incurred economic cost, the financial cost had the highest contribution (53.03%) while preventive cost had the least contribution (9.55%). Nevertheless, decomposition-wise, in descending order, the cost of drugs, timing cost of the sick and timing cost of the caregiver accounted for the highest proportion of the economic cost. Generally, it can be inferred that financial cost is the major cost incurred by the farmers on morbidity. This finding is contrary to the findings of Aboaba (2020) and Adekunle et al. (2016) who in their various study areas established that timing cost contributed most to incurred economic cost of morbidity.

Table 5. Cost estimates of morbidity

Items	Average	Percent
Cost of drugs/herbs etc	1947.00	28.59
Consultancy medical fees	500.01	7.34
Cost of travel	164.03	2.41
Cost of feeding	1000.02	14.69
TCS	1319.77	19.38
TCG	1228.27	18.04
TFC	3611.06	53.03
TTC	2548.04	37.42
PC	650.50	9.55
EC	6809.59	100.00

Note: TCS= time cost of the sick person; TCG= time cost of the caregiver; TFC= total financial cost; TTC= total time cost; PC= preventive cost; EC= economic cost; ₦ = Naira (Nigerian currency); \$1 = ₦ 417 as at the period (2022) of study.

Source: Field survey, 2022.

#### *Farmers' willingness to pay for healthcare insurance*

A perusal of the results showed that the majority (58.7%) of the farmers were willing to pay for healthcare services insurance, while 41.3% were not willing to pay for health insurance (Table 6a). Thus, it is evident that the farmers were willing to participate in social healthcare services as a measure towards enhancing their farm family livelihood. Furthermore, of the farmers who indicated their interest in paying for health insurance, slightly more than half (50.5%) were willing to pay 5% of their income as a premium in the initial bidding, while the remaining 49.5% declined the initial bidding. Therefore, this study calls on policymakers to extend the social health service scheme to wheat farmers rather than restricting it to formal labourers, but they should be meticulous about the premium charge to ensure broader acceptability and sustainability.

Table 6a. Willingness to pay and IBID of the farmers

Items	Frequency	Percent
<b>WTP</b>		
Yes	166	58.7
No	117	41.3
Total	283	100
<b>IBID</b>		
Yes	143	49.5
No	140	50.5
Total	283	100

Source: Field survey, 2022.

Furthermore, in the ideal situation, the average WTP for the healthcare insurance at ideal situation was N 119528.31, while at the present situation, the average positive (IBID) WTP for health insurance was N 138753.15 (Table 6b). The lower WTP in the ideal situation compared to the present situation indicates that farmers would not be willing to pay more even if the healthcare insurance scheme improves.

Table 6b. WTP for health insurance at ideal and present situations

Item	Condition	Mean	Difference
WTP present	Non-truncated	₦ 138753.15	₦ 19224.83
WTP ideal	Truncated	₦ 119528.31	

Source: Field survey, 2022.

#### ***Determinant(s) of farmers' WTP for healthcare insurance***

Of the fourteen specified variables, only three variables – initial bidding (IBID), livestock ownership (LIV) and extension services – were retained in the final model, while the rest were automatically discarded because their contributions to the model were insignificant. The tree's depth is three (3), meaning it has three levels below the root node, four (4) terminal nodes and a total of seven (7) nodes. The gain chart indicates that the model fits the specified equation well, as shown by the cumulative gain chart steeply rising towards 100% and then levelling off (Figure 4a). However, the index chart shows the best fit of the model, as demonstrated by its cumulative index chart starting above 100% and gradually descending until it reaches 100% (Figure 4b). Furthermore, with a risk index of 0.071, the risk of misclassifying farmers' WTP is approximately 7.1%. Consequently, about 92.9% of farmers willing to pay for health insurance in the study area are correctly predicted by the model.

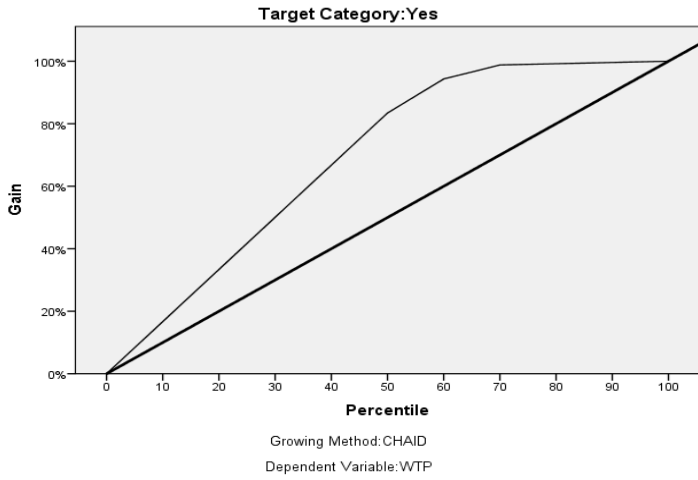


Fig. 4a. Gain chart distribution

Source: Computer print-out, 2022.

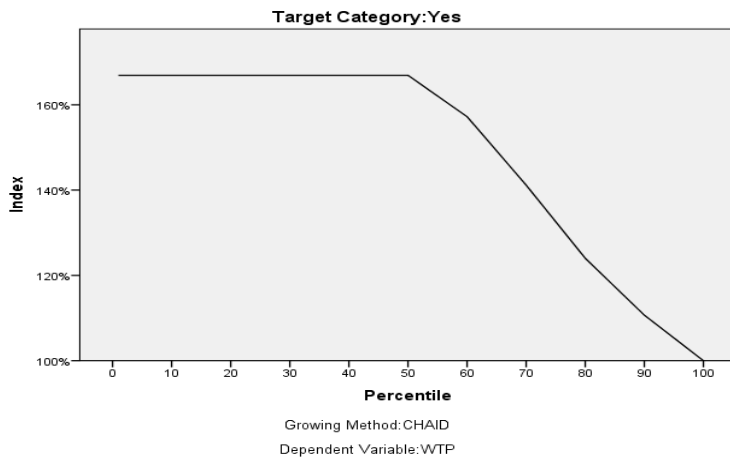


Fig. 4b. Index chart distribution

Source: Computer print-out, 2022.

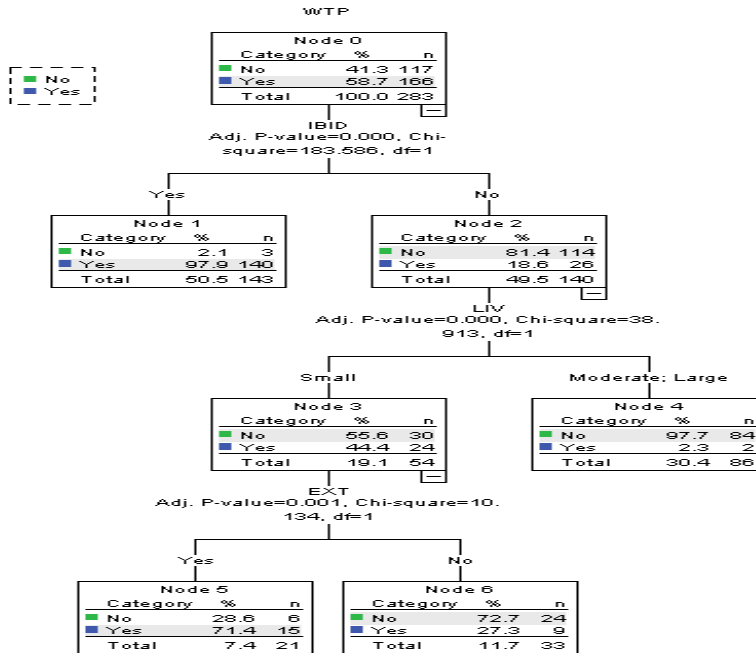


Fig. 4c. Key drivers of WTP for healthcare insurance

Source: Computer print-out, 2022.

Empirically, IBID is the most important predictor of willingness to pay (WTP) for healthcare insurance among the farmers (Figure 4c). For the farmers that accept the IBID of 5% of their income as a premium, IBID is the only predictor of WTP as it has no child node, thus a terminal node. Of the farmers in this category, 97.8% are willing to pay for healthcare insurance. For the farmers that indicated "no" to IBID, LIV is the best next predictor. For those with a large livestock value, given that it is a terminal node, LIV is the only predictor of WTP. In this category, very few (2.3%) of the farmers indicated their WTP and the possible reason may be attributed to large augmented deferred income value, a contingency which can enable them to cope with their family medical challenge when the need arises, thus the less or no need for formal anticipated future social health plan programme. For the farmers with small LIV, the extension service is the next predictor of WTP for healthcare insurance. The majority (71.4%) of the farmers with access to extension services are WTP, while only a few (27.3%) of those who didn't have access to

extension services indicated willingness to pay for healthcare insurance. Therefore, it can be inferred that the social aspect of advisory services is crucial in enlightening farmers to key into the social health insurance programme to cushion their farm family livelihood health risk challenges. As a rider, the onus lies on policymakers on the need to extend social health insurance to farmers in the study area rather than restricting it to formal employees, thus strengthening growth and development in the rural economy. By making farmers stakeholders in health expenditure, this singular act can go a long way in reducing high government capital expenditure on healthcare services, consequently entrenching a more balanced livelihood in the study area in particular and the country in general.

Table 7. Diagnostic test of gain and index

Node	Node		Gain		Response (%)	Index (%)
	Frequency	%	Frequency	%		
1	143	50.5	140	84.3	97.9	166.9
5	21	7.4	15	9.0	71.4	121.8
6	33	11.7	9	5.4	27.3	46.5
4	86	30.4	2	1.2	2.3	4.0

Source: Computer print-out, 2022.

Furthermore, a summary of the index values shows that the observed percentage of farmers willing to pay for health insurance in the target category of the terminal nodes viz. 1 and 5 are more than the expected percentage in the target category (willing to pay) of the root node. This is evident from their respective index values, which are greater than 100% (Table 7). In contrast, the observed percentage of farmers in the terminal nodes viz. categories 4 and 6 is lower than the expected percentage in the root node category, as indicated by their respective index values being less than 100%.

### Conclusions and recommendations

Based on these findings, it was inferred that accumulation was the major livelihood sustenance strategy used, vis-à-vis diversification activities, to increase stock and consumption outcomes for farm families. Additionally, the farmers have good possession of human, natural and social livelihood capitals, while possession of financial capital, a catalyst for growth and development, was not impressive. Sadly, there is poor possession of physical livelihood capital in the study area, mainly due to inadequate infrastructural facilities. Furthermore, the morbidity affecting the livelihood of most farmers was malaria disease. Consequently, for a better livelihood, slightly more than half of the sampled population were willing to participate in social health insurance, primarily driven by the social aspects of advisory services, which receive less attention. Therefore, the study recommends the need for enhanced institutional support to ensure a better livelihood for wheat farmers in the study area.



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Maryla Bieniek-Majka<sup>1</sup>

Uniwersytet Kazimierza Wielkiego w Bydgoszczy

## **Kryteria estetyczne narzucane przez sieci handlowe a potencjalne utracone korzyści w produkcji podstawowej marchwi. Studium przypadku**

### **Aesthetic Criteria Imposed by Retail Chains vs Potential Benefits Lost in Primary Carrot Production – A Case Study**

**Synopsis.** Celem niniejszego opracowania jest wskazanie wysokości potencjalnych, utraconych przychodów dla badanych producentów marchwi wynikających ze strat w produkcji podstawowej. Nadmierne straty spowodowane są koniecznością stosowania kryteriów estetycznych narzuconych przez sieci handlowe. Materiałem źródłowym była literatura przedmiotu, dokumentacja księgowa za lata 2019-2022 oraz informacje pozyskane podczas wywiadów eksperckich z producentami marchwi, które zostały przeprowadzone w styczniu 2023 roku. Badaniem objęto dobranych celowo 7 producentów, których zagregowana wielkość zbiorów marchwi stanowiła w 2021 roku około 15% wielkości zbiorów w województwie kujawsko-pomorskim i około 2,8% w kraju. Rozmiary strat przedstawiono na podstawie wskaźnika bilansu mas. Stwierdzono, że tylko 43,86% zebranego surowca jest sprzedawana jako pełnowartościowy produkt (zaakceptowany przez sieci handlowe). Pozostała część jest dostarczana jako pokarm dla zwierząt, surowiec do przetwórstwa bądź paliwo do biogazowni. Wartość potencjalnych, utraconych korzyści oszacowano na podstawie różnicy uzyskanego przychodu ze sprzedaży produktów odrzuconych, a wartością potencjalnego przychodu uzyskanego przy założeniu, że producenci mogliby sprzedać 50% masy odrzuconej marchwi po średniej cenie rynkowej produktu spełniającego „normy” z upustem cenowym w wysokości 30%, 50% lub 70%. Z przeprowadzonej analizy wynika, że średnie przychody producenta (przy uwzględnieniu przyjętych założeń) mogłyby być wyższe od 30% do 173%, co dałoby wyższy przychód od 0,34 mln zł do 1,92 mln zł rocznie.

**Słowa kluczowe:** utracone korzyści, straty, marchew

**Abstract.** The aim of this article is to present the value of potential lost revenues for the surveyed carrot producers resulting from losses in primary production. Excessive losses are caused by the need to apply aesthetic criteria imposed by retail chains. The source material was subject literature, accounting documentation for the years 2019-2022 and information obtained during expert interviews with carrot producers (January 2023). The study covered seven purposively selected producers, whose aggregate volume of carrot harvests in 2021 was approximately 15% of the harvest volume in the Kuyavian-Pomeranian Voivodeship and approximately 2.8% in the country. The size of the losses was presented based on the mass balance index. It was found that only 43.86% of the collected raw material is sold as a full-value product (accepted by retail chains). The remaining part is supplied as animal food, raw material for processing or fuel for biogas plants. The value of potential lost revenues was estimated based on the difference between the revenue obtained from the sale of rejected products and the potential revenue value obtained (assuming that producers could sell 50% of the weight of rejected carrots at the average market price of a product meeting the "standards" with a price discount in the amount of 30%, 50% or 70%). The analysis shows that the manufacturer's average revenues – taking into account the adopted assumptions – could be higher by 30% to 173%, resulting in higher revenue from 0.34 million to 1.92 million PLN annually.

**Key words:** lost benefit, losses, carrot

**JEL Classification:** O12, Q14

<sup>1</sup> dr, Uniwersytet Kazimierza Wielkiego w Bydgoszczy, e-mail: maryla.bieniek-majka@ukw.edu.pl;  
<https://orcid.org/0000-0003-1448-7406>



## **Wstęp**

Potencjalne utracone korzyści odnoszą się do sytuacji, w których pewne korzyści lub możliwości nie są osiągalne lub są ograniczone z różnych powodów. Utracone korzyści to często efekt decyzji własnych lub zewnętrznych decydentów, które prowadzą do utraty szansy na zdobycie dodatkowych zysków. Właściciele przedsiębiorstw analizują nie tylko bieżące korzyści, ale w swoich decyzjach uwzględniają także potencjalne utracone korzyści, aby uniknąć sytuacji, w której nie będą oni mogli w pełni wykorzystać potencjału swoich firm.

Gospodarstwa rolne to przedsiębiorstwa produkujące artykuły rolno-spożywcze. Dochód rolników jest determinowany wieloma czynnikami, jednakże do najważniejszych zaliczyć należy:

- ceny produktów rolnych,
- koszty produkcji,
- warunki agrometeorologiczne,
- technologie rolnicze,
- dostęp do rynków,
- wielkość gospodarstwa rolnego,
- polityka rolna.

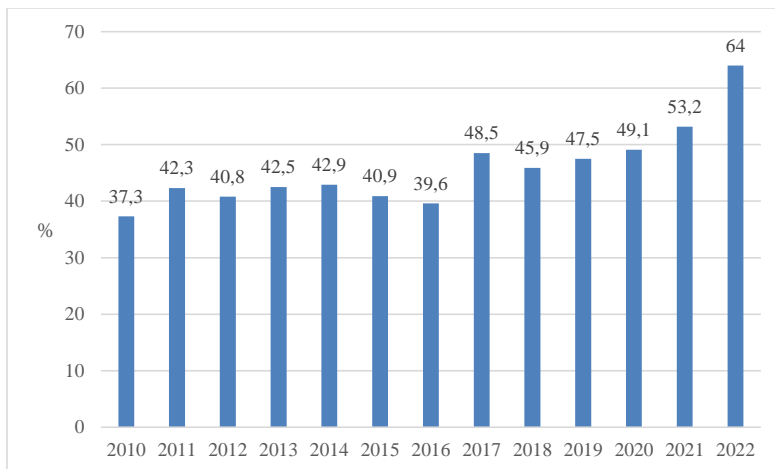
Należy zauważyć, że wskazane wyżej determinanty są ze sobą powiązane i zmiany w jednym obszarze mogą mieć odzwierciedlenie w innych czynnikach kształtujących dochody rolników.

Na poziom dochodów uzyskiwanych z działalności prowadzonej w gospodarstwie rolnym w sposób bezpośredni wpływają relacje między cenami środków produkcji dla rolnictwa, a cenami zbytu produktów rolniczych. Jak zauważają Andrzej Hornowski i Andrzej Parzonko (2023), w procesie podejmowania decyzji przez rolników kluczowe znaczenie ma także relacja wysokości możliwych do uzyskiwania dochodów z prowadzonej działalności rolniczej do dochodów możliwych do osiągnięcia z pracy poza gospodarstwem. Jak możemy zauważyć (rysunek 1) dysproporcja pomiędzy dochodami gospodarstw rolnych w porównaniu z wynagrodzeniami w całej gospodarce w Unii w latach 2010-2022 znacznie zmniejszyła się (z 37,3% do 64%) jednakże nadal dochody rolników są wyraźnie niższe od dochodów uzyskiwanych poza rolnictwem.

Niższe dochody, zdaniem Józefa Stanisława Zegara (2023) są konsekwencją niższej efektywności produkcyjno-ekonomicznej. Wydajność (produktywność) i efektywność techniczna polskiego rolnictwa odbiegają in minus od rolnictwa UE. Podkreśla on także, że niższa efektywność przekłada się na dochody rolników określane przez rynek i politykę. Rolnicy, niemal w połowie krajów UE, bez dopłat do działalności operacyjnej nie osiągnęliby bowiem dochodu z działalności rolniczej. Zatem dla tego dochodu, obok renty politycznej, coraz ważniejsza jest renta ekonomiczna - wynikająca z poprawy wydajności pracy. W tym miejscu nasuwa się pytanie - czy wzrost wydajności produkcji będzie miało przełożenie na wzrost dochodów w sytuacji, gdy rolnik nie może wprowadzić na rynek produktów wartościowych konsumpcyjnie jednakże nie spełniających walorów estetycznych?

Čzęsto duże partie produktów rolnych są traktowane jako odpad (strata) bo nie spełniają kryteriów jakości, takich jak kształt, rozmiar, kolor i waga, wymaganych przez przetwórców lub rynki docelowe (Andrzejewska, 2023). W literaturze przedmiotu o stratach żywności mówi się, gdy zmniejszenie masy jadalnej żywności występuje w początkowych etapach łańcucha żywnościowego takich jak: produkcja rolnicza, zbiory, przetwórstwo, transport czy

też magazynowanie. Natomiast w końcowych ogniach łańcucha żywnościowego (tj. etap dystrybucji, jak i na poziomie końcowego konsumenta) występuje marnotrawstwo jedzenia (Marszałek, 2018).



Rys. 1. Procentowa relacja przeciętnego dochodu z gospodarstwa rolnego w porównaniu z wynagrodzeniem pracowników w całej gospodarce UE-27

Fig. 1. Percentage ratio of average farm income to employee wages in the entire EU-27 economy

Źródło: opracowanie własne na podstawie danych Komisji Europejskiej. [https://agriculture.ec.europa.eu/common-agricultural-policy/income-support/income-support-explained\\_en?prefLang=pl](https://agriculture.ec.europa.eu/common-agricultural-policy/income-support/income-support-explained_en?prefLang=pl) data pobrania 04.01.2024.

Wielkość strat na początkowym etapie łańcucha rolno-żywnościowego należy do najtrudniejszych do rozpoznania i oszacowania. Jednak podejmuje się próby wskazania wielkości strat i wskazania sektorów w rolnictwie, które mają znaczący udział w ich generowaniu. Zespół pod kierownictwem Sylwii Łaby, na podstawie przeprowadzonych badań, wskazuje, że w Polsce w gospodarstwach rolnych w 2019 roku średnie straty w masach na jedno gospodarstwo wynosiły między 0,31 ton w produkcji rzepaku i rzepiku a 3,83 ton w przypadku produkcji owoców i warzyw, czyli kilkanaście razy więcej. Sektor owocowo-warzywny w ogólnym poziomie strat miał udział na poziomie niemal 24% wszystkich strat (prawie 0,5 mln ton) (Łaba, 2020).

Celem niniejszego opracowania jest wskazanie wysokości potencjalnych, utraconych korzyści dla badanych producentów marchwi wynikających ze strat spowodowanych stosowaniem cosmetic standards narzuconych przez sieci handlowe. Zdaniem Autorki są to straty nadmierne, które można ograniczyć umożliwiając wprowadzenie na rynek produktów konsumpcyjnie pełnowartościowych jednakże nie spełniających kryteriów estetycznych.

## **Praktyki stosowane przez sieci handlowe**

W ciągu ostatnich trzech dekad sektor handlu detalicznego w Europie Środkowo-Wschodniej uległ radykalnej zmianie. Rynek detaliczny jest skonsolidowany, a sieci handlowe z Europy Zachodniej mają przewagę konkurencyjną. Prowadzona przez nie polityka koncentruje się na procesie zarządzania organizacją oraz wymaganiach konsumentów. Zdaniem Mili Kavalić i zespołu (2019) przykłady dobrej praktyki kreowane przez sieci handlowe mogą stać się silnym czynnikiem pozycjonującym na rynku i mającym wpływ na budowanie i utrzymanie przewagi konkurencyjnej w przyszłości. Ponadto sieci handlowe ze względu na skalę działania, potencjał finansowy i siłę transakcyjną, mają znaczący wpływ na kształtowanie gustów i preferencji konsumentów, a więc mogą wywierać istotny wpływ na upowszechnianie dobrych praktyk w całym łańcuchu dostaw. Niestety sieci handlowe stosują także nieuczciwe praktyki handlowe, które przyczyniają się do wzrostu ilości start i marnotrawstwa żywności. Dla przykładu Ciesielski (2017) wskazuje, że dominujący handel detaliczny oprócz presji cenowej (ograniczającej poziom przychodów, a co za tym idzie dochodów producentów) stosuje tzw. nieuczciwe praktyki do których zalicza on m.in. brak pisemnej umowy (mimo nakazu prawnego (Bieniek-Majka, 2023)), wieloznaczne warunki umowne, zmiany umowy z mocą wsteczną, czy nieuczciwe przeniesienie ryzyka handlowego. Wyjątkowo negatywne skutki dla dostawców (mogące mieć swoje odzwierciedlenie w ich dochodach) powstają wtedy, gdy sieci wymuszają na dostawcach akceptowanie zmian wielkości zamówień, nawet tuż przed planowanym terminem rozpoczęcia dostawy, bądź przerzucają ryzyko handlowe na dostawców wymagając od nich odebrania niesprzedanego towaru. Jak zauważa E.A. Mayorova (2019) duży detaliści (sieci handlowe) z jednej strony nagminnie stosują nieuczciwe praktyki handlowe w łańcuchu dostaw, a z drugiej strony podejmują działania pro środowiskowe, które mają na celu poprawić ich wizerunek.

W ostatnim czasie można było zauważyć kilka przeprowadzonych przez sieci handlowe akcji wspierających producentów rolnych w trudnej sytuacji. Dla przykładu kampanie „liczy się wnętrze”, czy „druga szansa buraków” dotyczyły skupu przez sieć „krzywych buraków” od rolnika, według którego ich wygląd był konsekwencją wady nasion. Akcje „daj szanse marchewce” czy „daj szanse warzywom” nakłaniały klientów do zakupu produktów pełnowartościowych, ale niespełniających kryteriów cosmetic standards ustanowionych de facto właśnie przez sieć. Producent marchwi, któremu tak jak w przypadku buraków w sprzedaży owoców rolnych pomogła sieć handlowa podkreśla, że „doskonały wygląd warzyw, piękny kolor czy regularny kształt to częste przesłanki decydujące o zakupie danego produktu lub jego odrzuceniu w przypadku niespełnienia tych oczekiwań. Niestety wiemy, że klienci wciąż pozostają w tym zakresie bezlitośni, a przecież natura tak nie działa” (Portal..., 2021). Lu Shijun z zespołem (2022), który badał rynek chiński, zauważył, że rygorystyczne wymagania i irracjonalne preferencje konsumentów (“eye-catching”) dotyczące rozmiaru i koloru często prowadzą do wyrzucania dużej ilości żywności już na polu lub na etapie produkcji podstawowej co znajduje swoje odzwierciedlenie w przychodach producentów rolnych.

## **Materiały i metody badawcze**

Materiałem źródłowym była literatura przedmiotu, dokumentacja księgową za lata 2019-2022 oraz informacje pozyskane podczas wywiadów eksperckich z producentami marchwi, które zostały przeprowadzone w styczniu 2023 roku. Badaniem objęto dobranych celowo 7 producentów, których zagregowana wielkość zbiorów marchwi stanowiła w 2021 roku około 15% wielkości zbiorów w województwie kujawsko-pomorskim i około 2,8% w kraju. Badani producenci dysponowali zmodernizowaną bazą przechowalniczą, liniami produkcyjnymi oraz samochodami z naczepami wyposażonymi w agregaty chłodnicze. Uprawa marchwi i proces przygotowania do sprzedaży są przeprowadzane zgodnie z wytycznymi GlobalGAP. Posiadany certyfikat daje możliwość współpracy z sieciami handlowymi, które to są głównym odbiorcą przygotowanej do sprzedaży marchwi. Rozmiary strat przedstawiono na podstawie wskaźnika bilansu mas (Niadek i in., 2019), czyli udziału masy wyrobów gotowych oraz masy surowca przeznaczonego do sprzedaży jako surowiec do przetwórstwa lub pasza dla zwierząt w masie surowca przyjętego.

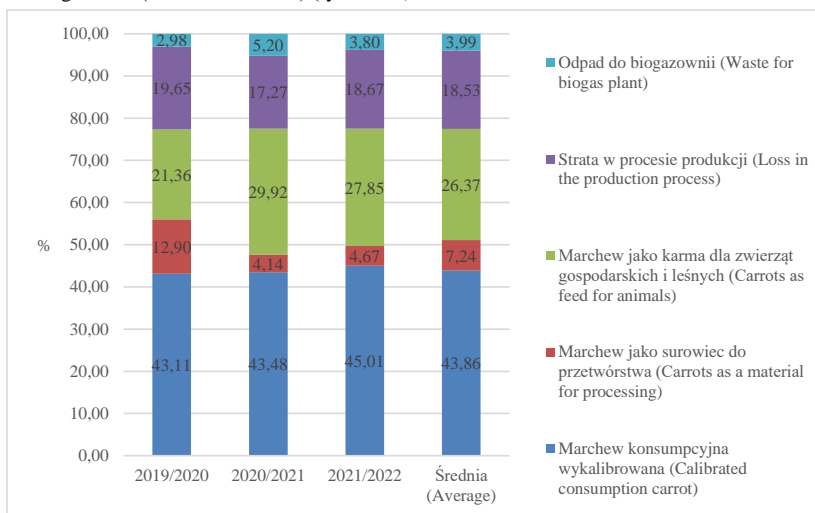
$$\text{Straty} = \frac{\text{masa produktów gotowych} + \text{masa surowca do sprzedaży (surowiec do przetwórstwa} + \text{pasza dla zwierząt)}}{\text{masy surowca przyjętego do magazynu}}$$

Wartość potencjalnych, utraconych korzyści oszacowano na podstawie różnicy uzyskanego przychodu ze sprzedaży produktów odrzuconych, a wartością potencjalnego przychodu uzyskanego przy założeniu, że producenci mogliby sprzedać 50% masy odrzuconej marchwi po średniej cenie rynkowej produktu spełniającego „normy” z upustem cenowym za niedoskonały wygląd w wysokości 30%, 50% lub 70%.

## **Potencjalnie utracone przychody producentów marchwi**

Polska ze średnią produkcją wynoszącą w latach 2019-2021 około 666 tys. ton. jest jednym z największych producentów marchwi w Europie (po Wielkiej Brytanii i Niemczech, gdzie wielkość produkcji w 2019 roku wynosiła odpowiednio około 758 i 791 tys. ton) (GUS, 2020). Zbiory marchwi w 2021 roku w Polsce stanowiły 16,4% wszystkich zbiorów warzyw, a w województwie kujawsko-pomorskim 18,5% (GUS, 2022). Wielkość zbiorów marchwi jadalnej w latach 2019-2021 u badanych producentów z województwa kujawsko-pomorskiego wzrosła z 14,7 tys. ton do 17,8 tys. ton i stanowiła w 2021 roku około 15% zbiorów warzyw w województwie kujawsko-pomorskim i 2,8% w kraju. Zebrany surowiec podlegał przechowaniu w magazynach chłodniczych, następnie w zależności od wielkości wpływających zamówień od klientów marchew była sukcesywnie myta, szczotkowana, kalibrowana, pakowana i transportowana do klienta. Głównymi odbiorcami gotowego produktu są sieci handlowe oraz hurtownicy. Ze względu na wymagania odbiorców, określone w literaturze przedmiotu cosmetic standards (Porter i in., 2018) dotycząc przede wszystkim parametrów marchwi (waga 50-250 g, średnica 2-4 cm), część surowca o pełnych właściwościach odżywczych jest odrzucana jako niespełniająca norm handlowych. Odsortowana marchew jest następnie dzielona według wielkości na poniżej i powyżej normy handlowej. Surowiec o rozmiarach powyżej normy może być pożądanym przez zakłady przetwórcze, natomiast drobna marchew może służyć jako karma dla zwierząt gospodarskich (przede wszystkim dla bydła), ale także dzikich zwierząt (dostarczana do nadleśnictw i ogrodów zoologicznych). Marchew ze śladami gnicia i zazielenienia jest przekazywana do

biogazowni. Bilans masy marchwi ustalony na podstawie dokumentacji magazynowej i handlowej dla badanych gospodarstw wykazał, że w fazie produkcji (od magazynu przechowalniczego, przez mycie, kalibrację, pakowanie i transport do magazynu wyrobów gotowych) straty surowca kształtowały się średnio na poziomie około 19%. Wynikały one z naturalnych procesów wysuszania marchwi w chłodni, strat w fazie transportu wewnętrznego i podczas procesu przygotowania do sprzedaży. Marchew konsumpcyjna, wykalibrowana, przeznaczona dla ostatecznego klienta stanowiła średnio tylko około 44% masy zebranego surowca, udział zaś zebranego surowca, który był przeznaczony do przetworzenia, to średnio około 7% masy całkowitej. Na tej podstawie można stwierdzić, że tylko nieco ponad połowa zebranego surowca była przeznaczona jako pożywienie dla ludzi, reszta stanowiła paszę dla zwierząt (średnio około 26% masy zebranego surowca) lub paliwo do biogazowni (średnio około 4%) (rysunek 2).



Rys. 2. Struktura % kierunków zagospodarowania zbiorów marchwi w badanych gospodarstwach rolnych w latach 2019-2022

Fig. 2. Structure of % directions of management of carrot harvests in the surveyed farms in 2019-2022

Źródło: badania własne.

W latach 2019-2022 (tabela 1) cena marchwi wykalibrowanej uzyskiwana przez badanych producentów była zróżnicowana, i co ciekawe w ostatnim sezonie była ona niższa niż w latach pozostałych. Należy podkreślić, że producenci są cenobiorcami, a sieci handlowe cenodawcami. Praktyki cenowe stosowane przez sieci handlowe mają podstawy utrzymania przewagi konkurencyjnej na rynku, a nie mają bezpośredniego związku z działaniami regulującymi ilość produktów na rynku.

W analizowanym okresie badani producenci uzyskali wyższą cenę za przekazany surowiec od przetwórców. Średnia cena marchwi wykalibrowanej w badanym okresie



kształtowała się na poziomie 1,32 zł, marchwi przeznaczonej do przetwórstwa 0,38 zł, a jako karmy dla zwierząt na poziomie 0,16 zł.

Tabela 1. Cena marchwi w zależności od kierunku sprzedaży w latach 2019-2022

Table 1. Carrot price, depending on the direction of sales in 2019-2022

Wyszczególnienie (Specification)	2019/2020	2020/2021	2021/2022	Średnia cena (Average price)
Marchew wykalibrowana zł/kg (Calibrated consumption carrot PLN/kg)	1,42	1,45	1,10	1,32
Marchew jako karma dla zwierząt zł/kg (Carrots as feed for animals PLN/kg)	0,19	0,15	0,15	0,16
Marchew jako surowiec do przetwórstwa zł/kg (Carrots as a material for processing PLN/kg)	0,37	0,34	0,43	0,38

Źródło: badanie własne.

Odrzucenie marchwi z powodów estetycznych i konieczność sprzedaży jej przez producentów z innym przeznaczeniem powoduje obniżenie przychodów, jakie producenci mogą uzyskać. W badanym okresie średni uzyskany przychód ze sprzedaży „odsortu” ukształtował się na poziomie około 1,11 mln zł.

Zakładając, że połowa surowca odrzuconego ze względów estetycznych mogłaby być sprzedana z uwzględnieniem rabatu cenowego na poziomie 30%, 50% i 70% od ceny za surowiec wykalibrowany przeznaczony do sprzedaży oszacowano potencjalny przychód badanych producentów (tabela 2).

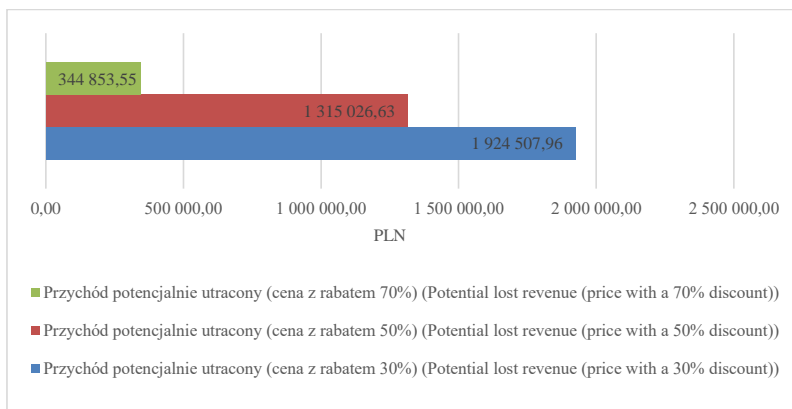
Tabela 2. Średnia wartość faktycznego i potencjalnego przychodu ze sprzedaży „odsortu” marchwi jako produktu konsumpcyjnego w zależności od wysokości udzielonego rabatu handlowego w latach 2019-2022

Table 2. Average value of actual and potential revenue from the sale of a "sort of" carrots as a consumer product, depending on the amount of the trade discount granted in 2019-2022

Wyszczególnienie (Specification)	Średnia Average (PLN)
Uzyskany przychód (Real revenue)	1 112 923,86
Potencjalny przychód (cena z rabatem 30%) (Potential revenue (price with a 30% discount))	3 037 431,82
Potencjalny przychód (cena z rabatem 50%) (Potential revenue (price with a 50% discount))	2 427 950,49
Potencjalny przychód (cena z rabatem 70%) (Potential revenue (price with a 70% discount))	1 457 777,40

Źródło: opracowanie własne.

Przy powyższych założeniach badani producenci mogliby uzyskać przychód na poziomie od około 3,04 mln zł (przy rabacie na poziomie 30%), przez 2,43 mln zł (przy rabacie na poziomie 50%), do 1,46 mln zł. (przy rabacie na poziomie 70%). Co oznacza, że wielkość przychodu mogłaby być wyższa od 30% do 173%.



Rys. 3. Średnia wartość potencjalnie utraconego przychodu w zależności od wysokości udzielonego rabatu handlowego w latach 2019-2022

Fig. 3. The average value of potentially lost revenue depending on the amount of the trade discount granted in 2019-2022

Źródło: opracowanie własne.

Na podstawie wielkości możliwych do uzyskania przychodów zostały oszacowane potencjalnie utracone korzyści, które kształtowały się średnio na poziomie od 0,34 mln zł.- 1,92 mln zł. (rysunek 3.). Możliwość dysponowania większymi środkami finansowymi pozwoliłoby producentom zwiększyć rentowność swojej działalności. Biorąc pod uwagę powyższe ustalenia producenci rolni mają zatem możliwości uzyskania większych środków finansowych z produkcji podstawowej. Wiele tu jednak zależy od zmiany dotychczasowych nawyków oraz preferencji ze strony ich konsumentów, skądinąd w dużym stopniu kształtujących normy handlowe.

## Podsumowanie

Badani producenci stanęli przed koniecznością odrzucenia ponad połowy ilości zebranego surowca ze względu na nie spełnianie kryteriów kalibracji określonych przez odbiorców (przede wszystkim sieci handlowe). Takie działanie naraża producentów na utratę potencjalnych przychodów. Możliwość sprzedaży przez producentów po niższej cenie produktu pełnowartościowego jako np. pasza, powoduje, że poziom tej straty jest niższy. Zminimalizowaniu wielkości utraconych korzyści dla producentów mogłaby być możliwość sprzedaży produktów mniej atrakcyjnych pod względem estetycznym z rabatem cenowym. Takie działanie mogłoby przyczynić się do zwiększenia ich przychodów od 30% do 173%.

Należy zwrócić uwagę na fakt, że wzorce estetyczne często wynikają z przyzwyczajień konsumentów, dlatego bardzo istotna jest edukacja mająca na celu zwiększenie akceptacji produktów pełnowartościowych jednakże o mniej estetycznym wyglądzie. W związku z powyższym rekomenduje się aby detaliści (przede wszystkim sieci handlowe) wdrażali

programy marketingowe przyjmujące do sprzedaży, z bonifikatą cenową, produkty o niedoskonałym wyglądzie, a także wprowadziły więcej akcji promujących ich sprzedaż w celu zmiany nawyków konsumentów. Takie działania mogłyby przyczynić się do zwiększenia dostępności produktów i lepszego zaspokojenia potrzeb żywnościowych ludzi, a także znaleźć odzwierciedlenie w zwiększeniu rentowności działalności producentów.

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**Yuriy Hubeni<sup>1</sup>, Nataliia Zelisko<sup>2</sup>, Volodymyr Krupa<sup>3</sup>**

Lviv National Environmental University, Ukraine

## **Structural and Dynamic Changes in International Trade in Agricultural Products in Ukraine**

**Abstract.** The article is devoted to studying the structural and dynamic changes in international trade in agricultural products in Ukraine. The authors reveal the theoretical essence of international trade in agricultural products, considering export and import conditions in light of modern challenges. The assessment of the foreign trade regime is provided and the trends and impact of implementing the Agreement on Association between Ukraine and the EU on the development of Ukraine's foreign trade are established. It was found that, on one hand, the export orientation of raw materials to the EU crop production market has increased, while on the other hand, there remains a high import dependence on prepared food products, with a more diversified import structure. The peculiarities of key directions of Ukraine's agro-industrial market under martial law and its place in the global food security system are described. The article also examines the structure of Ukraine's trading partners, which have been revised since the beginning of the war. The peculiarities of cooperation between Ukraine and the EU in international trade in agricultural products are analysed. Ways of diversifying exports and increasing the profitability of foreign trade in agricultural products from Ukraine in the EU market are suggested.

**Key words:** international trade, Agreement on Association, world market, foreign activity, regulation, competitiveness

**JEL Classification:** F140, F14; O19; Q17

### **Introduction**

Despite the war in Ukraine, the agro-industrial complex is one of the most dynamic and promising sectors for development. We can observe growth in production volume and the creation of special conditions to increase the export of agricultural products to the global market. Particularly noteworthy are the producers from Ukraine and their decisive role in the global agricultural products market. The functioning of the grain corridor has become a prerequisite for shaping the innovative strategy of agro-industrial companies in Ukraine, which will enhance the overall efficiency of the economy. The agricultural food market has always been significant for Ukraine in its export structure and in forming the country's budget. Despite the martial law in 2022, production did not halt; on the contrary, there was an increase in production volume, the creation of conditions to boost exports and gradual reduction in the import of agricultural products. The rapid recovery of the agro-industrial complex, the establishment of opportunities for product export and the

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<sup>1</sup> Dr. Scs., professor, Lviv National Environmental University, V. Velykyi str, 1, Dubliany, Zhovkva district, Lviv region, 80381, Ukraine, e-mail: hubeni@ukr.net;  
<https://orcid.org/0000-0002-1842-8975>

<sup>2</sup> PhD, associate professor, Lviv National Environmental University, e-mail: zeliskon@ukr.net;  
<https://orcid.org/0000-0002-2467-5585>

<sup>3</sup> PhD, associate professor, Lviv National Environmental University, e-mail: v\_krupa@ukr.net;  
<https://orcid.org/0000-0001-8658-7735>

functioning of the grain corridor are crucial for the social and economic development of Ukraine, post-war reconstruction and ensuring its continued operation.

In the era of globalisation, a single economic system is emerging, characterised by asymmetrical development of its elements due to the peculiarities and differences between countries during their integration processes. The primary objective is to ensure the efficient functioning of economic systems, minimise risks and address negative tendencies arising from global transformations.

One of the most pressing issues is to slow down and prevent the deepening of the global food crisis. Import protection policies, domestic support and price interventions remain essential in many developing countries and with their influence increasing, reflecting the growing importance of these nations in international markets and trade.

The aim of this research is to examine the structural and dynamic changes in international trade of agricultural products in Ukraine and to develop approaches to activate foreign economic activity.

The main tasks of the research are:

- to study prerequisites, stimulating and inhibiting factors for the development of international trade in agricultural products by assessing the existing objective factors of influence and current geopolitical risks;
- to analyse the volume and structure of agricultural product exports and imports;
- to define ways and measures for domestic agribusiness entities to enter the international agricultural food market.

## **Materials and methods**

The analysis of structural and dynamic changes in the international trade system for agricultural products was conducted using Ukraine as an example. In the unstable conditions resulting from Russia's full-scale invasion of Ukraine, the introduction of martial law, sea blockades and other negative factors, it is important to explore alternative ways of realising export potential by utilising all possible levers, methods and logistic supply chains.

The informational database for structural and dynamic changes in the international trade system for agricultural products is based on official statistics from the State Statistics Service of Ukraine, official reports and analytical materials from international and national organisations such as the World Trade Organisation (WTO), UNO committees (UNCTADstat, FAO, Trade Map), the statistical organisation of the European Committee (Eurostat), the International Monetary Fund (IMF), the Ministry of Agriculture of the USA (USDA), Global Trade Alert, as well as our own research materials.

The scale of Ukraine's international trade relies on logistic interactions within the entire food chain. Each region, with its specific natural and economic conditions and the number of branch enterprises available, directly or indirectly shapes the international trade commodity structure of the region and the country.

To achieve the set goal and address the tasks, various scientific research methods were employed, including induction and deduction to examine the theoretical and methodological foundations of forming and developing the global agricultural market, historical and logical methods to explore the evolution of the global food market, the method of systematic generalisation to summarise existing theories of international trade in

agricultural products and identify their pros and cons, analysis and synthesis methods to define the drivers behind the formation of a globalised commodity agro-food market and neo-protectionism in modern markets, comparative analysis methods to investigate the characteristics of global and national agro-food structures, systematic and structural methods to explore current trends and structural changes in the global agricultural market, econometric assessment methods and economic-mathematical modelling to identify patterns and simulate scenarios for transforming the national agricultural market under changing international trade policies and graphical methods to visually present the research findings.

These chosen methods are expected to facilitate a more in-depth analysis and evaluation of the structural and dynamic changes in the international trade system for agricultural products.

The article utilised economic-statistical methods to generalise statistical information on the volume of Ukrainian exports, specifically products from the agro-industrial complex. The assessment of Ukrainian exports under martial law was conducted through elementary-theoretical analysis and synthesis and alternative routes for exporting agricultural commodities to various regions of the world were summarised based on expert evaluations.

These methods helped to examine the structural and dynamic changes in Ukraine's international trade system for agricultural products, organise statistical data on export and import volumes for individual groups of agricultural products, define directions for agribusiness development at the current stage and establish causal relationships between changes in enterprise foreign economic activities and socio-economic processes in the country.

## **Literature review**

The issues involved in determining the prospects of Ukraine's agricultural integration into the global agricultural market are quite complex. Ukrainian scientists have extensively researched these matters, which are well-documented in economic literature. For instance, Lupenko Yu.O. outlined the directions of economic research into the international integration of Ukraine's agricultural sector. Puhachov A.O. and Melnyk H.S. focused on identifying potential advantages and risks within the development of Ukraine's agro-industrial complex, considering integration options with the European and Custom Unions. Tymofiyeva H.S. examined the modern integration of Ukraine's agricultural sector into the globalisation process, highlighting key agricultural products that impact Ukraine's position in the world market. Negrey M., Trofimtseva O. studied the functionality of Ukraine's agricultural sector during wartime conditions. Hubeni Yu. and Tsiolkovska S. proposed strategies to enhance the foreign economic activities of agricultural enterprises. Nechyporuk A., Kotova M., Kochubey D. identified the main trends in Ukraine's exports during martial law.

Various aspects of Ukraine's agricultural integration prospects are explored in numerous research papers. Despite the widespread research on this topic, further in-depth examination is required to understand the future integration of Ukraine's agriculture into global markets. Establishing key strategies to strengthen Ukraine's position in global agricultural markets within the current context of international economic integration is crucial.

The export of products from the agro-industrial complex, a cornerstone of Ukrainian exports, under martial law attracts attention not only from Ukrainian researchers, but also from scholars worldwide. The issue of food security has become increasingly urgent, leading to discussions among international organisations. Researchers such as Rose A., Zhenhua Ch. and Dan V. have evaluated how the Russia-Ukraine conflict directly impacts grain exports, causing economic repercussions worldwide. This situation could potentially trigger a global food crisis as Ukrainian grain exports play a significant role in ensuring food security. These authors extensively analysed the effects of reduced grain exports on macroeconomic indicators across different regions (Rose, Zhenhua, Dan, 2023).

Ay Kh. and Soylemez A. underscore the importance of the Black Sea grain initiative for Ukrainian grain exports and assess Turkey's policy during the agreement negotiations (Ay and Soylemez, 2023). Ahn S., Kim D. and Steinbach S. have demonstrated the adverse effects of Russia's invasion on global grain and oil crop trade, leading to significant price fluctuations and posing threats to global food security (Ahn, Kim, Steinbach, 2022).

Researchers at the Kyiv School of Economy, experts from the Ukrainian Agrarian Business Club and officials from the Ministry of Foreign Affairs of Ukraine are conducting detailed studies on agriculture under martial law. The impact of Ukraine's agricultural sector on global agricultural markets and food security is also being investigated by foreign scholars (Banse, 2022; Campeanu, 2022; Celi et al., 2022; Fiott, 2022; Glauben et al., 2022; Ghosh and Bhowmick, 2022; Oxford Analytica, 2022; Peterson, 2022).

Nevertheless, the current situation, characterised by instability and disruptions in Ukrainian export supply chains, necessitates a more thorough examination of these issues, particularly within the context of martial law.

## Results

Russia's invasion of Ukraine exposed and exacerbated tensions in global agricultural markets that had arisen during COVID-19. The critical need for creating stable food markets became evident. According to World Bank data for April 2022, the war in Ukraine altered global trade, production and consumption models in a way that will maintain historically high prices until the end of 2024, increasing food security and inflation. In response to new threats, on June 28, 2022, G7 countries established the Global Alliance for Food Security, committing an additional \$4.5 billion to protect the most vulnerable populations from starvation and malnutrition. This brings the total joint commitment to over \$14 billion for food security this year. The newly formed Alliance also pledged support for Ukraine in recovering its agricultural exports, establishing a safe sea corridor across the Black Sea and creating alternative routes for Ukrainian exports. The European Union and Great Britain strongly supported Ukrainian agrarian producers by lifting import restrictions, including tariff quotas.

The agricultural sector of Ukraine suffered significant damage. According to the Kyiv School of Economics' calculations, direct losses in the agricultural sector over three months of war amounted to \$4.3 billion, with estimated indirect losses at \$23.3 billion (KSE Agrocentre, 2022). The main problems faced by the agricultural sector due to military operations in Ukraine are as follows:

- Ukrainian territory occupation: destruction of production capacities and infrastructure, issues with organising the sowing campaign, shortage of fodder for

animals, halting of agricultural enterprises and a large number of mined areas (approximately 100,000 hectares in the Chernihiv, Luhansk, Donetsk, Kharkiv, Kherson, Zaporizhzhia and Kyiv regions);

- Logistic problems: blocking agricultural products export routes (ports, in particular), destroying transport infrastructure, disruption/desynchronisation of logistic chains both inside the country and abroad;
- Reducing the volume of the domestic market and decreasing the purchasing power of the majority of Ukrainians have led to a shortage of meat and dairy products consumed by Ukrainians. This trend was already observed before the war but has significantly increased during the conflict;
- Lack of resources for agricultural production: shortage of fuel, certain types of fertilisers, lack of fodder, plant protection products, problems of material and technical support, as well as the increase in prices for means of production in the agricultural sector;
- Workforce issues: internal and external migration, mobilisation to the Armed Forces of Ukraine, rising unemployment, psychological personnel problems, working in constant stress and threat;
- Stealing Ukrainian agricultural machinery and products: grain (more than 600,000 tonnes), oil, vegetables, fruits, etc.

Due to the aforementioned issues in the agricultural sector, there has been a rise in the prices of agricultural products. These problems currently persist and require immediate resolution. However, new challenges may also emerge in the future. According to the Ministry of Agrarian Policy, next year's harvest could decrease by up to 40% due to Russia's full-scale invasion. Ukraine has already lost 25% of its arable land.

It is important to consider that Ukraine plays a crucial role as a supplier of agro-food products overall and especially in grain production. Global reports acknowledge these trends in the agricultural market. The World Food Organisation forecasts that global agricultural production in 2022 may surpass consumption. The world grain market balance is outlined by the indicators in Table 1.

Table 1. Characteristics of world grain market, mln t

Direction	2020/2021	2021/2022	2022/2023	Changes 2022/23 compared to 2021/2022
Production	776.7	776.8	770.8	-0.8
Trade	189.2	192.1	188.9	-1.7
General usage	762.4	771.7	768.6	-0.4
Nutrition	525.5	531.3	535.9	0.9
Fodder	148.0	149.8	143.7	-4.1
Other users	88.9	90.6	89.0	-1.8

Source: made by the authors according to the materials (Câmpeanu, 2022).

In accordance with the World Food Organisation, main production will be concentrated in China, Russia and Ukraine, with reserves being reduced in the countries of Africa and Asia. In general, there is an observed reduction in trade in grain by 189 million tons (1.7%) compared to the 2021/2022 season.

Table 1 shows that alongside the decrease in production in 2022/23, a slight decrease in the total use of cereals by 0.4% is also forecasted. This situation is caused by a drop in



the level of food demand for the studied products, particularly for wheat and corn. Regarding food consumption, it is expected to grow by 0.9% in line with the increase in the population. Despite a slight reduction in the demand for grains, their production is not able to cover it completely, which in 2022/2023 led to a reduction in feed use by 4.1%.

The key reasons for the reduction are the blockade of Ukraine as a result of hostilities and the ban on exports from India (Banse, 2022). Ukraine is a significant exporter in the world food market and was one of the key players in exports before the war.

According to UNCTAD research, grain exports from Ukraine have almost stopped due to the war. To address the global food crisis in 2022, the Black Sea Grain Initiative (BSGI) was formed as part of restoring Ukrainian grain exports across the Black Sea to world markets. It enabled the poorest countries to access food, stabilise world grain prices and create an additional channel for funds to flow into the Ukrainian budget. Before the war, the agricultural food market held the second position in terms of export revenues in Ukraine's economy, following the metallurgical complex. Based on data from the State Statistics Service, there was a significant increase in goods in 2021 compared to 2020 – by 34%, amounting to \$72.82 billion. Additionally, exports increased by 38.4% to \$68.09 billion (KSE, 2022). The foreign trade balance was negative in 2021 and 2020, but trade operations were conducted with more than 200 partner countries. In 2021, China was the most active partner for Ukraine's exports, receiving goods worth \$8 billion, a 12.7% increase from 2020. Poland ranked second with \$5.23 billion, a record growth of 59.7% compared to 2020 and Turkey was in third place with exports increasing by \$4.14 billion, which is 70% higher than in 2020. The export structure includes ferrous metals, sold for \$13.95 billion, an 81.45% increase compared to 2020. Grain exports amounted to \$12.34 billion, showing an increase of 31.2%, while vegetable and animal fats and oils were exported for a total value of \$7.04 billion, a 22.5% increase compared to 2020.

Despite the factors mentioned above, the Ukrainian agrarian sector is still thriving and continues to maintain a leading position in world trade. Comparative research between the 2021-2022 marketing year and the 2022-2023 marketing year is presented in Tables 2-3.

Table 2. Ukraine agricultural exports (2021 calendar year)

Product	Value	Top markets		
Sunflower oil	\$6.4 billion	India \$1.9B	EU \$1.9B	China \$0.9B
Corn	\$5.9 billion	China \$1.9B	EU \$1.8B	Egypt \$0.5B
Wheat	\$5.2 billion	Egypt \$0.9B	Indonesia \$0.7B	Turkey \$0.4B
Rapeseed	\$1.7 billion	EU \$1.1B	Pakistan \$0.2B	UK \$0.2B
Barley	\$1.3 billion	China \$0.7B	Turkey \$0.2B	Saudi Arabia \$0.1B
Sunflower oilcake	\$1.2 billion	China \$0.6B	EU \$0.3B	Belarus \$0.1B
<b>TOTAL</b>	<b>\$27.8 billion</b>	<b>EU \$7.7B</b>	<b>China \$4.2B</b>	<b>India \$2.0B</b>

Source: Trade Data Monitor LLC.

Table 3. Ukraine agricultural production and exports (2022/23 marketing year)

Product	Production			Exports		
	Volume (1,000 MT)	Rank among global producers	% of global production (%)	Volume (1,000 MT)	Rank among global exporters	% of global exports
Corn	25,000	#8	2.1	9,000	#4	4.9%
Wheat	21,500	#9	2.8	10,000	#8	4.9%
Sunflower	9,500	#3	19.3	750	#1	20.7%
Barley	5,700	#7	3.9	1,800	#6	5.9%
Sunflower Oil	4,085	#3	21.4	3,600	#1	34.7%
Sunflower Meal	3,924	#3	19.0	2,700	#1	39.8%
Rapeseed	3,200	#6	4.0	2,750	#3	16.6%

Source: USDA WASDE and PSD Database, updated June 10, 2022.

The assessment of Ukraine's commodity export structure during the period 2021-2022 indicated a total export reduction from \$68.08 billion in 2021 to about \$44.18 billion in 2022, a decrease of 35%. Despite the general declining trend, the export share of agro-industrial complex products in the total commodity flow significantly increased due to international cooperation in addressing the global food problem. It is estimated that the export share rose from 39% in 2021 to about 51.7% in 2022 (Celi, Guarascio, Reljic, Simonazzi & Zezza, 2022). In the context of the international agreement to establish a grain corridor, it is logical and expected that the commodity grain group ranked first in terms of export volume in 2022, despite a recorded reduction in grain exports of 26.2%. Additionally, the export volume of oilseeds and fruits increased by 54.4% during the period under study.

Overall, 2022 could have been the most efficient and successful year in terms of product exports. The beginning of the year showed significant positive dynamics compared to the successful 2021 and with January-February already demonstrating a 34% increase. However, following the Russian invasion of Ukraine, exports sharply declined, with a drop of over 50% recorded in March. A gradual recovery became possible from May onwards, after Ukrainian ports were unblocked and the grain corridor was established. By September 2022, Ukrainian exports had reached \$33 billion, reflecting a decrease of more than 30% compared to 2021. For example, in September alone, a record \$4.144 billion was demonstrated, marking the best result since February 2020.

During the conflict, the European Union emerged as the key trade partner, replacing China due to logistical challenges, political relations, China's stance during the conflict and Ukraine's losses in the metallurgical complex. In September 2022, China only ranked fourth in the export partner structure. Poland and Romania became Ukraine's key trading partners, contributing to about 23% of exports. Presently, Russia is not considered a market for Ukrainian goods and restoring relations is not anticipated. The European Union's share in Ukraine's export structure increased from 41% in 2021 to 62% in 2022. Turkey, China and India became other significant trade partners.

The rapid growth in agro-food exports since 2016 (Figure 1) was primarily driven by Ukraine's accession to the European Free Trade Area. With the application of the Agreement by the EU for agricultural products, duties within the tariff quotas were

abolished, resulting in a growth rate of total agricultural exports of 4.9% in 2016, 16.2% in 2017, 4.8% in 2018 and 19.0% in 2019 (WASDE, 2022).

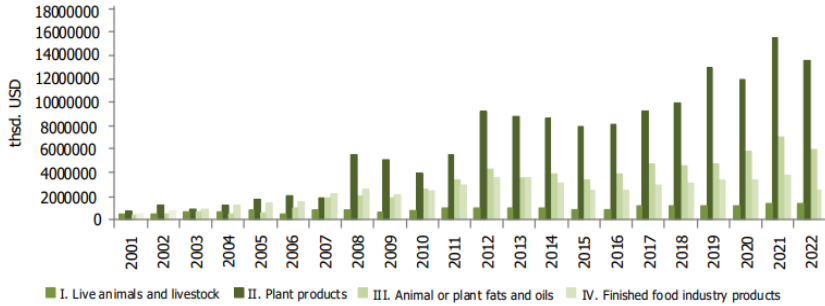


Fig. 1. Dynamics of Ukrainian agricultural exports in 2001-2022

Source: World Agricultural Supply and Demand Estimates, 2022.

It is worth noting that even in the unfavourable conditions of the global pandemic COVID-19 in 2020, Ukraine's total agro-food exports did not decrease but remained at the previous year's level (increased by 0.2%). However, the export of products of animal and plant origin decreased by 7.0% and 8.0%, respectively, while the export of fats and oils and the commodity group "finished food products" increased by 21.4% and 4.4%, respectively. This indicates the high level of stability in the domestic agricultural sector during global crisis processes, the steady external demand for these products and the significance of the domestic agrarian sector in the agro-industrial complex for generating foreign currency revenues for the state.

Detailed analysis of commodity and geographical structure of the national export enables the identification of the main importers of Ukraine's agro-industrial complex products. Currently, the European Union accounts for 55.6%, the Asian region for 32.2% and African countries for 7% of the biggest importers of agricultural sector products. To illustrate the export flows of agro-products in terms of shares in the total Ukrainian export of agro-industrial complex, the following countries can be highlighted (Figure 2).

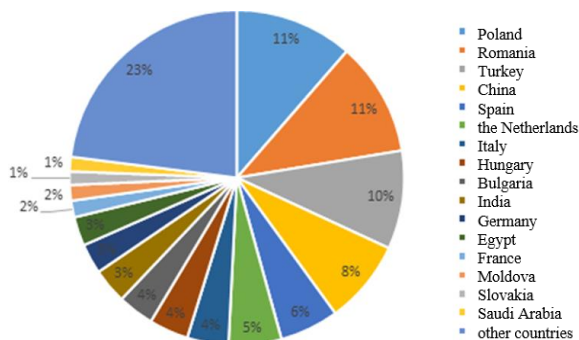


Fig. 2. Geographical structure of Ukraine’s agricultural products export in 2022, %  
 Source: State Statistics Service of Ukraine, 2023.

Again, Poland takes the first position with 11.4%, Romania is second in the ranking with 11.0%. The rest of the countries are: Turkey (9.5%), China (8.1%), Spain (5.7%), the Netherlands (5.1%), Italy (4.0%), India (3%), Germany (3%) and Egypt (5%).

In 2022, Ukraine imported agricultural products worth \$6.3 billion, which is 23% less than in 2021. According to Customs Service data, agricultural products worth \$6.3 billion were imported into Ukraine in 2022, a 23% decrease from 2021 when agro-food imports amounted to about \$8.2 billion. Due to Russia's full-scale invasion of Ukraine, the cost of supplies from the European Union decreased by 17%: from \$4064 million in 2021 to \$3376 million in 2022. At the same time, the EU countries' share exceeded half of domestic agro-food imports, amounting to 53.3%.

At the same time, purchases in other regions also decreased. The volume of imported food supplies from Asian countries amounted to \$1237 million (19.5%), from Latin America – \$421 million (6.6%), Africa – \$242 million (3.8%) and CIS – \$205 million (3.2%).

Since 2017, Poland has held the first place in the ranking of the main suppliers of agricultural products to Ukraine. Last year, it sold agricultural goods worth \$881 million to Ukraine, almost matching the 2021 figure of \$883 million.

The following countries also played significant roles in domestic imports: Turkey (\$538 million), Germany (\$449 million), Italy (\$391 million), the Netherlands (\$267 million), France (\$237 million), Norway (\$225 million), Spain (\$198 million), the United States of America (\$194 million) and China (\$193 million). Overall, these ten countries accounted for more than 56% of all imports last year.

In the structure of foreign supplies of agricultural sector goods to Ukraine, several product groups traditionally dominate:

- fruits, berries and nuts (\$663 million);
- fish and sea products (\$627 million);
- alcoholic and non-alcoholic drinks (\$490 million);
- various food products (\$416 million);
- tobacco products (\$368 million);
- residues, fodder for animals (\$362 million);

- oil seeds and fruits (\$359 million);
- vegetables (\$353 million).

These products formed more than 57% of the value of agricultural products import to Ukraine.

Despite statements by the European Commission and relevant EU institutions about the absence of any risks and negative impacts of agricultural exports from Ukraine to European markets, certain countries, especially our neighbours, insist on a complete ban or at least significant limitations on such supplies. This includes both the introduction of their own blocking measures, the essence and mechanism of which contradict not only international trade rules and provisions of the Association Agreement with Ukraine, but also the EU's internal regulations and. There is also pressure on the European Commission to introduce general restrictions on the supply of Ukrainian agricultural products.

Motives vary: for some countries, it is a principled protectionist position to support national producers, while for others, it is about their own economic interests. Some have political goals and tasks with different motives. Perhaps in some cases, it is about supporting local producers.

In pursuing their goals, opponents of Ukraine's increased influence on agricultural and consumer markets overlook the interests of European bloc partners. For them, the supply of agricultural raw materials from Ukraine is an almost irreplaceable source for developing entire sectors of their production and adding value and. Importing finished products also ensures food security and lower prices for the population.

It is worth mentioning that before the war, when trade volumes with the EU were regulated by customs duties and quotas, the European market was not our main or primary focus. On one hand, it primarily requires premium goods. On the other hand, it has slightly different standards for finished products, while Ukrainian agricultural production (especially grain) is aimed at developing markets. Logistic problems resulting from Russian aggression against our country changed the situation.

When our agricultural products enter the EU market, they are not distributed evenly among all 27 EU member countries – some receive more, others less, depending on how each state satisfies its own needs for specific commodities. This explains the differences in how imports from Ukraine are treated. While the European Union has no issue with it, individual countries may experience distortions based on their import-export balance and consumption patterns. Each market may find a specific product to be an irritant. Ukraine's advantage lies in its production scale. In the EU, the average farm size is 17 hectares, while Ukraine's agricultural sector comprises various groups of agricultural enterprises, including large "giant" holdings, sizable agricultural enterprises and farms. These farms typically range from 50 to 100 hectares, which is relatively large compared to the EU's average farm size of 17.4 hectares. The largest agricultural holdings lease more than 250,000 hectares of land and aim to increase this to 350,000 hectares or more. In this context, defining the average farm size offers limited insight into the scale of agricultural enterprises in Ukraine.

By European standards, our small farmer would be considered medium or large. Today, we are discussing not only our agricultural holdings but also small and medium-sized producers who, thanks to their scale, can reduce production costs.

## Conclusion

International trade is one of the main factors in Ukraine's economic development, but under martial law, it serves as an indicator of economic stability and the country's trade potential reliability. The analysis of changes in the export commodity structure and its geography under martial law shows a shift towards European Union countries and an increase in the export volume of agro-industrial complex products. Contributing to this shift are the signing of the Black Sea Grain Initiative and the establishment of Ways of Solidarity by the European Commission to enhance the connectivity between Ukraine and the European Union countries.

Nevertheless, the constant threat of disruptions in the available agricultural goods export routes, which are essential under martial law, necessitates a more thorough analysis of all alternative transportation options for this type of cargo.

Exploring new logistic routes that can utilise railways, roads, ferries and maritime transportation will help achieve the required export volumes of agro-industrial complex goods and mitigate risks arising from instability. Developing intermodal transportation is a viable logistics alternative and harnessing the benefits of both land and maritime transport modes will optimise the logistic routes for Ukrainian exports.

The development of agricultural goods export transportation requires further research considering the instability and adverse conditions of martial law, as well as the potential for post-war reconstruction of established routes with a focus on European markets.

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**Godfrey C. Onuwa<sup>1</sup>**

Federal College of Forestry, Jos, Nigeria

## **Empirical Analysis of African Aubergine (*Solanum gilo*) – Marketing and Income Disparity among Traders in Owerri, Imo State, Nigeria**

**Abstract.** African Aubergine is an indigenous tropical crop cultivated in Nigeria. Agricultural marketing creates incentives that accelerate the promotion of further production and consumption of harvested produce. Therefore, this study analysed African Aubergine marketing and income disparity among traders in Owerri, Imo State, Nigeria. Primary data collected via multistage sampling from ninety-five (95) respondents was analysed using descriptive statistics, marketing margin and efficiency analysis, Ordinary Least Square regression and Gini Coefficient index. The results show that the mean age, years spent in school, household size, trading experience and quantity of bags sold were 37 years, 8 years, 7 people, 9 years and 8 bags per month, respectively. The estimated marketing margin and efficiency index were ₦1,250 and 0.36, respectively. The estimated coefficients of Ordinary Least Square regression ( $R^2$ ) were 0.773. Thus, the variables (marketing experience, cost price, quantity sold and marketing cost) in the regression model accounted for 77% of the variation in the marketing margin of African Aubergine traders in the study area. The estimated Gini Coefficient was 0.59, indicating a moderate level of income disparity (inequality) in the sales income of the respondents. Several marketing constraints were observed in the study area. Therefore, this study recommends improved credit access and market information dissemination, commodity cost subsidisation, storage technology adoption, market infrastructure development and interventions, commodity price control and policy modification that regulates market activities.

**Key words:** agribusiness, commodity markets, Gini index, marketing margin and efficiency, market structure

**JEL Classification:** D4; L22; Q02; Q13

### **Introduction**

African Aubergine (*Solanum gilo*) is one of the most important vegetable crops (FAOSTAT, 2022). This crop is not only consumed almost daily, but also serves as a source of income for many rural households (Iheke, 2010a). While this vegetable crop is traded internationally on a limited scale, only a very small share of the total production in Nigeria is exported. The crop has intriguing nutritional characteristics and potentially useful agronomic traits. Additionally, there is notable diversity in the varieties cultivated in Nigeria (Onuwa et al., 2017). African Aubergine is among the oldest vegetables and is an indigenous tropical crop cultivated in Nigeria (Onuwa et al., 2017). FAOSTAT (2022) also reported that African Aubergine, as a vegetable, has been affirmed and recommended for tackling the malnutrition problem in Africa. African Aubergine can be consumed raw as snacks by both adults and children. African Aubergine is surpassing its status as a staple

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<sup>1</sup> Department of Agricultural Extension and Management, Federal College of Forestry, Jos, Nigeria; e-mail: onuwa@gmail.com; <https://orcid.org/0009-0001-5657-9427>



fruit to become a more commercial commodity that is now a major source of income for producing households and traders (NBS, 2022).

Agricultural markets can be defined as a set of conditions and activities that facilitate trade transactions whether or not the parties physically meet (Onuwa et al., 2023, Agba, 2006). ‘Market’ denotes the interaction of the forces of demand and supply, irrespective of the physical location of buyers and sellers. It involves not only the physical movement of goods and services to points where the produce is wanted, but also putting them into the desired form and amount and having them ready at the needed time (Iheke, 2010b). Marketing is a function that assesses consumer needs and then satisfies them by creating an effective demand for and providing the commodities and services required by consumers (Ariyo et al., 2013).

Market channels (structure) refer to characteristics of the market believed to influence the nature of competition and the process of price formation. Understanding market channels provides relevant information regarding the operational mechanism of markets and forms the basis of reducing marketing inefficiencies along the market chain. Marketing channels are avenues through which agricultural products move from producers to consumers. It is the chain of intermediaries through which the products pass from producers to the final consumers (Ayelech, 2011 and Sarode, 2009). The length of the channel varies from commodity to commodity depending on the quantity to be moved, the form of consumer demand and the degree of regional specialisation in production. Other marketing studies have identified a number of channels in the marketing chain. Onuwa et al. (2022) and Mussema (2006) posited multiple marketing channels in their respective studies on agro-commodity marketing. Without markets, agricultural production remains stagnant. Markets dictate how much producers will increase and/or produce their output (Onuwa et al., 2022).

Marketing systems in most developing countries often have operational inefficiencies that limit market performance (Lutfi et al., 2019 and Obasi, 2008). Market performance assesses the effectiveness of the marketing process and the successful achievement of its goals (Eronmwon et al., 2014). In market analysis, determining the marketing margin is crucial. The marketing margin for a specific commodity is the difference between the price the consumer pays for the final product and the amount the producer receives (Toure and Wang, 2013). It plays a vital role in analysing market performance and efficiency (Achike and Anzaku, 2010). Marketing efficiency significantly impacts market performance. The significance of agricultural marketing cannot be overstated. However, low marketing margins have been reported in agro-commodity marketing (Iheke, 2010b). Marketers often have to sell their products at very low prices to prevent waste or losses, consequently reducing marketing margins and efficiency. Agricultural marketing is viewed as an incentive for promoting more production and consumption of agricultural products (Slamet et al., 2017; Horna and Gruere, 2006). It involves various activities that, if well-implemented, can support livelihoods (Eronmwon et al., 2014). Agro-commodities produced by farmers must be gathered, stored, transported, processed and delivered in the required form, time and place as desired by consumers (Onunka et al., 2011 and Anuebunwa, 2007). Approximately 60% of the Nigerian population is involved in agro-commodity marketing, with the majority being small-scale traders (Anuebunwa, 2007), earning low incomes and facing challenges such as poor marketing facilities, inadequate

storage and preservation techniques, flawed road networks, limited health facilities, unfavourable government policies and a lack of technological expertise (Iheke, 2010a). Additionally, agricultural marketing encompasses the process from the production of agricultural commodities or services to their consumption or use (Iheke, 2010a, Anuebunwa, 2007). The marketing of African Aubergine entails various functions and activities necessary for the commodity to move from the production unit to the consumer. Underdeveloped marketing systems lead to postharvest losses (Slamet et al., 2017 and Adesope et al., 2009). Agricultural commodity marketers are often seen as agents of agricultural development and risk-takers. Many commodity markets are monopolised by a few, enabling them to make excessive profits at the expense of producers and consumers (FAO, 2021). However, there is a lack of empirical information on African Aubergine marketing, particularly regarding its structure, margins and income disparities in the face of marketing barriers. Therefore, this study seeks to analyse African Aubergine marketing and income disparity among traders in Owerri, Imo State, Nigeria. It will attempt to provide answers to the following research questions:

- i. What is the socioeconomic profile of the respondents?
- ii. What is the market performance of African Aubergine traders?
- iii. What are the determinants of marketing margin?
- iv. What is the income disparity among African Aubergine traders?
- v. What are the constraints of African Aubergine marketing?

## **Research methodology**

### **Study area**

The study was conducted in Owerri, the capital of Imo State, Nigeria. The area is situated in the heart of the rainforest in the southeastern region and covers approximately 40 square miles (100 km<sup>2</sup>) (NBS, 2021). It includes Owerri municipal council, Owerri West and Owerri North (Wikipedia, 2022). The population density ranges from 230 to 1400 people per square kilometer. Imo State's population is mainly rural (Wikipedia, 2022). The climate in Imo State is typically humid, with bimodal rainfall distribution peaking in July and September, with a break in August. Annual rainfall ranges from 1,990mm to 2,200mm. The mean annual temperature exceeds 20°C. Imo State experiences an average annual relative humidity of 75%, which is highest during the rainy season, reaching about 90%. The main agricultural zones in Imo State are Owerri, Orlu and Okigwe (NBS, 2022).

### **Method of data collection**

Primary data were collected through the use of structured questionnaires designed in line with the objectives of the study.

### **Sampling techniques**

A multi-stage sampling technique was employed for this study. The first stage involved the purposive selection of Owerri, including Owerri municipal, Owerri West LGA and Owerri North LGA out of the 27 LGAs in the state, due to the predominance of trading activities in the area. The second stage involved the purposive selection of six (6) major

commodity markets in the study area, namely Owerri main market, relief market, new market, Nkwo-Ukwu Ihiagwa market, Ezi-Obodo market and Obinze market, based on the concentration of vegetable marketing activities and their market size (Onuwa et al., 2022). In the third stage, 95 African Aubergine traders from the commodity markets were randomly selected as respondents for this study.

**Analytical techniques**

Data collected was analysed using the following techniques: descriptive statistics (mean, frequency counts and percentages) were used to analyse objectives i and v; market performance (objective ii) was analysed using marketing margin and efficiency; ordinary Least Square (OLS) regression was used to analyse the determinants of marketing margin (objective iii); the income disparity among African Aubergine traders (objective iv) was analysed using the Gini Coefficient index.

**Market performance**

An efficient marketing system minimises the cost of the marketing process and ensures greater returns to producers, while at the same time providing final consumers with quality products at reasonable prices. In measuring market performance, marketing margin and marketing efficiency analysis were adopted.

**Marketing margin**

The marketing performance of African Aubergine was assessed by computing marketing margins. A marketing margin, also known as profit, signifies the variation in prices across various levels within the marketing system. It quantifies the percentage of the final selling price retained by a specific group of traders within the marketing chain (Toure and Wang, 2013). Alternatively, this term can also denote the price contrast between what producers receive and what consumers pay for the same quantity and quality of a product. It may additionally describe the price differentials between two stages in the marketing chain. Marketing margin (Profit) is an important measure in trade transactions, as it gives the trader a measure of how much profit he makes on merchandise sales. The size of the marketing margin indicates the amount of value (profit) added in the marketing system (Lutfa et al., 2019). Marketing margin comprises different components, including costs of marketing services, total and net returns (profit). The analysis of marketing costs estimates how much expenses were incurred for each marketing activity (Ayelech, 2011 and Sreenivasa et al., 2007). It would also compare marketing costs incurred in the path of distribution. The analysis of marketing margin was computed by comparing the difference between the average selling price (i.e., price at which the African Aubergine traders sold their goods) and cost price (i.e., price at which the African Aubergine traders purchased their goods). The computation employed the following formula presented in Eq. (1):

$$MM = P2 - P1 \dots\dots\dots (1)$$

Where:

- MM = marketing margin [₦ (Nigerian Naira) /kg];
- P1 = price at market level 1 (cost price) (₦/kg);
- P2 = price at market level 2 (selling price) (₦/kg).

**Marketing efficiency**

Marketing efficiency is a ratio of marketing margin to marketing costs. Marketing efficiency is the maximisation of the ratio of output to input (Gebremedhin and Jaleta, 2012). Marketing efficiency is the most frequently used measure of market performance. Improved marketing efficiency is a common objective of farmers, wholesalers, retailers and commodity traders (Yohanes, 2015). The following marketing efficiency notation was adopted in this study and presented in Eq. (2):

$$M.E.= \text{Marketing margin (profit)} \div \text{Cost of marketing} \dots\dots\dots (2)$$

Decision rule:

- If M.E. = 1, marketing is efficient;
- If M.E. < 1, marketing is inefficient;
- If M.E. >1, high marketing efficiency.

**Ordinary Least Square (OLS) Regression**

The Ordinary Least Square (OLS) regression was used to determine factors that influence the marketing margin of African Aubergine traders. The OLS regression model provided the best fit and was chosen as the leading equation based on the number of significant variables, the magnitude of the coefficients and statistical and econometric criteria (Gebremedhin and Jaleta, 2012; Wissmann et al., 2007). The OLS regression was used to establish the effects of specified variables on the marketing margin (Wissmann et al., 2007). The Durbin-Watson statistic (d) was employed to detect the presence of autocorrelation at lag 1 in the residuals (prediction errors) in the regression analysis. Additionally, homoscedasticity of the residuals' variance (i.e., the homogeneity of variance) was checked using the Levene test. In its explicit form, the regression model is presented in Eq. (3) as:

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \varepsilon_i \dots\dots\dots (3)$$

Where:

- Y = marketing margin [₦ (Naira) /100kg bag];
- β<sub>0</sub> = intercept;
- β<sub>1</sub> – β<sub>5</sub> = Coefficient of parameters to be investigated;
- X<sub>1</sub> = gender (male =1, female =0);
- X<sub>2</sub> = marketing experience (years);
- X<sub>3</sub> = cost price (₦);
- X<sub>4</sub> = quantity sold (number of bags);
- X<sub>5</sub> = Marketing cost (₦);
- ε<sub>i</sub> = Error term.

**Gini coefficient**

The Gini Coefficient technique is a measure of statistical dispersion intended to represent the income dispersion of the respondents in the ith class. It is the most commonly used measure of income inequality (Onuwa et al., 2017). The Gini Coefficient ranges between 0 and 1, where 0 implies equality in income distribution and 1 implies inequality (Yohanes, 2015). The closer the Gini Coefficient is to zero, the greater the degree of

equality in income distribution among the respondents. Similarly, the closer the value is to unity (1), the greater the degree of inequality. In other words, the Gini Coefficient, therefore, measures the degree of income (G) as presented below in Eq. (4) as:

$$G = 1 - \sum XiYi \dots\dots\dots (4)$$

Where:

$X_i$  = percentage of traders in the  $i_{th}$  class;

$Y_i$  = percentage of trader’s gross income in the  $i_{th}$  class;

$X_iY_i$  = product of the decimal values of X and Y in the  $i_{th}$  class.

## Results and discussion

### Socioeconomic profile

Table 1 shows the socioeconomic profile of African Aubergine traders. The results revealed that the mean age of the respondents was 37 years. This implies that most of the respondents are in their economically active age bracket and thus were able to undertake higher business risks associated with marketing. They are expected to effectively and efficiently utilise the available resources. This result is consistent with Toure and Wang (2013) and Ayoola and Zever (2010) who reported in their respective study a significant relationship between the respondents' age and marketing efficiency. The average number of years spent in school was eight (8) years. This indicates that most of the respondents attained primary education. This is desirable because the level of education not only increases their production, but also their ability to understand new techniques. This factor influences African Aubergine marketing in the study area. Iheke (2010b) opined that the educational attainment of a respondent will increase their versatility and equip them with other skill sets. This feature puts them in a position to understand and adopt available innovations that facilitate an increase in their trading activities. Thus, education mitigates barriers in trade transactions.

Table 1. Descriptive (summary) statistics of respondents’ socioeconomic profile

Variables	Sample mean
Age (years)	37.2
Educational level (years)	8.1
Household size (population)	7.4
Trading experience (years)	9.2
Bags sold (number)	6

Source: Onuwa (2022).

The mean household population was seven (7) people, implying that the respondents have reasonable household sizes. Iheke (2010a) noted that the higher the number of people working in the household, the higher the household income, *ceteris paribus* and, hence, the improved welfare of the household. Also, a mean household size of six (6) persons was reported by Nwaiwu et al. (2012). The mean years of experience of the African Aubergine traders was nine (9) years. This suggests that the traders had adequate years of experience in the business, which might indicate the high practical knowledge required to overcome

marketing challenges associated with the business. The years of experience of the African Aubergine traders would have exposed them to various challenges associated with African Aubergine trading and, therefore, they would have more adaptive strategies to marketing challenges, resulting in better profitability. Therefore, the more experience a marketer has, the higher their understanding of the marketing system, conditions and price trends. Nwaiwu et al. (2012) reported that respondents would rely heavily on their experience for increased productivity rather than on their educational attainment. The mean number of fruit bags sold per month by the traders was six (6) bags. This implies that African Aubergine traders sold minimal quantities of their commodities, indicating that the business was relatively viable in the study area. This suggests that most of the African Aubergine traders were predominantly retailers. This is supported by Lutfi et al. (2019), Onunka et al. (2011) and Ugwumba (2009), who reported in their respective studies on agro-commodity marketing, a large population of retail traders.

**Market performance**

Table 2 revealed the results of market performance (marketing margin and efficiency). The estimated marketing margin was ₦1,250 per 100kg bag, indicating that African Aubergine marketing is a relatively profitable business venture in the studied area. Additionally, the estimated market efficiency index was 0.36, suggesting that the marketing of African Aubergine in the study area was inefficient. This result aligns with Yohanes (2015), Ayelech (2011) and Iheke (2010b), who reported similar marketing margins and efficiency indexes for agricultural crops.

Table 2. Marketing margin and efficiency of African Aubergine traders

Variables	Cost (₦/100kg per bag)
(A) Sales revenue (selling price)	4700
Total sales revenue	4700
(B) Marketing cost:	
i. Unit (cost) price	2,800
ii. Transportation cost	250
iii. Market/union charges	150
iv. Storage cost	100
v. Packaging & handling cost	150
(C) Total marketing cost (cost price)	3,450
(E) Marketing margin (profit) (A-C)	1,250
(F) Marketing efficiency Index (M.E.I) (E/C)	0.36

Source: Onuwa (2022).

**Determinants of marketing margin**

Table 3 presents the Ordinary Least Square (OLS) regression analysis. The OLS regression was used to establish the effects and determine the factors that affect the marketing margin of African Aubergine traders in the study area. The F-ratio (5.859) is significant at  $P < 0.05$  (5%) level, implying that the variables (Xi) in the regression model accurately predict the outcome variable (Yi). The Durbin-Watson statistic (-3.152) ( $d > 2$ ), indicates negative autocorrelation, suggesting that the residuals (prediction errors) from the least squares regressions are serially uncorrelated. Also, the Levene test (2.241) was significant at  $P < 0.05$  (5%) level, implying that there are no significant differences between

the variances of the samples (i.e., the homogeneity assumption of the variance is met). Thus, the regression model is well-fitted to the dataset. The estimated coefficient of multiple determination (R<sup>2</sup>) was 0.773, which implies that 77% of the variation in the marketing margin of African Aubergine traders was accounted for by the independent variables (marketing experience, cost price, quantity sold and marketing cost) in the regression model, the remaining 23% not explained may be due to omitted or unspecified variables and the error term.

Table 3. Factors that influence the marketing margin of African Aubergine traders

Variable	Coefficient	Standard Error	T-Ratio
Constant	2.902**	1.131	2.566
Gender (X <sub>1</sub> )	0.764 <sup>n.s</sup>	0.689	1.11
Market experience (X <sub>2</sub> )	0.653**	0.244	2.676
Cost price (X <sub>4</sub> )	-0.343**	0.119	-2.882
Quantity sold (X <sub>5</sub> )	0.731**	0.267	2.737
Marketing cost (X <sub>6</sub> )	-0.575**	0.212	2.712
R <sup>2</sup>	0.773		
F-Ratio	5.859		
D-W ( <i>d</i> >2)	-3.152		
Levene test	2.241**		

\*\*= Significant at 5% (P<0.05) Level; <sup>n.s</sup> = Not Significant.

Source: Onuwa (2022).

The interpretation of the regression result suggests the following:

**Marketing experience:** The coefficient of marketing experience (0.653) was positive and statistically significant at a 5% level. Hence, the number of years a respondent spends performing any marketing function directly influences their marketing experience and, thus, improves efficiency in commodity marketing over time. This result is consistent with Onuwa et al. (2023) and Onunka et al. (2011), who also reported in their respective studies on the determinants of marketing margins and profitability of African Aubergine marketing a positive correlation between the respondents' marketing experience and profitability in agro-commodity marketing.

**Cost price:** The coefficient of the cost price per bag (-0.343) was negative and significant at the 5% level. This implies that as commodity prices increase, quantity demanded decreases. Consequently, a decline in the quantity of commodities sold affects the margins derived therefrom. This result corroborates Onuwa et al. (2017), who also reported in their study on the profitability of African Aubergine marketing a significant relationship between the prices at which the goods were purchased and the marketing margin of the African Aubergine traders.

**Quantity sold:** The coefficient of quantity sold (0.731) was found to be positive and significant at the 5% level. This suggests that African Aubergine traders will earn a more lucrative income as their sales volume increases. This factor is influenced by the forces of demand and supply, which are determinants of market equilibrium. This result aligns with the findings of Onuwa et al. (2022) and Ugwumba (2009), who similarly observed a significant and positive correlation between the sales volume of agricultural commodities and the marketing margin of the participants in their respective studies on agro-commodity marketing.

**Marketing cost:** The coefficient of marketing cost (-0.575) was negative but statistically significant at the 5% level. This implies that an increase in marketing costs will affect the quantity of bags sold. Agro-commodity marketing costs are influenced by various market function charges. This variable has an inverse relationship with marketing margins. Thus, the higher the estimate, the lower the margins derivable by African Aubergine traders. Policies aimed at reducing marketing costs are necessary to increase the level of supply and profitability. A similar outcome was reported among traders in agro-commodity markets by Gebremedhin and Jaleta (2012) and Ayoola and Zever (2010).

**Income disparity (inequality)**

Table 4 revealed that the computed Gini Coefficient for African Aubergine traders in the study area was 0.59. This index indicates an average level of income disparity (inequality) in the sales income of the respondents, which is attributable to marketing inefficiencies and the volume of trade transactions among African Aubergine traders in agro-commodity markets. This corroborates Onuwa et al. (2017), who also reported [in their study on the profitability of African Aubergine marketing] a moderate level of income disparity (inequality) in the sales income of their respondents.

Table 4. Estimation of income disparity among African Aubergine traders

Income class (₦)	Frequency	%(X)	Gross income(₦)	% Gross income (Y)	XY
≤49,999	61	64.2	592,900	48.2	0.31
50,000-99,999	30	31.6	336,300	27.3	0.09
≥100,000	4	4.2	300,500	24.4	0.01
Total	95	100.0	1,229,700		0.41
Gini Coefficient: 0.59					

Source: Onuwa (2022).

**Constraints of African Aubergine marketing**

Table 5 reveals the critical constraints affecting African Aubergine marketing in the study area. The identified constraints include inadequate capital (89.5%), high marketing costs (82.1%), inadequate price information (64.2%) and poor market infrastructures (57.9%). Other constraints include the perishability of the commodity (45.2%), inadequate storage facilities (44.2%), price volatility (38.9%) and exploitation by middlemen/agents (24.2%). This is consistent with findings from Onuwa et al. (2022), Slamet et al. (2017), Asa et al. (2012) and Sreenivasa et al. (2007), who also highlighted [in their respective studies] similar constraints that significantly impacted agro-commodity marketing.

Table 5. Distribution based on the constraints of African Aubergine marketing

Constraint	Frequency	%
Inadequate capital	85	89.5
High cost of marketing	78	82.1
Inadequate price information	61	64.2
Poor market infrastructures	55	57.9
Perishability of commodity	43	45.2
Inadequate storage facilities	42	44.2
Price volatility	37	38.9
Exploitation by middlemen/ agents	23	24.2

\*Multiple responses were allowed.

Source: Onuwa (2022).



## Conclusions

This study analysed African Aubergine marketing and income disparity among traders in Owerri, Imo State, Nigeria. The study revealed that socioeconomic factors affected African Aubergine marketing in the study area. Also, African Aubergine marketing is a relatively profitable business venture as indicated by the estimates of the marketing margin. However, low levels of market efficiency persist among the respondents. Also, variables in the regression model, including trading experience, cost price, quantity sold and marketing cost significantly influenced the likelihood of variation in the marketing margin. Additionally, the Gini Coefficient index indicated a moderate level of income disparity (inequality) in the sales income of the respondents. The identified constraints were significant and had a critical impact on African Aubergine marketing. Marketing costs were relatively high, making it crucial to address this issue in the study area. Therefore, policy actions should focus on alleviating these constraints to enhance profitability and lower marketing costs.

Based on the findings of this study, the following recommendations are made:

- i. Implementation of policies to improve access to agricultural credit and business capital for African Aubergine traders in agro-commodity markets;
- ii. Implementation of policies to subsidise the cost of marketing functions and improve marketing efficiency among African Aubergine traders in agro-commodity markets;
- iii. Adoption of modern information communication tools (ICTs) for the effective dissemination of market information among African Aubergine traders in agro-commodity markets;
- iv. Providing basic market infrastructures and interventions that support and facilitate the activities of African Aubergine traders in agro-commodity markets by stakeholders and appropriate agencies;
- v. Adoption of modern storage facilities that extend the shelf life of the crop (African Aubergine) and thus mitigate post-harvest losses due to the perishable nature of the crop;
- vi. Formulation and implementation of policies that mitigate agro-commodity price volatility and exploitation by agents, particularly among African Aubergine traders;
- vii. Adoption of policies to improve market performance and reduce income disparities, particularly among African Aubergine traders in agro-commodity markets.

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Institute of Economics and Finance

Department of International Economics and Agribusiness

166 Nowoursynowska St.

02-787 Warsaw, Poland

Phone: +48 22 5934103, +48 22 5934102, fax.: +48 22 5934101

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