An Economic Analysis of Food Processing for Key Fruit and Vegetable Crops in Egypt: A Case Study of Qalyoubia Governorate

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Abstract: This research addresses the issue of daily surpluses in local markets of agricultural products, specifically vegetable and fruit crops. These surpluses often suffer damage and spoilage due to insufficient demand, primarily driven by rising commodity prices. Such losses have economic repercussions for farmers, merchants, and the state, as these goods are highly perishable. To mitigate this issue, it is crucial to process the surplus into valuable products that can be preserved throughout the year, increasing both their shelf life and market availability. This approach not only enhances the added value of these products but also benefits stakeholders—farmers, merchants, and the state—by boosting agricultural income.

The objective of this research is to analyze the economics of added value generated by food manufacturing projects, focusing on surplus conversion of key vegetable and fruit crops in Qalyubia Governorate. The study highlights the role of the Qaha factories in Qalyubia, which process surplus produce into high-value products. Key findings include:

- **Tomatoes:** Surplus of 20.9 tons, yielding an added value of approximately 115,925 thousand pounds and a net return of 56,290 thousand pounds.
- **Guava:** Surplus of 14,975 tons, with an added value of 700,290 thousand pounds and a net return of 242,415 thousand pounds.
- **Strawberries:** Surplus of 17.8 tons, generating an added value of 2,104,059 thousand pounds and a net return of 1,055,509 thousand pounds.
- **Mangoes:** Surplus of 29.7 tons, resulting in an added value of 2,939,280 thousand pounds and a net return of 1,648,380 thousand pounds.
- **Oranges:** Surplus of 45.6 tons, contributing an added value of 1,802,689 thousand pounds and a net return of 914,060 thousand pounds.

These findings underscore the significance of transforming surplus agricultural products into processed goods with substantial added value, thereby supporting economic sustainability.
Keywords: Food Processing, Value Added, Surplus, Economic Returns, Costs

I.INTRODUCTION

Food manufacturing stands as one of the most significant transformative industries within the Egyptian economy. It represents a vital component of agricultural vertical integration projects, serving as a crucial link between the agricultural and industrial sectors. This process enables the conversion of agricultural products from their raw forms into high-value manufactured goods that cater to the diverse and ever-evolving needs of both domestic and international consumers. Examples of such products include juices, jams, and preserves derived from vegetable and fruit crops.

The importance of food processing lies in its ability to enhance added value by transforming raw agricultural inputs into final consumer goods. It also provides various marketing benefits, such as formal, temporal, and spatial advantages, ensuring product availability throughout the year. Additionally, this sector plays a pivotal role in stabilizing prices, mitigating the challenges posed by the seasonality of agricultural production, and generating export surpluses that improve the trade balance. These activities contribute to foreign currency acquisition and the creation of employment opportunities in local factories.

Vegetable and fruit crops hold particular significance in Egypt, especially within Qalyubia Governorate, due to favorable cultivation conditions, including suitable land, required expertise, and strategic proximity to major markets such as Obour Market, Belqus Market, and local weekly markets. The governorate boasts approximately 19,000 acres dedicated to vegetables and 38,200

acres to fruit crops, representing about 1.37% and 2.18% of the national total for vegetables and fruits, respectively, during the 2021/2022 season.

These factors underscore the need for advancements in the food manufacturing sector to enhance its efficiency. Such development is essential to absorb surplus production, minimize losses and spoilage in local markets, increase the added value of agricultural products, create job opportunities for young people, and support the export of manufactured goods.

Research Problem The research problem revolves around the significant daily surplus of agricultural products, specifically vegetable and fruit crops, in local markets. This surplus often faces damage and spoilage due to limited demand caused by high commodity prices and low purchasing power among citizens. These circumstances result in substantial material losses for farmers, merchants, and the state, reflecting a waste of agricultural economic resources. This issue is further exacerbated by the absence of effective marketing channels to redirect these surpluses into food manufacturing processes. Such transformation would generate valuable products with extended shelf lives, making them available for consumption year-round. Moreover, it would enhance the added value of these products, benefiting farmers, merchants, and the state by increasing national agricultural income.

Research Objective The primary objective of this research is to analyze the economics of the added value derived from food manufacturing projects aimed at converting surplus production of key vegetable and fruit crops in Qalyubia Governorate. To achieve this objective, the research focuses on the following sub-goals:

1. Examining the production and consumption patterns of major vegetable and fruit crops.
2. Investigating the marketing stages of key fruit crops and estimating surplus levels in local markets.
3. Identifying the most significant food manufacturing projects in Qalyubia Governorate.
4. Conducting an economic feasibility study for a food manufacturing facility within the governorate.
5. Highlighting key challenges and obstacles facing food manufacturing projects in Qalyubia Governorate.

Importance of the Research This research is significant because it identifies the critical positive and negative aspects of utilizing surplus vegetable and fruit production in Qalyubia Governorate for manufacturing purposes. The findings will provide decision-makers with actionable insights to optimize production, reduce losses, and enhance the added value of agricultural products. Additionally, the research emphasizes increasing the availability of manufactured goods throughout the year and boosting exports of these products to improve the trade balance, generate foreign currencies, and strengthen the balance of payments.

II. Methodology

The study employs a combination of descriptive and quantitative analysis methods:

- **Descriptive Analysis:** To explain theoretical concepts and provide contextual understanding.
- **Quantitative Analysis:** To evaluate relationships between variables using methods such as simple and multiple regression, two-way analysis of variance, and other statistical tools. This approach aims to meet the overall research objectives effectively.

The research relies on two primary types of data sources:

1. **Secondary Data:** Collected from published and unpublished materials, including reports and bulletins from the Ministry of Agriculture, Economic Affairs Sector, and the Central Agency for Public Mobilization and Statistics, as well as relevant academic studies and references.
2. **Primary Data:** Derived from fieldwork conducted in Qalyubia Governorate. Data was gathered through structured questionnaires administered to food processing factories and selected vegetable and fruit merchants in the area.

- **Field Study Sample** The field study sample was selected from Qalyubia Governorate. The Qaha Preserved Foods Factory, located in Toukh Center, was chosen as the primary subject due to its prominence as one of the most renowned and licensed factories in the governorate for conducting economic feasibility studies on the food processing of vegetable and fruit crops. Additionally, a field sample comprising merchants and sellers of vegetable and fruit crops was selected to estimate the surplus quantities available in the weekly local markets scattered across villages and cities.

- The selection process considered the relative importance of the number of villages within each center. Three centers in the governorate were chosen, and the sample size was determined at 150 individuals, distributed among these centers according to their relative importance, as illustrated in Table No. (1). Toukh Center ranked first, followed by Banha Center in second place, and Shibin Al-Qanater Center in third place. The distribution of sample items was proportional to the number of villages within each center, with Toukh Center comprising 59 units, Banha Center 48 units, and Shibin Al-Qanater Center 43 units.
- Data collection was conducted through personal interviews with merchants and vendors in markets across villages and cities. This approach facilitated the estimation of both the quantity and the value of the surplus agricultural products in these local markets.

Table No. (1) The relative importance of the number of villages and the distribution of sample items at the level of Qalyuobia Governorate centers in 2022/2023

Centers	Number of villages	%	Order	**Sample distribution**
Benha	41	20. 0 2	2	48
Kafr Shukr	22	4 8 .10	4	-
Toukh	50	24.64	1	59
Qaluob	18	8.87	6	-
The charitable bridges	17	8.37	7	-
Shibin El-Qanater	36	17.73	3	43
The Khanka	19	9.36	5	-
Total	203	100	-	150

Source: Qalyubia Governorate, Information and Decision Support Center, unpublished data.

III. Results and Discussions

First: The Current Status of Self-Sufficiency in Vegetables and Fruits in Egypt This section explores key variations in the nutritional balance of vegetables and fruits in Egypt during the period 2011–2022.

1. **Development of the Food Balance of Vegetable Crops**
    - **Production Trends of Vegetable Crops:** Data from Table No. (2) indicate that the average production of total vegetable crops in Egypt was approximately 12,827.92 thousand tons during the 2011–2022 period. Production reached a minimum of about 11,535 thousand tons in 2020 and a maximum of 14,460 thousand tons in 2012. Fluctuations in production occurred throughout the study period. From Equation No. (1) in Table No. (3), it was observed that vegetable production decreased by approximately 159 thousand tons annually, representing 1.23% of the overall average, a decline that is statistically significant.
    - **Availability for Consumption:** Table No. (2) illustrates that vegetable consumption in Egypt averaged 12,260.92 thousand tons, with a minimum of 10,588 thousand tons in 2020 and a peak of 14,087 thousand tons in 2012. Equation No. (2) in Table No. (3) shows a statistically significant decrease in vegetable consumption by 249 thousand tons annually, equivalent to 2.03% of the average over the study period.
    - **Self-Sufficiency Rates:** According to data from Table No. (2), the self-sufficiency rate for vegetables averaged 104.88%, with a low of 97.02% in 2014 and a high of 108.94% in 2020. Equation No. (3) in Table No. (3) shows an annual increase of 0.80% in the self-sufficiency rate, equivalent to 0.76% of the average during the study period.
    - **Surplus or Deficit Trends:** Table No. (2) highlights the surplus or deficit in vegetable crop production. A surplus was recorded in all years except 2014, with an average surplus of 567 thousand tons during the study period. The minimum surplus occurred in 2015 (142 thousand tons), while the maximum

was 1,093 thousand tons in 2023. From Equation No. (4) in Table No. (3), the surplus increased by an average of 89.67 thousand tons annually, a statistically significant growth accounting for 15.81% of the annual average during the study period.

2. **Development of the Nutritional Balance of Fruit Crops**
   - **Production Trends of Fruit Crops:** Table No. (3) indicates that the average production of fruit crops was 14,321.58 thousand tons during the 2011–2022 period. Production reached a minimum of 12,432 thousand tons in 2011 and a maximum of 16,688 thousand tons in 2022. Equation No. (5) in Table No. (3) demonstrates a statistically significant annual increase in fruit production by 309.52 thousand tons, representing 2.16% of the average production.
   - **Availability for Consumption:** The average availability of fruits for consumption was approximately 12,637.33 thousand tons, with a low of 10,663 thousand tons in 2011 and a high of 13,961 thousand tons in 2015, as shown in Table No. (2). From Equation No. (6) in Table No. (3), fruit consumption increased by 111.02 thousand tons annually, a statistically insignificant rise accounting for 0.87% of the overall average.
3. **Evolution of the Self-Sufficiency Rate** Based on the data in Table No. (3), the minimum self-sufficiency rate for fruit crops was recorded at approximately 93.30% in 2012, while the maximum reached 123.30% in 2021, with an overall average of 113.7% during the study period. An analysis of the general time trend using Equation No. (7) from Table No. (3) shows that the self-sufficiency rate increased by approximately 1.43% annually. However, this increase was statistically insignificant and accounted for around 1.26% of the general average. Additionally, the coefficient of determination indicates that about 45% of the changes in self-sufficiency can be attributed to group factors influenced by the time variable.
4. **Development of the Amount of Surplus or Deficit** According to Table No. (2), the average surplus of fruit crops during the study period amounted to approximately 1,684.25 thousand tons. The lowest surplus was observed in 2012, with about 823 thousand tons, while the highest surplus occurred in 2022, amounting to 2,870 thousand tons. Notably, a production surplus was recorded in all years except 2012. Analysis of the general trend using Equation No. (8) from Table No. (3) reveals a statistically significant annual increase in the surplus by approximately 198.5 thousand tons, representing about 11.78% of the general average. The coefficient of determination further indicates that about 56% of the change in the surplus is explained by the time variable during the study period.

Table No. (2): Production and Availability of Fruit and Vegetable Crops in Egypt (2010–2022)
(000 Tons)

Years	Total vegetables				Total fruit			
	Production	Available for consumption	Self- % sufficiency	Surplus Or Deficit	Production	Available for consumption	% sufficiency	Surplus Or Deficit
2011	13834	13681	101.11	153	12432	10663	116.59	1769
2012	14460	14087	102.64	373	13464	12287	93.30	(823-)
2013	13799	13144	104.98	655	12970	11539	112.40	1431
2014	13543	13958	97.02	(415-)	14480	13217	109.55	1263
2015	12366	12324	100.34	42	15102	13961	108.17	1141
2016	12345	11647	105.99	698	14887	13336	111.63	1551
2017	12015	11228	107.0	787	14647	12698	115.35	1949
2018	11821	11036	107.11	785	15026	12866	116.78	2160
2019	12223	11486	106.41	737	15010	13145	114.18	1865
2020	11535	10588	108.94	947	14443	12188	118.50	2255
2021	12389	11440	108.29	949	14710	11930	123.30	1780
2022	13605	12512	108.73	1093	16688	13818	120.77	2870
Average	12827.92	12260.92	104.88	567	14321.58	12637.33	113,379	1684.25
Standard deviation	916.76	1158.14	3.48	424.2	1334.12	922.55	7.38	917.85

Source: Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, *Food Balance Bulletin,* Miscellaneous Register.
Note: Numbers in parentheses indicate negative values.

- **Self-sufficiency:** Calculated as: (Production / Available for Consumption*100)
- **Surplus/Deficit:** Calculated as: (Production – Available for Consumption)

Table No. (3) Equations of the general time trends of key food balance indicators for vegetables and fruits in Egypt (2011–2022)

No	Dependent variable	general trend equation	Average	^{2}R	F	annual % change
1	Vegetable crop production	S^H =99.64+0.80 C H (-203)*	12827.9	0.35	5.62	1.23
2	Vegetable crop consumption	S^H =13879.48–249 C H (3.50-)*	12260.9	0.55	12.26	2.03
3	Self – sufficiency ratio (Vegetables)	S^H =99.64+0.80 C H (3.79)*	104.88	0.59	14.39	0.76
4	Surplus/Deficit (Vegetables)	S^H =–15.86+89.67 C H (3.36)*	567	0.53	11.32	15.81
5	Fruit crop production	S^H =12309.7+309 C H (4.33)**	14321	0.64	17.88	2.16
6	Fruit Crop Consumption	S^H =11915.7+ 111.02 C H (1.44)(ns)	12637	0.17	2.08	0.87
7	Self-Sufficiency Ratio (Fruits)	S^H =14.029+1.43 C H (2.87)*	113,379	0.45	8.25	1.26
8	Surplus/Deficit (fruits)	S^H =344+198.5 C H (3.55)*	1684.25	0.56	12.59	11.78

- S^H = Dependent variable.
- C H = Time factor (values ranging from 1 to 12).
- R^2 = Coefficient of determination, indicating the proportion of variation explained by the model.
- FF = Model significance:
- *Significant at the 0.05 level.
- ** Significant at the 0.01 level.
- **Source** : calculated from table (2)

Second: The Relative Importance of the Distribution of Food Manufacturing Units in Egypt and Qalyoubia Governorate (2021/2022) The data presented in Table (4) highlights the relative importance of marketing services in Qalyoubia Governorate compared to Lower Egypt and the entirety of the Republic in 2021/2022. Key observations include:

- **Sorting and Packing Stations:** Qalyoubia Governorate houses approximately 15 sorting and packing stations, representing 4.73% of the total 317 stations in the Republic and 7.2% of the 211 stations in Lower Egypt.
- **Refrigerators and Freezers:** The number of refrigerators and freezers in Qalyoubia amounts to about 128 units, accounting for 5.8% of the Republic's total (2,177 units) and 7.14% of those in Lower Egypt.
- **Food Manufacturing Factories:** The types and distribution of food manufacturing factories in Qalyoubia vary, as detailed below:
    - **Pickle Factories:** Qalyoubia has 14 pickle factories, representing 5.8% of the 239 factories nationwide and 7.14% of those in Lower Egypt.
    - **Vegetable Drying Factories:** The governorate has only one vegetable drying factory, accounting for 10% of the total 10 factories in the Republic and 50% of those in Lower Egypt.
    - **Beverage Factories:** There is one beverage factory in Qalyoubia, compared to 112 factories across Egypt, representing 9% of those in Lower Egypt.
    - **Jam Factories:** Qalyoubia is home to three jam factories, accounting for 8.5% of the 35 factories in the Republic and 10.34% of those in Lower Egypt.
    - **Juice Factories:** The governorate has three juice factories, representing 5.26% of the 57 factories nationwide and 6.25% of those in Lower Egypt.
    - **Tomato Sauce Manufacturing Factories:** There are three factories in Qalyoubia, contributing 3.41% of the 87 factories in Egypt and 20% of those in Lower Egypt.

- **Fruit Drying Factories:** Qalyoubia has one fruit drying factory, accounting for 2.22% of the 45 factories in the Republic and 4.76% of those in Lower Egypt.

From these findings, it is evident that the number of food manufacturing factories for fruit and vegetable products in Qalyoubia Governorate is relatively limited. With only one to three factories per category, the numbers are disproportionate to the governorate's production levels, consumption needs, job market potential, population density, and surplus of fruit and vegetable crop products.

Table No. (4) The relative importance of the distribution of marketing services units and food manufacturing factories in Egypt and Qalyoubia Governorate in 2021/2022

Statement		governorate	Republic	Lower Egypt	% governorate	
					The Republic	Lower Egypt
Services Marketing	Sorting and packing stations	15	317	211	4.73	7.2
	Refrigerators and freezers	128	2177	1791	5.87	7.14
	Total	143	2494	3001	-----	-----
Factories Manufacturing Food	Pickles	14	239	196	5.86	7.14
	drying vegetables	1	10	2	10	50
	Drinks	1	112	11	0.89	9.00
	Jams	3	35	29	8.57	10.34
	Juices	3	57	48	5.26	6.25
	tomato sauce	3	87	15	3.44	20.00
	Fruit drying	1	45	21	2.22	4.76
	Total	26	585	322	---	-----

Source: Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, General Administration of Food Security, Food Processing Bulletin, various years.

Third: The Relative Importance of the Actual Capacity of Food Processing Factories and Marketing Services in Egypt and Qalyubia Governorate Table No. (5) presents data on the actual capacity utilization of food processing factories and marketing services in Qalyubia Governorate, Lower Egypt, and the Republic during 2021/2022. The analysis reveals the following:

- **Sorting and Packing Stations:** The actual capacity in Qalyubia Governorate was approximately 240 thousand tons, representing 61.15% of the governorate's total capacity of 392.5 thousand tons. The percentage in Lower Egypt was 70.10% of the total capacity, while it was 68.47% nationwide.
- **Refrigeration and Freezing Facilities:** The actual utilization rate of refrigeration and freezing units in Qalyubia stood at 85.98% of total capacity, compared to 48.23% in Lower Egypt and 52.49% at the national level.
- **Pickle Factories:** The actual capacity utilization in Qalyubia was 57.57%, slightly higher than the 53.75% in Lower Egypt and 48.40% across the Republic.
- **Vegetable Drying Factories:** In Qalyubia, the actual capacity utilization reached 79.42%, compared to 86.40% in Lower Egypt and just 34.61% across the Republic.
- **Juice and Jam Factories:** The actual capacity utilization was 50.78% in Qalyubia, 57.23% in Lower Egypt, and 60.84% across the Republic.
- **Tomato Sauce Factories:** The utilization rate in Qalyubia was 58.87%, compared to 36.95% in Lower Egypt and 30.72% nationwide.
- **Fruit Drying Factories:** In Qalyubia, the actual capacity utilization was 51.71%, while it was 67.77% in Lower Egypt and 65.57% nationally.

From the data, it is evident that a significant proportion of the capacity in food processing factories and marketing services is underutilized, with idle capacity exceeding 50% in several facilities. Conversely, in some other facilities, the utilization rates fall below 50%, reflecting inconsistencies at the national, regional, and governorate levels.

Table No. (5) The relative importance of the actual capacity of food manufacturing factories in Egypt and Qalyoubia Governorate in the average year 2021/2022 Quantity in thousand tons

Statement	Sorting and packing stations			Refrigerators and freezers			Pickle factories			Vegetable drying plants			Juice and jam factories			tomato sauce factory			Fruit drying plant		
	Total energy	Actual energy	%	Total energy	Actual energy	%	Total energy	Actual energy	%	Total energy	Actual energy	%	Total energy	Actual energy	%	Total energy	Actual energy	%	Total energy	Actual energy	%
Qalyubia	392.5	240	61.15	264	227	85.98	3.3	1.9	57.57	0.350	0.278	79.42	8.25	4.19	50.78	2.378	1.40	58.87	0.350	0.181	51.71
Lower Egypt	1776	1245	70.10	4167	2010	48.23	40	21.5	53.75	0.500	0.432	86.4	619.6	354.6	57.23	51.57	19.06	36.95	0.984	0.667	67.77
Total Republic	2182	1494	68.47	4526	2376	52.49	53.3	25.8	48.40	57.2	19.8	34.61	912.8	555.4	60.84	71.6	22.00	30.72	39.8	26.1	65.57

Source: Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, General Administration of Food Security, Food Processing Bulletin, various years.

Fourth: Geographical Distribution of Marketing Services and Food Manufacturing Units in the Centers of Qalyubia Governorate (2022/2023) The geographical distribution of marketing services and food manufacturing factories across the centers of Qalyubia Governorate, as presented in Table No. (6), highlights the following observations:

- **Banha Center:**
  - **Sorting and Packing Stations:** 3 stations, representing 20% of the governorate's total.
  - **Refrigeration and Freezing Units:** 9 refrigerators and 1 freezer, accounting for 10.02% of the governorate's total.
  - **Food Manufacturing Factories:** Includes 1 jam factory, 1 tomato sauce factory, 1 juice production factory, and 4 pickle factories.
- **Kafr Shukr Center:**
  - **Sorting and Packing Stations:** 3 stations, representing 20% of the governorate's total.
  - **Refrigeration and Freezing Units:** 2 refrigerators and 2 freezers.
  - **Food Manufacturing Factories:** Limited to pickle factories.
- **Toukh Center:**
  - **Sorting and Packing Stations:** 6 stations, representing 40% of the governorate's total.
  - **Refrigeration and Freezing Units:** 16 refrigerators (25%) and 21 freezers (26.5%).
  - **Food Manufacturing Factories:** Includes 1 fruit drying factory, 2 jam production factories, 1 tomato sauce factory, 2 juice production factories, and 1 pickle factory.
- **Qalyoub Center:**
  - **Refrigeration and Freezing Units:** 7 refrigerators (10.9%) and 26 freezers (32.91%).
  - **Food Manufacturing Factories:** None.
- **Al-Qanater Al-Khayriya Center:**
  - **Sorting and Packing Stations:** 3 stations, accounting for 20% of the governorate's total.
  - **Refrigeration and Freezing Units:** 16 refrigerators (25%) and 6 freezers (7.59%).
  - **Food Manufacturing Factories:** Includes 1 vegetable drying factory, 1 fruit drying factory, 1 tomato sauce factory, and 6 pickle factories.
- **Shibin Al-Qanater Center:**
  - **Refrigeration and Freezing Units:** 3 refrigerators (4.68%) and 11 freezers (13.92%).
  - **Food Manufacturing Factories:** None.
- **Al-Khanka Center:**
  - **Refrigeration and Freezing Units:** 11 refrigerators and 5 freezers.
  - **Food Manufacturing Factories:** Limited to 2 pickle manufacturing units.

From the above, it is evident that marketing services and food processing units are primarily concentrated in Banha, Toukh, and Al-Qanater Al-Khayriya Centers. Other centers in the governorate exhibit significantly fewer facilities, reflecting an imbalance in the distribution of resources.

Table (6) The relative importance of marketing services and food manufacturing units in the center of Qalyoubia Governorate in 2022-2023

The Center	Sorting and feeding stations		Refrigerators		Freezers		Vegetable drying plants		Fruit drying plants		Jam production plants		tomato sauce factories		Juice production plants		Pickles	
	count	**%**	**count**	**%**	**count**	**%**	**count**	**%**	**count**	**%**	**count**	**%**	**count**	**%**	**count**	**%**	**count**	**%**
Benha	3	20	9	14.06	8	10.12	-				1	33	1	33.3	1	33.3	4	28.51
Kafr Shukr	3	20	2	3.12	2	2.53	-										1	7.14
Toukh	6	40	16	25	21	26.5	-		1	50	2	66	1	33.3	2	66.6	1	7.14
Qalyub	-	-	7	10.93	26	32.91	-											
The charitable bridges	3	20	16	25	6	7.59	1	100	1	50			1	33.3			6	42.85
Shibin El-Qanater	-	-	3	4.68	11	13.92	-											
The Khanka	-	-	11	17.18	5	6.32	-										2	14.28
Total Governorate	15	100	64	100	79	100	1	100	2	100	3		3	100	3	100	14	100

Source: Qalyoubia Agriculture Directorate, Food Security Department, unpublished data.

Fifth: Results of the Field Study Sample First: A Sample of Merchants and Sellers of Vegetables and Fruits in Local Markets Across Qalyubia Governorate Table No. (7) outlines the results of the field study conducted in various centers of Qalyubia Governorate, revealing the following findings:

1. **Personal and Economic Data of Respondents:**
   - The average age of respondents was approximately **56 years** in the Toukh Center, **62 years** in the Banha Center, and **48 years** in the Shebin Al-Qanater Center, with an overall average age of **55.3 years** for the total sample.
2. **Educational Status:**
   - The educational levels of the 150 respondents were distributed as follows:
     - **27 individuals** (18%) had higher education.
     - **47 individuals** (31%) had intermediate education.
     - **76 individuals** (50.66%) were illiterate.
3. **Professional Engagement:**
   - Among the respondents, the professional activity distribution was as follows:
     - **97 individuals** (64.66%) engaged in trade and sales on a daily basis.
     - **36 individuals** (24%) practiced the profession on a weekly basis in markets.
     - **17 individuals** (11.33%) worked seasonally.
4. **Classification of Merchants:**
   - Merchants involved in vegetable and fruit marketing in the governorate were categorized as:
     - **8%** wholesale merchants.
     - **0.66%** retail merchants.
     - **16.66%** farmers marketing their crops directly in local markets.
5. **Specialization:**
   - The specialization of merchants was distributed as follows:
     - **16 merchants** (10.66%) specialized in selling vegetables.
     - **16 merchants** (10.66%) specialized in selling fruits.
     - **118 merchants** (78.66%) dealt in both vegetables and fruits.
     -

Table No. (7) Personal and economic characteristics of fruit and vegetable merchants in the field study sample in Qalyoubia Governorate for the 2024season.

Statement			Toukh Center		Benha Center		Shebin El-Kom Center		Total sample	
			count	%	count	%	count	%	count	%
Personal and economi	Average age of the respondent		56	-	62		48		55.3	year
	Ed uc ati	High	14	23.72	7	14.58	6	13.95	27	18
		middle	17	28.81	18	37.5	12	27.90	47	31.33

		My mom	28	44.45	23	47.91	25	58.14	76	50.66
		Total	59	100	48	100	43	100	150	100
	Practicing the professio	daily	39	66.10	25	52.08	33	76.74	97	64.66
		weekly	15	25.42	13	27.08	8	18.60	36	24
		seasonal	4	8.47	10	20.83	2	4.65	17	11.33
		Total	59	100	48	100	43	100	150	100
	Merchant Rating	sentence	2	3.39	4	8.33	6	13.95	12	8
		fragmentation	38	64.40	38	79.66	30	69.76	106	70.66
		farms	19	32.20	6	12.70	7	16.28	25	16.66
		Total	59	100	48	100	43	100	150	100
	Specialization	Vegetable trader	6	10.17	60	12.50	4	9.30	16	10.66
		Fruit merchant	4	6.77	3	6.25	9	20.93	16	1.66
		Both together	49	83.05	39	81.25	30	69.76	118	78.66
		Total	59	100	48	100	43	100	150	100

Source: Collected and calculated from the field study sample in Qalyoubia Governorate seasons 2024.

Second: Surveying the Opinions of Merchant Respondents Regarding Their Behaviors and Actions Toward the Types of Vegetables and Fruits They Handle in Qalyubia Governorate

Table No. (8) summarizes the findings from the researchers' survey of merchants' opinions, highlighting the key challenges and behaviors they face in selling their products:

1. **Surplus Sales at the End of the Day:**
   - All respondents across the three surveyed centers (100%) confirmed they regularly face surplus quantities of unsold products at the end of each day. These unsold items are often offered for sale the next day, with risks of damage or spoilage depending on factors such as transportation, packaging, and temperature conditions.
2. **Methods of Disposing of Daily Surplus:**
   - Merchants adopt various methods to manage the surplus:
     - **4%** of the total sample use the surplus for family consumption.
     - **22%** store the surplus for extended periods.
     - **4.66%** process the surplus into food products for family use.
3. **Approval of Transferring Surplus to Food Manufacturing:**
   - The survey revealed unanimous agreement (100%) among respondents to transfer surplus to food manufacturing as a strategy to reduce losses and generate added value.
4. **Availability of Food Manufacturing Factories in the Sample Areas:**
   - Only **14.6%** of respondents acknowledged the presence of food manufacturing factories in Toukh and Banha centers, though their availability was limited.
   - A significant **85.3%** of respondents indicated either no awareness or no availability of such factories, particularly in villages and smaller centers such as Shibin Al-Qanater.
5. **Value of Losses from Surplus and Spoilage:**
   - About **74.66%** of respondents reported experiencing high levels of losses due to spoilage.
   - **23.33%** classified their losses as moderate, largely dependent on the type of crop being sold.
6. **Proposals for Managing Surplus via Food Manufacturing:**
   - Respondents provided several recommendations for improving surplus management, including:
     - **94.66%** suggested establishing refrigerators near markets to preserve fresh produce.
     - **72.66%** recommended creating collection centers for vegetables and fruits.
     - **80%** advocated for setting up small factories in each center with simplified licensing processes. These factories could process surplus into value-added products, creating economic opportunities and jobs for local youth.

Table No. (8) Results of a survey of the opinions of respondents from vegetable and fruit merchants and their behaviors regarding the goods dealt in in the sample of the field study in Qalyubia Governorate for the 2024season.

Statement		center Toukh		center Benha		Shebin Center alkanater		total The sample	
		count	%	count	%	count	%	count	%
Is there a surplus of sales at the end of the ?day	Yes	59	100	48	100	43	100	150	100
	no	-	-	-	-	-	-	-	-
	Total	59	100	48	100	43	100	150	100
How to get rid of excess	Next day sale	43	72.88	30	62.50	31	72.09	104	69.66
	Family consumption	2	3.38	1	2.08	3	6.97	6	4
	Storage	14	23.73	17	35.41	2	4.65	33	22
	Manufacturing	-	-	-	-	7	16.28	7	4.66
	Total	59	100	48	100	43	100	150	100
Do you agree to transfer the surplus to manufacturing	OK	59	100	48	100	43	100	15	100
	Disagree	-	-	-	-	-	-	-	-
	Total	59	100	48	100	43	100	15	100
Are there any food factories in the area	Yes	12	20.34	10	30.83			22	14.67
	no	47	79.66	38	79.16	43	100	128	85.30
	Total	59	100	48	100	43	100	150	1000
What is the value of losses from surplus and damage	High	42	71.18	40	83.33	30	69.76	112	74.66
	Medium	17	28.81	8	16.66	10	23.25	35	23.33
	Low	-	-	-	-	3		3	2
	Total	59	100	48	100	43	100	150	100
What are the proposals to transfer the surplus to manufacturing	Providing refrigerators	59	100	43	89.58	40	93.02	142	94.66
	Presence of a gathering center	59	100	10	20.83	40	93.02	109	72.66
	Factory work Small in every center	59	100	18	37.5	43	100	120	80
	Total	59	100	48	100	43	100	150	100

Source: Collected and calculated from the field study sample in Qalyubia Governorate in 2024.

Second: Surveying the Opinions of Merchant Respondents Regarding Their Behaviors and Actions Toward the Types of Vegetables and Fruits They Handle in Qalyubia Governorate

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Table No. (9) Estimating the quantity and value of the surplus susceptible to spoilage of the most important vegetable and fruit crops in the sample of the field study in Qalyubia Governorate for the 2024 season.

Crop type	Time surplus	center Toukh		center Benha		center Shibin El-Qanater		total	The sample
	per person	Quantity kg	Value in pounds	Quantity kg	Value in pounds	Quantity kg	Value in pounds	Quantity kg	Value in pounds
tomatoes	daily	5	62	4	50	6	68	15	180
	weekly	30	372	26	325	40	453.3	96	1150.30
	monthly	140	1736	120	1500	160	1812.8	420	5048.8
	Total sample	8260	102424	5760	72000	6880	77950	20900	252374
Guava	daily	3	30	4	48	4.50	45	11.50	123
	weekly	20	200	25	355	26	260	71	760
	monthly	85	850	100	1200	120	1200	305	3250
	Total sample	5015	50150	4800	57600	5160	51600	14975	159350
Strawberry	daily	6	90	8	120	5	80	19	290
	weekly	30	450	45	675	35	560	110	1685
	monthly	130	1950	180	2700	120	1920	430	6570
	Total sample	7670	115050	8640	129600	5160	82560	21470	327210
Mango	daily	10	200	6	120	7	125	23	445
	weekly	60	1200	40	800	45	803.57	145	2803.5
	monthly	250	5000	170	3400	160	2856	580	11256
	Total sample	14750	295000	8160	163200	6880	122808	29790	1681008
Orange	daily	15	225	10	120	8	80	33	425
	weekly	80	1200	70	840	50	500	200	2540
	monthly	350	5250	250	3000	220	2200	820	10450
	Total sample	20650	309750	12000	144000	12980	94600	45630	548355
Green beans	daily	5	100	6	120	7	105	18	325
	weekly	30	600	40	800	45	675	115	2075

	monthly	120	2400	160	3200	200	3000	480	8600
	Total sample	7080	161,600	7680	153600	8600	129000	23360	444200

- Quantity and value of the total sample = number of sample members in the center.
- quantity and value of the sample per month for each center

Source: Collected and calculated from the questionnaire form, based on the study sample in Qalyoubia Governorate.

Analysis of Variance of the Surplus of Study Crops Between Varieties and Centers in the Field Sample in Qalyubia Governorate

This section details the results of a two-way analysis of variance (ANOVA) conducted to assess the differences in surplus amounts across varieties within each center, as well as between centers for each type of vegetable and fruit crop in the field sample. The objective was to determine whether these differences were statistically significant and to understand the role of food processing in managing surplus crops. Food processing serves as a key solution for transforming perishable raw crops into high-value manufactured products with both nutritional and economic benefits.

Key Findings:

1. **Significant Differences Between Varieties:**
   - Table No. (10) revealed a statistically significant difference between crop varieties, as evidenced by the F-value being significant at the 0.05 level. This indicates variations in the surplus quantities among the different types of crops.
2. **Non-Significant Differences Between Centers:**
   - The analysis also showed that the differences in surplus amounts between the sample centers were not statistically significant.
3. **Duncan Test Results:**
   - A post-hoc Duncan test was conducted to further examine the differences between crop varieties and centers. After arranging the averages in ascending order, Table No. (11) confirmed that:
     - There is a **significant difference** between crop types.
     - There is **no significant difference** between the centers within Qalyubia Governorate.

These findings underscore the importance of prioritizing food processing initiatives to effectively manage surplus crops. By absorbing excess produce and transforming it into durable manufactured goods, food processing can address the disparities in surplus quantities while minimizing spoilage and losses.

Table No. (10) Results of analysis of variance for the daily surplus of study crops in the field sample in Qalyoubia Governorate

Source of variance	Sum of squaresof SS	degrees of freedom Df	variance estimate MS	F value	Morale level	TableF value
Between the varieties	93.40	5	18.68	4.65	0.05	2.62
Between centers	4.36	2	2.18	0.54	0.05	2.8
Error	40.14	10	4.013	-	-	-
Total	137.90	17	-	-	-	-

Source: Calculated from Table No. (9).

Table No. (11) Duncan's test for differences between the surplus of the study crops of vegetables and fruits between the varieties and centers in Qalyubia.

Statement	number	Differences	critical value
Between the varieties	6	7.46	6.8
Between centers	3	4	

Source: Calculated from Table No. (9).

Second: Qaha Factory for Preserved Foods in Qalyoubia Governorate:

- Technical and marketing characteristics of Qaha Factory: The type of factory specializes in manufacturing juices, jams and other canned food. It is located in the city of Qaha in the Toukh Center in Qalyoubia Governorate. It is 400 meters away from the Cairo-Alexandria Agricultural Road on Qaha Al-Qanater Al-Khayreya Road. It was established in 1940 AD and the production capacity of the factory is according to the needs of the market.

.- Source of purchasing raw materials: from farmers, marketing companies and markets -

- The methods used to purchase raw materials through bargaining and prior contracting, and - sells its products to the consumer, consumer complexes, and export. The factory operates throughout the year. The factory is located in this region due to the abundance of raw materials .needed for manufacturing, in addition to the ease of disposing of manufactured products

- The most important problems facing the factory: lack of capital and unavailability of trained .workersCompetitors for products, export problems, and high taxes and fees

- How to overcome these problems: Propaganda and advertising of products, training of - .workers, and creating sales outlets in new cities

- There is a desire from the factory workers to expand the manufacturing process because it is a profitable process. The preferred method of selling is retail sales.

Table No. (12): Technical and marketing characteristics of the Qaha Preserved Foods Factory and the most important problems it faces and how to overcome them (as a case study in Qalyoubia Governorate)

Statement		Repetition	Statement		Repetition
type Factory	specialized Non-specialist	1	Reasons for the factory's presence in the region	Abundance of raw materials Ease of product distribution	1 1
The place	Qaha city Toukh - Qalyubia Date of creation 1940	1	The most important problems facing the factory	1- Lack of trained workers 2- Having a competitorFor products 3- Export problems 4- Increase in taxes and fees	1 1 1 1
Energy Unproductive	month year	According to market needs	How to overcome these problems from the point of view of factory officials	1- Advertising and publicity 2- Establish a training unit for workers 3- Establishing factory branchesIn new areas	1 1 1
source buying Raw materials	farms Companies Markets	1 1 1	Do you recommend expanding the number of these ?factories	Yes ?Why no ,	1 profitable
Roads Follow - up In purchase	By bargaining By prior contract	1 -	Which is better for selling goods ?method	1- sentence 2- fragmentation	-- 1
Who do you ?sell to Products	For the consumer For the merchant For export	1 1 1	-	-	-
Factory working period	All year round	1	-	-	-

Source: Collected from the questionnaire form for Qaha Preserved Foods Company.

The Role of Food Manufacturing in Increasing Added Value and Revenue Achieved at the Qaha Factory for Preserved Foods (2023–2024) Table (13) highlights the economic

contributions of food manufacturing in terms of added value and profitability for various crops processed at the Qaha Factory. The findings are summarized as follows:

1. **Tomatoes:**
   - **Conversion Factor:** 7.5 tons of raw tomatoes yield 1 ton of raw pulp, which is further concentrated to produce 2 tons of tomato sauce.
   - **Added Value:** 41,600 pounds.
   - **Net Return:** 20,200 pounds.
   - **Profitability of the Invested Pound:** 0.94.
2. **Guava:**
   - **Conversion Factor:** 1.25 tons of guava yield 1 ton of raw pulp, which produces approximately 2.94 tons of diluted juice at a 17% concentration.
   - **Added Value:** 58,400 pounds.
   - **Net Return:** 20,235 pounds.
   - **Profitability of the Invested Pound:** 0.53.
3. **Strawberries:**
   - **Conversion Factor:** 1.2 tons of strawberries yield 1 ton of raw pulp, which is converted into 3.12 tons of jam.
   - **Added Value:** 117,600 pounds.
   - **Net Return:** 70,800 pounds.
   - **Profitability of the Invested Pound:** 1.54.
4. **Mango:**
   - **Conversion Factor:** 1.5 tons of mangoes yield 1 ton of raw pulp, resulting in 5 tons of diluted juice.
   - **Added Value:** 148,000 pounds.
   - **Net Return:** 83,000 pounds.
   - **Profitability of the Invested Pound:** 1.27.
5. **Oranges:**
   - **Conversion Factor:** 2.25 tons of oranges yield 1 ton of raw pulp, which is diluted into 3.27 tons of juice.
   - **Added Value:** 88,890 pounds.
   - **Net Return:** 45,072 pounds.
   - **Profitability of the Invested Pound:** 1.028.
6. **Green Beans:**
   - **Data Unavailable:** No data was provided for green beans in the Qaha Factory records.

Table No. (13): The most important indicators of productive and economic efficiency for manufacturing the most important fruit and vegetable products at the Qaha Factory for the 2023/2024 season.

Cost-benefit indicators	Unity	Tomatoes	Guava	strawberry	mango	Orange	Green beans
quantity inputs used	ton	7.5	1.25	1.2	1.5	2.25	---
Conversion factor	Raw lube per ton	1	1	1	1	1	---
Final product	JuiceSauce or or jam by the ton	2	2.94	3.12	5	3.27	---
Raw material value	Quantity * Price	=6000*7.5 45000	=5000*1.25 6250	=32000*1.2 38400	=8000*1.5 12000	=7000*2.250 15750	---
Final product value	Quantity * Price	=43300*2 86600	=2200*2.94 64705	=50000*3.12 156000	=32000*5 160000	*3.27 104640 =	---
added value	Value of final product – Value of raw material	41600	58455	117600	148000	88890	---
Manufacturing	Quantity of	=6500*2	=7000*2.94	=7000*3.12	=7000*5	=7000*3.27	---

costs	final product * Manufacturing costs per ton	13000	20580	21840	35000	22890	
Packaging costs	Quantity of final product t/ton*	=4200*2 8400	=6000*2.94 17640	=8000*3.12 24960	=6000*5 30000	=6400*3.27 20928	---
Total costs	T manufacturing T packaging +	21400	38220	45800	65000	43818	---
net return	Added value - total costs	20200	20235	70800	83000	45072	---
Profitability of the invested pound	/ Net return Total costs	0.94	0.53	1.54	1.27	1.028	---

Source: Collected and calculated from the questionnaire form of Qaha Preserved Foods Company.

Estimating the Added Value and Net Return from Surplus in Markets for Vegetables and Fruits (Field Study Sample)

This study calculated the added value and net return from surplus crops using data from Qaha Company as a reference for converting market surplus into manufactured products, based on conversion factors as follows:

Surplus Quantities and Economic Value:

1. **Tomatoes:**
   - Surplus: 20.9 tons.
   - **Added Value:** 115,925 pounds.
   - **Net Return:** 56,290 pounds.
2. **Guava:**
   - Surplus: 14,975 tons.
   - **Added Value:** 700,290 pounds.
   - **Net Return:** 242,415 pounds.
3. **Strawberries:**
   - Surplus: 17.8 tons.
   - **Added Value:** 2,104,059 pounds.
   - **Net Return:** 1,055,509 pounds.
4. **Mango:**
   - Surplus: 29.7 tons.
   - **Added Value:** 2,939,280 pounds.
   - **Net Return:** 1,648,380 pounds.
5. **Oranges:**
   - Surplus: 45.6 tons.
   - **Added Value:** 1,802,689 pounds.
   - **Net Return:** 914,060 pounds.

Impact:

The conversion of market surplus into manufactured goods leads to:

- **Increased GDP and agricultural income.**
- **Surplus for export** to improve the trade balance.
- **Creation of jobs** for young graduates.
- **Optimal use of agricultural resources.**

IV. CONCLUSIONS

The study identified the issue of daily surplus in local markets for vegetable and fruit crops. This surplus, due to a lack of demand driven by high prices and low purchasing power, results in significant waste and financial losses for farmers, merchants, and the state. The absence of effective marketing channels to redirect surplus into food manufacturing further exacerbates the problem.

Key Findings:

1. **Surplus Levels:**
   - Average vegetable crop surplus: 567 thousand tons per year (except in 2014).
   - Average fruit surplus: 1,684.25 thousand tons per year (except in 2012).

2. **Limited Food Processing Facilities:**
    - Insufficient processing facilities in Qalyubia Governorate are not proportional to production and consumption needs.
    - Idle capacity in factories: 50%.
3. **Profitability in Food Manufacturing:**
    - **Profitability per invested pound:**
        - Tomato sauce: 0.94
        - Guava: 0.53
        - Strawberries: 1.54
        - Mango: 1.27
        - Oranges: 1.03

Economic Added Value (Market Surplus Conversion):

- Tomatoes: Added Value = **115.9 thousand pounds**, Net Return = **56.3 thousand pounds**.
- Guava: Added Value = **700.3 thousand pounds**, Net Return = **242.4 thousand pounds**.
- Strawberries: Added Value = **2,104.01 thousand pounds**, Net Return = **1,055.5 thousand pounds**.
- Mango: Added Value = **2,939.3 thousand pounds**, Net Return = **1,648.4 thousand pounds**.
- Oranges: Added Value = **1,802.7 thousand pounds**, Net Return = **914.0 thousand pounds**.

Recommendations:

1. **Establish Surplus Collection Centers:** Create centers to collect surplus vegetables and fruits from markets.
2. **Train Graduates:** Train young graduates in food processing under the *Decent Life Initiative,* focusing on rural villages and cities, especially for agricultural graduates.
3. **Support Manufacturing Projects:** Activate the Agricultural Professions Syndicate initiative in collaboration with the Agricultural Bank to finance food manufacturing projects and generate employment.
4. **Provide Technical Resources:** Develop technical brochures in cooperation with the Food Safety Authority and Food Technology Research Institute to support young graduates.
5. **Simplify Licensing and Export:** Facilitate local licensing processes and remove barriers to exporting manufactured food products.
6. **Empower Rural Women:** Encourage and support home-based food manufacturing by rural women to contribute to household income.

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