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ANALYSIS OF THE REALITY OF THE SUGAR INDUSTRY IN EGYPT AND THE DETERMINANTS OF BRIDGING THE CONSUMPTION GAP AN ANALYTICAL STUDY (2000- 2025)

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ABSTRACT

The study aims to analyze the reality of sugar production in Egypt and the determinants of its ability to meet the growing local demand during the period (2000–2025) in light of the structural transformations witnessed by the Egyptian agricultural and industrial sectors and the research problem is crystalized in the widening of the sugar gap which has become a critical indicator of the fragility of national food security where local production amounting to about 3.18 million tons faces increasing pressures in the face of national consumption that reached nearly 3.83 million tons in 2026 which imposes a continuous dependence on the outside to bridge a deficit ranging between 670-800 thousand tons annually and the study relied on the descriptive analytical approach and logical inference to monitor the stages of the industry's development starting from the absolute historical dependence on sugar cane reaching the stage of "strategic diversification" imposed by the scarcity of water resources where sugar beet succeeded in acquiring 77% of the total national production and the study reached core results most notably that achieving sufficiency which rose from 70% in 2010 reaching 82.6 in 2025 still clashes with technical obstacles represented in the aging of breeds and the fragmentation of agricultural holdings in addition to the technological gap in some old factories and the study concludes with the necessity of adopting an integrated model based on expansion in "contract farming" in the new lands and updating irrigation systems in Upper Egypt to reduce water waste with the necessity of activating fiscal and educational policies to rationalize individual consumption which exceeds international rates by nearly 42% and the study concludes by presenting proposals for mechanisms to develop production in a way that ensures the sustainability of food security and improving the Egyptian trade balance.

KEYWORDS: Egyptian Food Security, Sugar Gap, Sugar Beet, Self-Sufficiency, Horizontal Expansion, Agricultural Policy, Sugar Cane.

1. INTRODUCTION

Sugar is considered one of the most important essential food commodities in the peoples' food basket and it is a basic substance in the human physiological composition through which the energy necessary to perform various human activities is renewed and sugar is consumed either in its known form as final consumption or within some foods and beverages such as sweets pastries and jams etc. The average per capita consumption of sugar globally for the year 2026 is around 22.5 to 22.8 this figure represents the "general average" but it varies sharply between regions as it reaches much higher levels in developed countries such as North America and Europe while it is growing rapidly in developing and emerging countries in Asia and Africa and according to the FAO report updated in January 2026 total global consumption is expected to reach about 178.11 million tons for the current season and estimates also indicate an annual growth in demand ranging between 1% to 1.5% driven by population growth in regions such as South Asia and Africa Egypt is considered one of the highest sugar-consuming countries in the Arab region and the world and reports issued for the year 2025/2026 including USDA and FAO reports show precise details about this consumption gap:

- **Per capita consumption average in Egypt:**

Estimates for the average annual per capita consumption of sugar in Egypt range between 31 – 51.4 kg

- **Conservative estimate according to FAO/OECD:**

It amounts to about 30.8 – 34 kg annually which is still higher by nearly 42% than the global average

- **High estimates locally:**

Some data such as the Cabinet Information Center indicate that actual consumption may reach 51.4 kg per person especially when calculating the sugar included in food industries beverages and sweets that individuals consume heavily

- **National consumption volume:**

It is expected to reach about 3.85 million tons in the current season 2026

- **Local production volume:**

It is estimated at about 3.18 million tons where about 77% comes from sugar beet and 23% from sugar cane

- **Consumption gap:**

The gap between production and consumption amounts to about 670 – 800 thousand tons annually which is bridged through importation mostly from Brazil or through the state's strategic stocks.

1.1. Research Problem

Egypt suffers from a decrease in the degree of self-sufficiency in sugar at a time when the annual consumption volume reaches approximately 3.85 million tons the local production volume does not exceed 3.18 million tons and the gap between production and consumption is covered through importation whose quantities are increasing year after year due to the growing volume of consumption population increase and the development of food industries and the problem of sugar production in Egypt is represented in the contradiction between resources and institutions where the ambition to increase production clashes with limited water resources especially in cane crops while production efficiency suffers from a technical gap resulting from the fragmentation of holdings and the aging of logistics chains this structural imbalance makes the local supply price in a state of constant conflict with increasing input costs which threatens the sustainability of the sector's growth in the face of global competition

1.2. Research Objectives

The research aims to

- 1 Prove the availability of possibilities to increase sugar production locally and raise the degree of self-sufficiency
- 2 The possibility of exerting efforts to remove all obstacles facing the sugar industry
- 3 Propose a mechanism to develop production to cover the growing demand for this very important food substance

2. RESEARCH METHODOLOGY

The research relied on descriptive analysis and logical inference through reviewing the history of the sugar industry in Egypt and its developments according to the stages of government support that sponsored it and the state of decline it reached leading to extracting results that explain current production conditions and the mechanism for overcoming the obstacles suffered by sugar production

2.1. Research Structure

In line with the methodology adopted in the research its contents were presented in four main sections.

- 1 history of sugar cultivation and production and the entities in charge of it and production capacities and their development
- 2 obstacles and determinants of developing Egyptian production of sugar

- 3 possibilities of developing production and achieving an acceptable level of self-sufficiency in sugar.
- 4 presentations of the research results and recommendations with highlighting the returns that the development of production will achieve economically

2.2. Previous Studies

1- Study of Al-Shafei (2025) The study dealt with future predictions for sugar production and consumption in Egypt until 2024 where the research problem was crystallized in the widening of the consumption gap resulting from the rapid population increase and the study started from the hypothesis that relying on modern agricultural technologies will enhance acre productivity and reduce the import gap and the study aimed to analyze the efficiency of current supply chains in the sugar sector and its importance lies in providing a forward-looking vision for decision-makers to secure the strategic stock and the study reached two main results namely that the expansion of beet refining factories reduced reliance on imports by 15% and predicted Egypt's arrival at full self-sufficiency by 2028 and the study recommended the necessity of supporting farmers to adopt drip irrigation systems to reduce the water production cost.

2- Study of Abdel Wahab (2024) The study dealt with the economic efficiency of sugar beet production in reclaimed lands where the research problem was crystallized in the limited water resources and their direct impact on the cultivation of water intensive crops such as sugar cane and the study started from a hypothesis that expanding beet cultivation in new lands achieves an economic return and water saving higher than traditional crops and the study aimed to evaluate the economic feasibility of production in modern reclamation areas and its importance lies in supporting the state's strategy towards agricultural horizontal expansion and the study reached two main results namely the superiority of sugarbeet in achieving a profit margin for farmers compared to other winter crops and the contribution of new lands production to the stability of sugar prices locally and the study recommended the necessity of providing high quality seeds specifically suited to the nature of the soil and salinity in reclaimed areas to ensure the sustainability of production.

1- Al-Shafei Mohammed (2025) Future Vision for the Sugar Sector in Egypt an Analytical Study in Light of Vision 2030 Journal of Economic and Financial Research.

2- Abdel Wahab Ahmed (2024) Economic Efficiency of Sugar Beet Production in Reclaimed Lands and its Impact on Achieving Food Security in Egypt Egyptian Journal of Agricultural Economics.

3- Study of Al-Qadi (2023) The study dealt with the impact of global sugar price fluctuations on the stability of the Egyptian local market where the research problem was crystallized in the inflationary pressures that reflected on the prices of basic food commodities and the study started from a hypothesis that enhancing investment in sugar manufacturing industries reduces the sensitivity of the local market to external shocks and the study aimed to measure the relationship between the import cost and the retail price in the Egyptian market and its importance lies in protecting consumers from global price fluctuations and the study reached two main results namely the existence of a strong positive relationship between global fuel prices and the cost of transporting and distributing sugar locally and the success of protective policies in stabilizing sugar supply during crises and the study recommended activating future hedging contracts to purchase raw sugar from global markets to reduce risks

3- Study of Mansour (2022) The study dealt with the health and economic dimensions of imposing taxes on sugary drinks in Egypt where the research problem was crystallized in the increasing financial burdens on the health insurance system as a result of the spread of obesity diseases related to sugar and the study started from a hypothesis that flexible tax policies will lead to modifying consumption behavior and reducing demand for high sugar products and the study aimed to evaluate the expected financial impact of implementing the value added tax on added sugar and its importance lies in balancing the financial deficit and improving public health indicators and the study reached two main results namely that imposing a 10% tax may reduce consumption by 8% annually and the increasing awareness of consumers of healthy alternatives when the prices of sweetened products rise and the study recommended directing the proceeds of these taxes to support the funding of healthy school nutrition programs.

1- Al-Qadi Sarah (2023) Global Price Fluctuations of Strategic Commodities and Their Impact on Monetary Balance A Case Study of the Egyptian Sugar Market International Journal of Trade and Economics.

2- Mansour Khalid (2022) Fiscal Policies and Their Impact on the Consumption of Health-Harming Goods an Empirical Analysis of the Egyptian Market Journal of Tax and Financial Studies.

Chapter One: Theoretical Framework of the Sugar Sector and Food Security in Egypt.

The sugar commodity is considered one of the strategic food commodities that enjoy special importance in the Egyptian economy due to its direct link to daily consumption and various food industries and the sugar sector in Egypt has witnessed remarkable developments during recent decades whether at the level of production or agricultural policies however it still faces a group of structural challenges that limit its ability to achieve self-sufficiency and in this framework the sugar gap emerged as one of the most prominent indicators of the imbalance between supply and demand and the resulting implications for food security accordingly this chapter aims to review the historical development of sugar production in Egypt and analyze the most prominent challenges facing it as well as studying the sugar gap and its relationship to food security.

First: Historical Overview Egypt is considered one of the oldest countries that knew sugar cane cultivation and sugar industry in the region as the introduction of the cane crop to the country dates back to the year 641 AD during the era of the Arab entry into Egypt where it found in Upper Egypt the appropriate climatic environment for its growth around the course of the Nile River also the history of the sugar industry in Egypt was linked to the economic and agricultural transformations witnessed by the Egyptian countryside since the nineteenth century until today and passed through several stages Stage One: Origins and Initial Expansion (from 641 AD until the end of the nineteenth century) The study “History and Current Status of Sugarcane Breeding in Egypt” published in the journal Sugar Tech in 2021 indicated that the sugar cane crop was the only crop used to produce sugar in Egypt until 1982 and the nineteenth century witnessed a great development when sugar extraction factories were established in the areas of Qena Armant and Nag Hammadi with state support during the era of Muhammad Ali Pasha and his heirs which consolidated the position of sugar cane as a strategic and economic crop in Upper Egypt and the study explains that Egypt relied on importing commercial cane varieties from countries such as Jamaica Mauritius and India until the early twentieth century before the national research activity began in improving varieties locally in 1913 by establishing the Sugar Cane Research Department at the Ministry of Agriculture and varieties such as POJ 2878 and NCo 310 were among the most important varieties cultivated until the middle of the twentieth century

Stage Two: Institutional Development and Reliance on Local Cane (1940–1980) Since the middle of the twentieth century Egypt began to rely gradually on local genetic improvement programs and according to a study by Hussein Hassan Ali Adam (Ain Shams University 2004) titled Economics of Sugar Crops Production in Egypt in Light of Some Global Economic Variables the sugar cane area in 1980 reached about 273 thousand acres with a production of about 11.9 million tons and an average productivity of 43.6 tons/acre and it was found that the governorates of Qena Aswan Sohag and Minya represented the basic centers of production and that the cane crop remained the only source for sugar production until the end of the 1970s and during this period the sugar industry witnessed a remarkable industrial expansion by establishing new factories and raising the efficiency of old factories in Nag Hammadi Edfu and Girga which gradually increased the national production capacity despite the limited operational efficiency and heavy reliance on flood irrigation.

Stage Three: Introducing Sugar Beet as a Complementary Crop (from 1982 to the present) In 1982 Egypt started a new stage with the establishment of the first production line to extract sugar from beet at the Delta Sugar factory in Kafr El-Sheikh which represented a strategic shift in production policy and a study by Iman Abdullah Abdullah and Rania Abdullah Tolba (Egyptian Journal of Agricultural Economics 2018) titled The Role of Agricultural and Industrial Policies in Reducing the Sugar Gap in Egypt indicated that the state moved towards expanding beet cultivation due to limited resources and the areas expanded from 555 thousand acres in 2015 to 780 thousand acres in 2025 with beet currently contributing more than 62% of total national sugar production as studies indicate that the agricultural strategic plan until 2030 aims to increase sugar production to 3.5 million tons through developing varieties expanding the cultivated area in the Delta Ismailia and Minya and improving operational efficiency in the factories of Nubaria Nile and Al-Nooran.

Stage Four: Modern Transformations Towards Self-Sufficiency (2020–2026) According to a recent report published by Al Jazeera Net (April 29 2025) titled Expectations of Achieving Self-Sufficiency local sugar production in 2025 reached about 3.12 of which 2.5 million tons from sugar beet and 620 thousand tons from sugar cane the report also explained that this transformation came as a result of raising the supply prices of beet and cane to encourage farmers besides expanding new factories such as the Canal

Sugar factory in Minya which is considered one of the largest sugar factories in the Middle East with a production capacity exceeding 900 thousand tons

annually and the development of sugar production in Egypt can be summarized in four main stages.

Table No. (1):

Stage	Period	Main Features
Origins and Establishment	641 – 1900	Introduction of cane to Egypt and establishment of the first government sugar factories
National Organization and Expansion	1900 – 1980	Establishment of research departments development of factories increase in production
Diversification of Sources	1982 – 2020	Introduction of sugar beet expansion of areas increase in its contribution to national production
Self-Sufficiency and Potential Export	2020 – present	Achieving self-sufficiency establishing new factories and increasing production to 3.5 million tons

Second Obstacles and Determinants of Developing Egyptian Production of Sugar

The issue of developing sugar production in Egypt is one of the vital issues that academic research has addressed intensively given its link to food security and water resources and based on economic and agricultural studies the obstacles and determinants can be classified into four main axes.

A- The water challenge and the "return per cubic meter" equation Water represents the first strategic determinant and studies indicate a gap in the efficiency of water use between the two crops

- Cane is a greedy consumer of water where one acre of cane consumes between 8000 to 10000 cubic meters annually and studies currently focus on the necessity of shifting from flood irrigation to improved irrigation drip in Upper Egypt but the obstacle lies in the high cost of infrastructure and the fragmentation of holdings
- The comparative advantage of beet beet consumes about 2500 to 3500 cubic meters of water only which explains the state's tendency to make it the engine of growth in reclaimed lands such as the New Delta project

B- Obstacles of production and technological efficiency There is a gap between the achieved productivity and the maximum productivity due to the following reasons

- Deterioration of varieties wide areas of cane rely on the commercial variety C9 which has started to suffer from production degradation as a result of its use for long decades and research indicates slowness in breeding and disseminating new varieties resistant to diseases and higher in sucrose percentage
- Mechanical and time loss field studies show that the delay in supplying the crop after its

harvest especially cane leads to the phenomenon of "sucrose deterioration" where sugar transforms into non-sugary substances due to heat which reduces the quality of the raw material supplied to factories.

C- Economic determinants and price distortions

- Crop competition beet and cane face intense competition from other winter and summer crops such as wheat and corn as well as the
- continuous rise in the prices of fertilizers energy and labor which reduces the profit margin for the farmer unless accompanied by an increase in government supply prices
- Economies of scale fragmentation of holdings less than an acre for most farmers prevents the use of large mechanical harvesters making the harvesting process manual and expensive and increasing the cost of a final ton of sugar compared to the global price in terms of profitability which sometimes leads to farmers' reluctance

D- Institutional and logistical challenges.

- Centralization of factories aging of some production lines in old factories leads to a decrease in sugar extraction rates compared to global standards which leads to a decrease in manufacturing efficiency and an increase in waste and repetition of technical failures also cane factories are concentrated in the far south of Upper Egypt raising the transport cost from distant fields.
- Weak coordination absence of effective and full coordination between the entities responsible for securing the raw material Ministry of Agriculture and the entities responsible for manufacturing Ministry of Industry.
- Support and pricing policies insufficiency of incentive prices granted to farmers compared to increasing production costs

which pushes many of them to refrain from

cultivating this strategic crop.

Table No. (2): Analytical Comparison of Structural Determinants of Sugar Production in Egypt.

Comparison aspect	Sugar cane Upper Egypt	Sugar beet Delta and new lands
Water determinant	Critical obstacle huge consumption 8-10 thousand m ³ /acre and difficulty of shifting to modern irrigation due to the dense growth nature of the crop	Comparative advantage low consumption about 3 thousand m ³ /acre perfectly compatible with spray and drip irrigation systems
Time determinant	Perennial crop occupies the land for 12 months which reduces farmer flexibility in planting alternative crops	Winter crop occupies the land for 6 months only which allows for a dual agricultural cycle such as planting corn in summer
Technological challenge	Aging of breeds reliance on S9 variety for long periods led to a decline in productivity and disease resistance	Technical development reliance on imported high productivity hybrid seeds but they raise the import cost
Extraction efficiency	Loss problem delay in transport to factories reduces sugar percentage and aging of some government factories raises the waste rate	High efficiency newer factories private sector and investors and extraction rates in them approach global levels
Economies of scale	Severe fragmentation very small holdings hinder comprehensive mechanization and increase manual labor cost	Relative expansion in reclaimed lands such as the New Delta and holdings are larger allowing full mechanization from planting to harvesting

Third The Sugar Gap and Its Relationship to Food Security in Egypt

The concept of food security is considered one of the pivotal concepts in agricultural economics as it refers to the state's ability to provide its basic food needs sustainably whether from local production or through safe importation and in this context strategic commodities including sugar represent an essential element in achieving this security and the sugar gap is directly linked to the concept of food security as it is defined as the difference between local production and total consumption which reflects the extent of the economy's ability to achieve self-sufficiency from this vital commodity and literature indicates that the food gap is considered one of the most important challenges facing developing countries as it drains a large part of their monetary resources and affects their economic stability.

1/ The Sugar Gap as an Indicator of Food Security Weakness

Applied studies indicate that Egypt suffers from a continuous sugar gap where local production does not cover the increasing demand leading to reliance on importation to meet local needs where production reached about 3.18 million tons against consumption exceeding 3.82 million tons meaning a gap approaching one million tons with a self-sufficiency rate of less than 70% and this situation reflects a structural imbalance in the food security system where providing sugar becomes subject to external factors such as global price fluctuations and the availability of foreign exchange and international supply chains therefore the continuation of the sugar gap does not represent just a production problem but reflects fragility in national food security.

2/ Analyzing the economic relationship between the gap and food security

- Reliance on importation as a source of risk Whenever the sugar gap increases the reliance on importation increases which leads to exposing the local market to external shocks and increasing pressure on the balance of payments and the rise in local prices as countries that suffer from large food gaps are more vulnerable to economic and food crises especially in light of global crises.
- Decrease in food security coefficient Food security is sometimes measured by what is called the food security coefficient which depends on the volume of local production and the volume of strategic stock and the volume of consumption and one of the studies showed that the food security coefficient for sugar in Egypt reached about 0.12 only which is a low level reflecting the weak ability to face shocks also the strategic stock is not sufficient except for a short period about 39 days and this means
- that any disruption in importation may lead directly to a crisis in sugar availability.

3/ Imbalance Between Supply and Demand

Literature shows that the sugar gap in Egypt is resulting from rapid growth in demand population income food industries against slower growth in production due to resource constraints and studies have shown that most indicators consumption importation gap take an upward trend over time which indicates a structural nature of the problem.

4/ Economic Dimensions of Food Security in Sugar

The relationship between the sugar gap and food security can be analyzed through three main dimensions:

- Production dimension it is represented in limited water resources high production cost weak efficiency in some manufacturing stages this leads to the inability of local production to cover demand.
- Consumption dimension it is represented in high average per capita consumption increase in industrial demand for sugar this leads to the inflation of the gap
- Trade dimension reliance on importation leads to exposure to global market fluctuations therefore instability of supplies
- Implications of the gap on food security.

Instability in markets and price fluctuations then the emergence of acute shortage crises in production and stock.

- Pressure on financial resources increase in the import bill draining of foreign currency
- Weak ability for food planning it lies in the reliance on external conditions and the difficulty of building a sufficient strategic stock.

Finally, it can be said that the sugar gap in Egypt is not just a production problem but it is a central indicator showing the weakness of food security as it reflects the imbalance between resources and needs and the weakness of food independence and increasing reliance on the outside therefore addressing this gap represents a basic entry point for

enhancing food security and not just a limited agricultural goal.

Chapter Two: Analytical Framework Production and Consumption of Sugar and the Food Gap in Egypt (2000–2025)

This chapter aims to provide a statistical analysis of the development of the sugar sector in Egypt during the period (2000–2025) through reviewing the most important quantitative indicators linked to production consumption and the sugar gap in addition to analyzing their time trends using actual data and this analysis contributes to providing a more accurate picture of the nature of the imbalance between supply and demand in a way that supports a deeper understanding of the sugar gap problem and its implications for food security.

First Development of Sugar Production and Consumption in Egypt During the Period 2010–2025

1/ Sugar Production in Egypt

Local production of sugar is considered one of the most important determinants of achieving balance in the market as it reflects the ability of the agricultural and industrial sectors to meet local demand and in this part the development of sugar production in Egypt during the period 2010–2025 is reviewed and analyzed based on available statistical data to identify production trends and the extent of its ability to keep pace with local demand.

Table No. (3)

Year	Production
2010	1935
2011	2010
2012	2120
2013	2230
2014	2280
2015	2340
2016	2210
2017	2265
2018	2420
2019	2480
2020	2550
2021	2850
2022	2800
2023	2700
2024	3100
2025	3180
General Average	2466.875

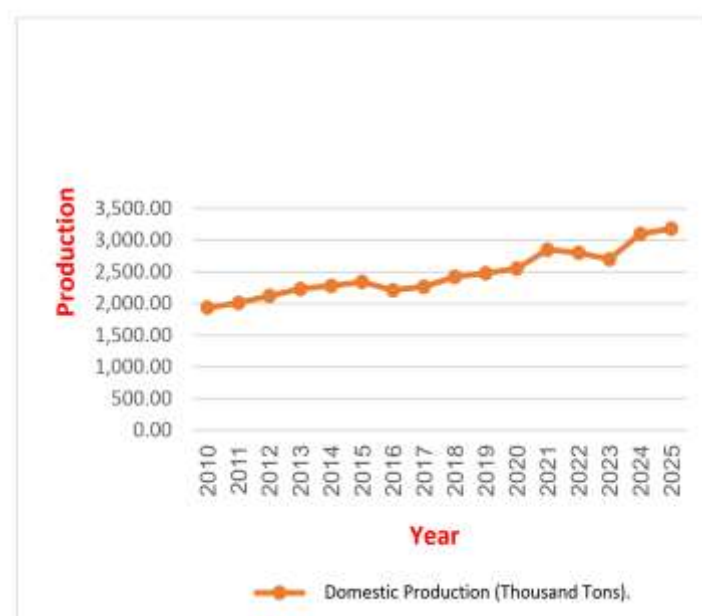


Figure No. (1): Development of Sugar Production in Egypt During the Period (2010 – 2025).

Figure No 1 shows the existence of a general upward trend as production rose from about 1935 thousand tons in 2010 to about 3180 thousand tons in 2025 with a total increase estimated at about 64% during the study period and the general average of production is about 2466.9 thousand tons reflecting a noticeable improvement in the production capacity of the sugar sector in Egypt. The development of production can be divided into several main time stages where the period from 2010 to 2015 witnessed stable gradual growth as production rose from 1935 to 2340 thousand tons which is attributed to the expansion in the cultivation of sugar crops especially sugar beet and the improvement of agricultural production methods. In contrast the year 2016 witnessed a relative decline in production to reach 2210 thousand tons which may be linked to some agricultural or economic challenges that affected production in that period; however, production returned to its upward path during the period from 2017 to 2020 as it rose gradually to reach 2550 thousand tons, and the period from 2021 to 2025 is considered a clear boom stage in production where production recorded a large increase to reach 2850 thousand tons in 2021 before witnessing some fluctuation in the years 2022 and 2023, then rising significantly again in the years 2024 and 2025 to reach its highest level during the study period at 3180

thousand tons. This upward trend in production reflects the impact of agricultural policies aimed at increasing local production along with the expansion in sugar beet cultivation and improving the efficiency of manufacturing processes; however, the fluctuations that appeared in some years indicate the continued existence of structural challenges affecting the stability of production, such as fluctuations in agricultural production or resource-related constraints. In general, it can be said that the sugar production sector in Egypt witnessed a noticeable improvement during the study period; however, this improvement requires continued support for expansion and productivity policies to ensure sustainability of growth and achieving a greater degree of stability in production levels.

2/ Sugar consumption in Egypt Sugar consumption is considered one of the important indicators reflecting the volume of local demand as it is affected by several factors, most importantly population growth, income levels, and expansion in food industries. This part addresses the analysis of the development of sugar consumption in Egypt during the period 2010–2025 with the aim of identifying demand trends and the extent of their compatibility with the development of local production.

Table No. (4):

Year	Consumption
2010	2750
2011	2800

2012	2850
2013	2900
2014	3000
2015	3050
2016	3100
2017	3150
2018	3200
2019	3250
2020	3300
2021	3350
2022	3400
2023	3500
2024	3750
2025	3850
General Average	3200

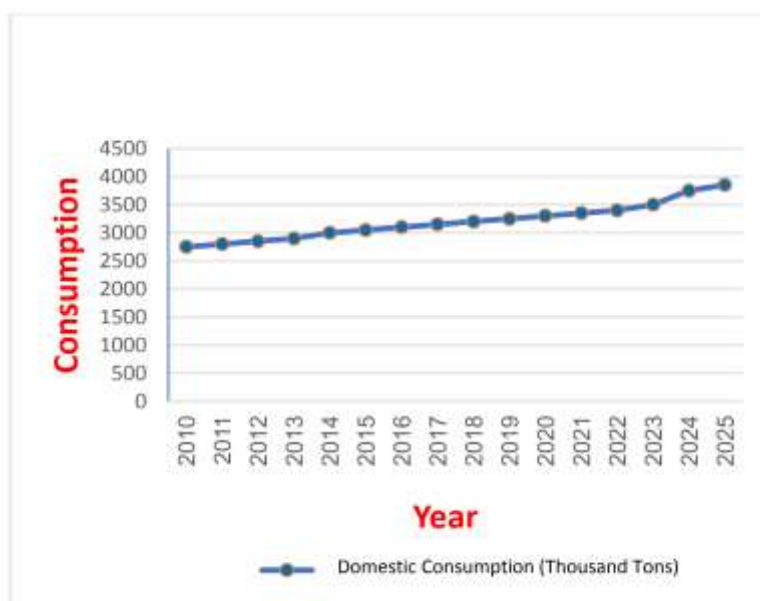


Figure No. (2): Development of Sugar Consumption in Egypt During the Period (2010 - 2025).

Figure No 2 shows that sugar consumption data in Egypt has taken a clear and continuous upward trend as consumption rose from about 2750 thousand tons in 2010 to about 3850 thousand tons in 2025 with a total increase estimated at about 40% and the general average of consumption is about 3200 thousand tons reflecting a noticeable rise in local demand for sugar and it can be observed that consumption was characterized by a semi regular gradual growth during most years of the study as it rose from 2750 thousand tons in 2010 to about 3250 thousand tons in 2019 which reflects the direct impact of population growth and the increase in individual consumption in addition to the expansion in food industries that rely on sugar as a basic component also this upward trend continued during the period from 2020 to 2025 as consumption rose from 3300 thousand tons to 3850 thousand tons with a relative acceleration in growth rates during recent years especially in 2024 and 2025 and this

acceleration is attributed to the increase in local demand and high consumption rates in the industrial and food sectors In general sugar consumption in Egypt is characterized by relative stability compared to production as it does not show sharp fluctuations but rather reflects a continuous upward trend which indicates that demand for sugar is characterized by relative stability and is difficult to reduce in the short term and the compound annual growth rate in total demand for consumption during the study period is estimated at about 2.3% although at a relatively lower rate than some periods of production growth it remains a major factor in the continuation of the gap between production and consumption and this trend reflects a continuous rise in local demand for sugar as a result of population growth and expansion in food industries which increases pressures on local production and by comparing this trend with the development of production it becomes clear that there is an increasing gap between supply and

demand which will be analyzed in the next part.

3/ Production and consumption of sugar in Egypt It is clear from Figure No 3 that there is a clear gap between production and consumption of sugar in Egypt during the study period 2010–2025 where local consumption exceeds production in most years and it is also noted that both production and consumption take a general upward trend however the growth rate of consumption exceeds the growth rate of production which led to the continuation of the sugar gap over time and this gap ranged between about 0.8 - 1.0 million tons during most years of the study reflecting the inability of local production to meet the growing demand it is also noted that a relative decrease occurred in both production and consumption during the year 2020 and it can be explained by the impact of economic activity by some

exceptional factors and circumstances such as the Corona pandemic and weak production however the gap continued despite that and in contrast the year 2025 witnessed a noticeable increase in production compared to previous years which contributed to narrowing the gap relatively although it did not disappear completely In general these results indicate the existence of a structural imbalance between supply and demand in the sugar market in Egypt where local production does not keep pace with the continuous increase in consumption which leads to reliance on importation to cover the deficit and this reflects a continuous challenge to achieving self-sufficiency and emphasizes the necessity of adopting more effective policies to increase production and improve its efficiency.

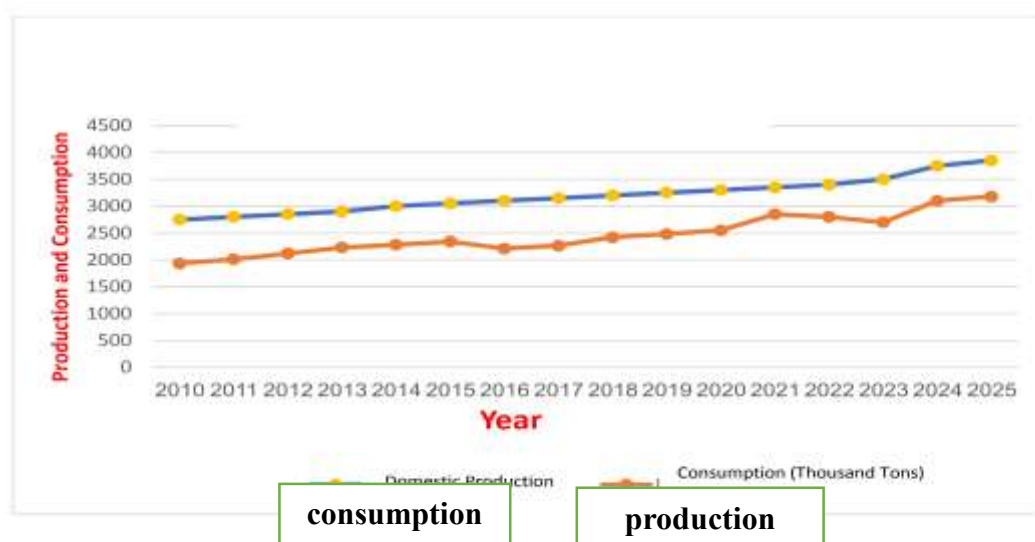


Figure No. (3): Development of Sugar Production and Consumption in Egypt During the Period (2010 – 2025).

Second Self-Sufficiency Ratio of Sugar in Egypt

The self-sufficiency ratio is considered one of the most important indicators used to measure the ability of local production to meet domestic demand as it reflects the extent of the state's reliance on its own resources versus reliance on importation and it is measured through the formula = $(\text{Production} / \text{Consumption}) \times 100$

Table No 5 below clarifies the analysis of the sugar gap in Egypt during the period 2010–2025 where the continued existence of a deficit between local production and consumption the gap ranged between 500 thousand tons as a minimum in 2021 and 890 thousand tons as a maximum in 2016 and this reflects a continuous reliance on importation to cover the needs of the local sugar market in parallel the self-sufficiency ratio shows a fluctuating trend

tending towards relative improvement in the long term as it rose from about 70.36% in 2010 to more than 82% in recent years with recording its highest level at 85.07% in 2021 and this indicates an improvement in the ability of local production to meet demand albeit in an unstable manner The development of the gap and self-sufficiency can be divided into several stages as in the period from 2010 to 2015 the gap witnessed a gradual decrease from 815 to 710 thousand tons in parallel with a relative improvement in the self-sufficiency ratio which reflects the beginning of the expansion in sugar production with the continued reliance on sugar cane as a main source however the year 2016 witnessed a noticeable widening in the gap to reach 890 thousand tons and a decrease in the sufficiency ratio to about 71.29% which coincides with the global sugar shortage crisis and its accompanied disturbances in

local markets and the gap continued at relatively high levels during the years 2017 and 2018 despite the relative improvement resulting from the expansion in sugar beet production especially in 2018 and during the period from 2019 to 2020 the gap witnessed a gradual improvement to decline to about 750 thousand tons with the rise of the self-sufficiency ratio to more than 77% despite the challenges linked to global supply chain disturbances during the Corona pandemic.

The period from 2021 is considered an important turning point where the gap decreased significantly to about 500 thousand tons and the self-sufficiency ratio rose to its highest level driven by the entry of new factories and the increase in production capacity however this improvement did not fully continue as the gap returned to widening relatively during the period from 2022 to 2023 as a result of fluctuation in production and the rise in consumption in addition to challenges linked to importation and in recent years 2024–2025 a relative improvement in indicators is observed where the gap decreased and the self-

sufficiency ratio rose to about 82% supported by sugar beet production reaching record levels however the continued reduction of gap rates from full self-sufficiency has not been achieved yet In general the analysis of the sugar gap reflects the existence of a continuous structural imbalance between supply and demand in the sugar market in Egypt where the gap is affected by several overlapping factors including changes in agricultural production and the continuous growth in consumption along with external factors such as global market fluctuations and supply chains and this emphasizes that achieving self-sufficiency requires not only increasing production but also improving the efficiency of the production system and managing demand more effectively as a clear inverse relationship is evident between the size of the sugar gap and the self-sufficiency ratio where the decrease in the gap leads to an improvement in the level of sufficiency and vice versa which reflects the direct interconnection between supply and demand indicators in this sector.

Table No (5): Analysis of the Sugar Gap in Egypt During the Period (2010–2025).

Year	Sugar gap thousand tons	Self-sufficiency ratio	Event
2010	815	70.36	Primary reliance on cane
2011	790	71.79	-
2012	730	74.39	-
2013	670	76.9	-
2014	720	76	-
2015	710	76.72	-
2016	890	71.29	Global sugar shortage crisis
2017	885	71.9	-
2018	780	75.62	Jump in beet production
2019	770	76.31	-
2020	750	77.27	Supply chain impact Corona
2021	500	85.07	Entry of new factories
2022	600	82.35	Production fluctuation due to climate change
2023	800	77.14	High consumption and import challenges
2024	650	82.67	Beet production reaching record levels
2025	670	82.6	End of season estimates

Third Impacts of the Sugar Gap on Food Security in Egypt

In light of the previous results related to the development of production consumption and the sugar gap in Egypt during the period 2010–2025 it is clear that the sugar sector represents one of the basic components of food security given its being a strategic commodity that enters into direct consumption and into many food industries and data shows the continued existence of a sugar gap although it is characterized by fluctuation which reflects a continuous challenge to achieving self-sufficiency and the widening of the gap in some years such as 2016 and 2023 indicates an increase in the

degree of reliance on importation which makes food security vulnerable to being affected by global market fluctuations whether in terms of prices or availability of supplies and in this context global crises such as supply chain disturbances during the Corona pandemic highlight the fragility of reliance on the outside in providing basic food commodities and in contrast the noticeable improvement in the self-sufficiency ratio during some years especially in 2021 reflects the positive impact of expansionary production policies such as the expansion in sugar beet cultivation and the entry of new manufacturing capacities and this confirms that enhancing local production is considered one of the most important

tools to reduce risks linked to food security.

However the continued growth of consumption at stable rates driven by population growth and industrial expansion means that achieving full self-sufficiency does not depend only on increasing production but also requires effective management of demand and improving the efficiency of supply chains and reducing waste in production and distribution stages

Also data highlights that the sugar gap is not just a production matter but is a reflection of a structural imbalance between supply and demand which necessitates the adoption of integrated policies including supporting agricultural production improving productivity and developing industries linked to sugar along with enhancing the ability to face external shocks

In general it can be said that achieving food security in the sugar sector in Egypt requires a mix of policies that target increasing local production in a sustainable manner and diversifying import sources to reduce risks and improving consumption efficiency to ensure reducing the sugar gap and enhancing the degree of self-reliance in this vital sector and this confirms that the sugar gap represents a direct indicator of the degree of food security fragility and that reducing it is considered a basic condition for enhancing economic and food stability in Egypt.

3. RESULTS AND RECOMMENDATIONS

First Results

- 1- Structural transformation of production the study proved the success of the strategic shift towards "sugar beet" to become the primary engine of production with a contribution rate of 77% due to its ability to adapt to modern irrigation systems and reclaimed lands compared to sugar cane.
- 2- Production growth versus consumption explosion despite the growth of local production by 64% since 2010 to reach 3.18 million tons in 2025 the population increase and the expansion of food industries raised consumption to record rates ranging between 31 to 51.4 kilograms per capita annually.
- 3- Improvement of the self-sufficiency indicator Egypt recorded a noticeable improvement in the self-sufficiency ratio to reach about 82.6% in 2025 driven by the entry of major investments such as the Canal Sugar factory after the ratio was revolving around 70% in the year two thousand and ten.
- 4- Impact of water resources it was found that the

water resource is the largest determinant for sugar cane expansions with consumption ranging between 8000 – 10000 cubic meters per acre while beet possesses a competitive advantage with its low consumption estimated at about 3000 making it the most suitable for future expansion plans.

- 5- Fragility of food security the sugar gap which ranges between 670 to 800 thousand tons still represents a weak point in national food security as it makes the local market vulnerable to global price fluctuations and international supply chains

Second Recommendations

- 1- Directing scientific studies and specialized research in this field and alerting those in charge of this sector to exert efforts to develop and increase production quantities to secure the growing needs of this vital substance.
- 2- Developing vertical productivity, the necessity of breeding and disseminating new strains of cane and beet to raise the sucrose percentage and disease resistance which raises the acre productivity without the need for additional areas.
- 3- Modernizing irrigation systems accelerating the transformation of sugar cane farms in Upper Egypt from flood irrigation to improved drip irrigation with providing financing support for farmers to face the high costs of infrastructure.
- 4- Improving manufacturing efficiency modernizing production lines in old government factories to reduce mechanical loss and increase sugar extraction rates to reach global levels.
- 5- Fair pricing policies reviewing the supply prices of beet and cane periodically in line with inflation rates and input costs fertilizers and energy to ensure that farmers do not refrain and shift to other crops
- 6- Managing the demand side activating national awareness campaigns to rationalize individual sugar consumption and encouraging food industries to reduce added sugar percentages which contributes to reducing the gap from the consumption side.
- 7- Contract farming enhancing the contract farming system between factories and farmers to ensure the supply of the crop at the time of its harvest which prevents the phenomenon of sucrose deterioration resulting from transport

delay.

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