

## The performance analysis of the industrial tomato sector in Algeria: On the consequences of unfair prices

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### ABSTRACT

The aim of this study is to examine the structure of Algeria's industrial tomato sector, drawing lessons and highlighting the associated challenges. The study relies on comprehensive data, encompassing a substantial number of observations (up to 9 127) from the production and processing segments of the supply chain. The main findings reveal significant concentration within the processing segment (with a concentration index of 0.87 in 2021), indicating an oligopolistic market structure with limited competitive dynamics. Furthermore, the production segment displays a concerning trend of disengagement among producers, with a significant decline in their participation in the contracting process in recent years. The study also highlights weak contractual performance in the vertical relationship between the two segments, primarily due to unfair pricing practices. These findings collectively indicate an alarming situation for the entire sector. Consequently, this study provides some implications for public policy, suggesting the need for updated measures to address the current challenges.

**Keywords:** *Sector analysis; vertical relationship; contract farming; industrial tomato; Algeria.*

## 1 Introduction

Tomato production in its various forms has tripled worldwide in the last three decades. This means an increasing demand for this product (in fresh or processed form) by a rapidly growing world population (Costa and Heuvelink, 2018). On the other hand, the global average consumption of tomato<sup>1</sup> has increased from 9.1 in 1965 to 24 kg/capita/year in 2021. The processed tomato also has a key role in this global dynamic. The Mediterranean region is no exception, as the main producing countries for processed tomatoes are, in descending order: Turkey, Egypt, Italy, Spain, Algeria, Morocco, and Tunisia.<sup>2</sup> However, in terms of yields, a different “descending” ranking emerges as follows: Palestinian Territories, France, Morocco, Spain, Turkey, Algeria and Italy.

The peculiarity of the tomato processed into concentrates in the countries of the southwestern Mediterranean (Maghreb countries) lies in the fact that it is ubiquitous in the diet and daily hot meals of a typical Maghrebi consumer. The consumption pattern in these three countries shows a strong component of red soups but is influenced by the attributes of traditional dietary recipes rooted in local customs. Algeria, in particular, is considered as a country with a vocation for the production of tomatoes (fresh and industrial). In 1965 (after independence), the area under cultivation was 6,940 hectares and increased to 25,755 hectares by 2021 (i.e., a fourfold increase). On the other hand, the average individual consumption has increased from 7 kg/inhabitant/year in 1965 to 37.4 kg/inhabitant/year<sup>3</sup>, with a clear upward trend. This underlines the importance of this product in the bundle of food items of an Algerian consumer (Baci, 1995; Bouzid and Bedrani, 2013).

The processed tomato sector in Algeria has undergone several restructurings driven by public policy. These restructurings followed an interventionist and centralized approach for nearly 30 years after independence, which ultimately proved unsuccessful. However, with the arrival of the new millennium, there was a significant shift in perspective and political orientation towards an open market, resulting in a revitalization of the sector and a complete overhaul of its structure. In 2010, a public entity was established to organize the coordination of industrial tomato production and supply, marking a critical moment for the sector.

The National Inter-professional Office for Vegetables and Meats (ONILEV)<sup>4</sup> was primarily established to facilitate vertical coordination between tomato-producing farmers and tomato-processing canneries, serving as the key intermediary between these two actors. This coordination is achieved through established regulatory mechanisms that aim to insert the actors into the contract farming. This practice has had great success, as evidenced by various sources (Benmehaia et al., 2017; Benmehaia and Brabez, 2018; Assassi et al., 2020; Assassi and Souillier, 2023), as it has enabled the realization of the advantages associated with contract farming and has contributed to meeting the government's food security objectives.

However, recent indicators have emerged indicating potential signs of a collapse, leading experts in the field (Branthôme, 2023) to speculate the possibility of a forced return to importing tomato paste into Algeria. This raises questions about the current state of the industrial processed tomato sector. How well does the public regulatory mechanism handle the supply relationships? What challenges do the stakeholders face? This study aims to address these inquiries and provide answers in this field of investigation.

This study aims to analyze the overall structure of Algeria's industrial processed tomato sector and gain insights into the lessons learned and challenges faced. The study utilizes extensive data on the two main components of the sector, namely production and processing segments. Two types of data sources have been employed: comprehensive field dataset over four consecutive years (2019-2021) involving the two players in both segments and aggregated data from statistics and reports provided by the public office for previous years.

The paper is organized as follows: Section 2 provides the conceptual framework of the study outlining the organization of the sector. Section 3 provides an overview of the methodology employed, outlining the data utilized. Section 4 explores the findings and their discussion. Finally, Section 5 presents the concluding remarks of the study.

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<sup>1</sup> These figures are based on the FAO Statistics in 2023. See Colvine and Branthôme (2016) and Costa and Heuvelink (2018) for more details on the global supply chains of tomato.

<sup>2</sup> These rankings are obtained from The Atlas Big website: <https://www.atlasbig.com/en-us/>

<sup>3</sup> These figures are based on the FAO Statistics reports in 2023.

<sup>4</sup> Abbreviation for *Office National Interprofessionnel des Légumes et Viandes*.

## 2 Governance, Performance Analysis, and Tomato Value Chain: Conceptual Framework

### 2.1 Exploring Food Value Chain Governance

Agricultural value chains are complex systems that encompass the entire process of bringing agricultural products from the farm to the consumer. These chains involve various interconnected activities, including production, processing, distribution, and marketing, each performed by different actors along the chain. Analyzing these value chains is essential for understanding the dynamics that shape agricultural markets, influencing the livelihoods of millions of people worldwide.

Value chain governance can be defined as the execution of a policy framework or informal agreements involving stakeholders, local associations, interest groups, and private entities in decision-making processes aimed at achieving common objectives, such as the provision of public goods and services or project completion (Kooiman, 1999). Essentially, it revolves around power dynamics, relationships, and accountability: determining who holds influence, who makes decisions, and how decision-makers are held answerable. The term "governance" emphasizes the participation of representatives from public, private, voluntary, and community sectors in the policy decision-making process (Rhodes, 1997). It is evident, therefore, that governance encompasses the interplay among structures, processes, and traditions shaping power dynamics and providing avenues for citizen or stakeholder input in decision-making processes.

In the vast body of literature dedicated to agricultural value chains, scholars have explored different methodologies and frameworks for comprehensively analyzing value chain governance. One prevalent approach involves a systematic examination of the various stages of the value chain, from production inputs to final consumption, with a focus on identifying key actors, understanding their roles and relationships, and assessing the flow of goods and services between them.

Performance analysis is a critical aspect of value chain analysis, involving the assessment of key performance indicators such as production costs, market prices, profit margins, and value-added along the chain. Understanding these metrics helps to identify inefficiencies, bottlenecks, and opportunities for improvement within the value chain. Moreover, governance structure analysis is necessary for knowledge upgrading to enhance productivity, quality, and competitiveness throughout the chain.

Governance structures within agricultural value chains play a pivotal role in shaping market dynamics, influencing power relations, and determining the distribution of benefits among chain actors (Williamson 1979; Samoggia *et al.*, 2022). Governance analysis involves examining the rules, norms, and institutions that govern interactions and transactions within the chain, as well as the mechanisms for decision-making, dispute resolution, and resource allocation. By understanding governance dynamics, stakeholders can identify opportunities to strengthen coordination, collaboration, and collective action within value chains. Empirical studies and case analyses provide valuable insights into the functioning of agricultural value chains in diverse contexts and regions worldwide (Sharma, 2023; Koirala, 2022; Rahman, 2022; Samoggia *et al.*, 2022; Wosene, 2022; Amao *et al.*, 2022; Mantino, 2018). These studies shed light on the challenges faced by different actors within the chain, such as smallholder farmers, processors, traders, and retailers, as well as the opportunities for value creation, market access, and inclusive growth.

In addition to understanding internal value chain dynamics, it is essential to consider external factors that influence agricultural markets, including government policies, trade regulations, market infrastructure, consumer preferences, and environmental sustainability concerns (Samoggia *et al.*, 2022). External factors can significantly affect the competitiveness, resilience, and sustainability of agricultural value chains, necessitating a holistic approach to analysis and intervention. Efforts to improve the performance and inclusivity of agricultural value chains often involve interventions aimed at strengthening governance structures, promoting collaboration among stakeholders, and enhancing market access for smallholder farmers (Hooks, 2017; IDH, 2017). These interventions may include capacity-building programs, infrastructure development initiatives, and policy reforms aimed at creating a more enabling environment for value chain development.

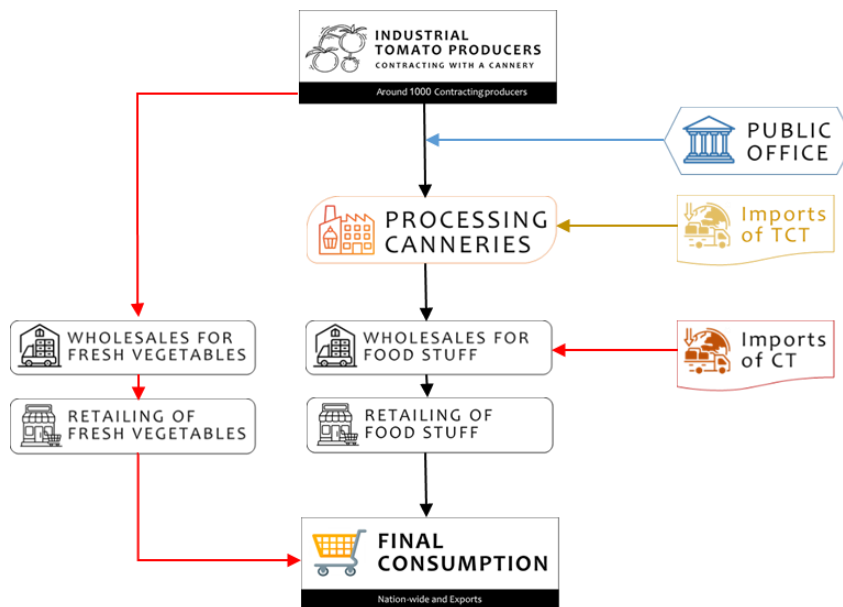
Overall, agricultural value chain governance analysis serves as a valuable tool for diagnosing challenges, identifying opportunities, and designing targeted interventions to enhance the efficiency, equity, and sustainability of agricultural markets and livelihoods. Through collaborative efforts and evidence-based decision-making, researchers contribute to understanding how to build more resilient, inclusive, and prosperous agricultural value chains that benefit producers, consumers, and society as a whole.

The above framework sets the basis for the current study analysis on the governance structure of Algeria's industrial tomato sector value chain, so to draw lessons and highlight the associated challenges.

## 2.2 The Industrial Tomato Chain Governance in Algeria

The *filière* approach serves as the fundamental framework for this study, aiming to investigate the structure and dynamics of the agri-food supply chain. It provides a systematic perspective on a network of interconnected actors and activities. In the context of this study, the analysis will focus on identifying the key actors and mapping the physical flows within the supply chain. This analysis will enable us to draw essential conclusions about the structure and functioning of Algeria's industrial tomato sector. Additionally, two other concepts will be instrumental in our analysis. First, contract farming,<sup>5</sup> which involves arrangements between farmers and buyers for the production and supply of agricultural products. Second, hybrid forms of economic organization,<sup>6</sup> which encompass alternative models that combine elements of both market-based and hierarchical structures. These concepts will contribute to our understanding of the industrial tomato sector in Algeria.

The industrial tomato sector in Algeria has undergone significant transformations in its market structure since its independence (1962). One pivotal change occurred in 2010 with the establishment of the National Interprofessional Office for Vegetables and Meat (ONILEV). As a regulatory body, ONILEV's primary role is to coordinate the industrial tomato market. In addition to its regulatory responsibilities for other sectors related to vegetables and meat, it plays a crucial role in coordinating the vertical relationships between industrial tomato producers and tomato processing plants, specifically canneries, across the country. Figure 1 depicts the current organizational diagram of this sector, highlighting the different actors involved in the product delivery segments under examination. As depicted in the flow chart, tomato producers are obligated to deliver the contracted quantity of tomatoes through a channel regulated by the regulatory public office to tomato processing canneries. These canneries, in case of insufficient supply, may resort to importing triple concentrate tomato (TCT). Subsequently, the processed tomato (paste) quantities are distributed through commercial channels for consumption as canned tomato products. However, the importation of concentrated tomato (CT) serves as an alternative, although it is not significant due to its high cost. Additionally, tomato producers retain the flexibility to sell their tomato crops through various marketing channels (depicted by red flows), ultimately reaching final consumers via local markets for fresh vegetables.



**Figure 1.** Diagram of the industrial tomato sector organization in Algeria (2010-2023)

The regulation was implemented through public regulatory mechanisms with the objective of facilitating coordination between the parties involved in production and supply activities within the constraints of market conditions. These mechanisms aimed to create an environment where both parties could effectively collaborate and subsequently receive a premium as an incentive upon successful delivery.

It became evident that the existing early mechanism (2010-2013), in its initial form, proved insufficient in addressing the production shortages experienced by the canneries. As a result, in 2013, a new organizational approach was

<sup>5</sup> See for example Meemken and Bellemare (2020), Bijman (2008), Minot (2018), Otsuka *et al.* (2016), and Bijman *et al.* (2020) for a review of contract farming literature.

<sup>6</sup> For more details on the concept of hybrid forms in the food sector, see for example: Ménard (2018, 2022) and Meirelles de Souza Filho and Varela Miranda (2019).

introduced under the responsibility of the public office in charge. This involved the establishment of formal production contracts between the two key actors involved. This practice provided a more incentivized structure, aimed at revitalizing the dynamism of Algerian industrial tomato supply. The implementation of these production contracts has yielded several benefits, including income stabilization, improved management of downstream processed tomato products, and enhanced food security and sustainability<sup>7</sup> for the country. This development highlighted the limitations of two extreme forms of economic organization, namely centralized administration and *laissez-faire* market approaches, in effectively managing the complexities of the industrial tomato supply chain. Instead, hybrid forms of vertical coordination could potentially be the most effective solution in ensuring successful operations within the sector.

### 3 Research Methodology

This study exploits a comprehensive database covering the entire industrial tomato sector in Algeria. This dataset includes data collected from the research team's field surveys conducted across the national territory, focusing specifically on areas involved in industrial tomato cultivation. The investigation encompassed the relationships between tomato producers and tomato processing canneries, which were subjects of interest. These surveys were conducted over four consecutive campaigns from 2018 to 2021 under the administration of the public office. For each campaign, information includes the actors' expectations regarding the contractual clauses established and administered by the public office (collected directly in March-April). Subsequently, a second phase of data collection (July-August) obtained information on the actual outcomes and achievements of the two parties involved in the contracting process.

The database enabled us to gain a comprehensive understanding of the dynamics and effectiveness of the contractual relationships within the industrial tomato sector. In 2018, the sector included 3 713 contracting tomato growers and 16 tomato canneries, while in 2021 there are only 920 contracting growers and 15 co-contracting canneries. In total, 9 127 contracting tomato growers and 18 tomato canneries<sup>8</sup> over 4 successive years. In addition, for previous campaigns, aggregated data was collected from previous reports by the public office in charge. These are the 2013 and 2017 campaigns about the total number of contracting tomato growers.

The variables of interest for analysis are the specific elements included in the contracts between producers and canneries. These contracts focus on areas and quantities that are subject to clauses. The database contains the following variables: area contracted, production contracted, area cropped, and production delivered. Each of these variables is crucial for our investigation. It is important to note that the cross-sectional unit of the study is the contracting farmer.

## 4 Results and Discussion

### 4.1 General overview of the structure of the sector

By analyzing the essential aggregates of Algeria's industrial tomato sector, the research study can observe the structural dynamics primarily in terms of the number of key actors involved, namely farmers and canneries, and the characterization of production through areas and quantities produced. Table 1 presents the evolution of these structural aggregates within the sector. A discernible trend reveals a clear regression across all aggregates.

**Table 1.**  
Evolution of the main structural aggregates of the industrial tomato sector in Algeria

<b>Structural aggregates</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>
<b>Number of contracting growers</b>	3.713	2.627	1.867	920
<b>Number of contracting canneries</b>	20	16	16	15
<b>Total areas contracted (ha)</b>	19.409	14.118	12.030	7.462
<b>Total produced quantities (1000 tons)</b>	642	499	538	351

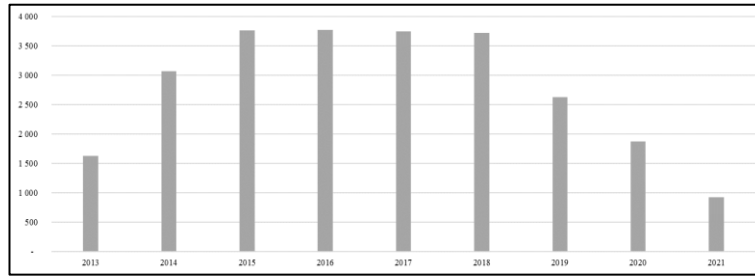
The number of industrial tomato growers directly reflects the rate of farmers' participation in the contracting process, as depicted in Figure 2, which provides an overview of this participation rate since 2013. The total number of participants increased significantly after the implementation of the mechanism, reaching a peak of 3 760 in 2015. However, according to the findings in Table 1, it is obvious that the total number of participants has been consistently and rapidly decreasing, with only 920 participants remaining in 2021.

A similar pattern is observed for the number of canneries participating in the contracting process. Initially, there were only a few canneries (5 to 6) before the implementation of the system, but this number surged to a maximum of 20

<sup>7</sup> See Bouzid and Padilla (2014) and Baba et al. (2022) for the case of sustainability in the Algerian tomato sector.

<sup>8</sup> There has been a slight fluctuation in the number of canneries operating in the market, with some entering the market while others have exited.

between 2015 and 2018. Subsequently, certain canneries gradually exited the market, while a few others entered, resulting in a total of 15 canneries involved in the contracting process by 2021. These trends indicate significant changes in the structure and participation levels within the industrial tomato sector over time.



**Figure 2.** Dynamics of participation of tomato growers in production contract 2013-2021

On the other hand, it is clear that production is following a similar trend. The contracted areas, which reflect the industrial tomato's production potential, have experienced a significant decline since reaching their peak in 2018, now standing at only 7 462 hectares in 2021. Similarly, the quantity produced has decreased from over 600 thousand tons in 2018 (and in previous years) to approximately 350 thousand tons in 2021. These figures indicate a notable decrease in production levels over the years, highlighting the challenges faced by the industrial tomato sector in Algeria.

To gain a deeper understanding, an examination of the spatial distribution of certain structural aggregates becomes necessary for our analysis. The available data enables us to observe the distribution of the number of industrial tomato producers across different regions and study its dynamics (see Table 2). Among the regions with a vocation for industrial tomato cultivation and a strong participation in production contracts, four stand out: Skikda, Guelma, Annaba, and El Tarf. These neighboring regions, located in the northeast corner of the country, represent the pole of industrial tomato production in Algeria.

**Table 2.**  
Evolution of the number of contracting tomato growers by region

Regions	2018	%	2019	%	2020	%	2021	%
<b>Skikda</b>	1.717	46,24	1.122	42,71	541	28,98	179	19,46
<b>Guelma</b>	676	18,21	565	21,51	518	27,75	80	8,70
<b>El Taref</b>	601	16,19	561	21,36	539	28,87	518	56,30
<b>Annaba</b>	498	13,41	304	11,57	262	14,03	131	14,24
<b>Others</b>	221	5,94	75	2,85	7	0,37	12	1,30
<b>Total</b>	3.713	100	2.627	100	1.867	100	920	100

According to the results, this cluster of regions dominates over others, which exhibit relatively insignificant participation rates (declining from 5% in 2018 to 1% in 2021). Tracking the dynamics over time, it is noteworthy that Skikda, traditionally known for its excellence in this domain (with 46% participation in 2018, and even for an extended period before that), has been overtaken by El Tarf in 2021, boasting a participation rate of 56% among its contracting growers. This emphasizes the intense interregional competition and dynamism within the sector.

Canneries, on the other hand, are experiencing parallel dynamics. Over the course of four successive years, the research study observes both entries and exits of processing firms in this sector. Some canneries cease activity definitively, the case of 7 canneries, while others enter the activity, constituting 5 new canneries. Additionally, certain canneries temporarily suspend their activity, which applies to 3 canneries. The overall stability in this market is quite low, with only 10 permanent companies. Consequently, the tomato processing segment exhibits considerable instability, with more than half of the canneries hesitating to settle permanently. Regarding the areas dedicated to industrial tomato production in the main production regions (as shown in Table 3), there are clear trends. Skikda and Annaba have experienced significant regression in cultivated areas, while the neighboring regions, Guelma and El Tarf, have shown an increase.

**Table 3.**

Evolution of areas dedicated to industrial tomato production by region

Regions	2018	%	2019	%	2020	%	2021	%
Skikda	8.437,3	43,5	5.192,4	36,8	2.654,0	22,0	1.208,0	16,2
Guelma	3.922,9	20,2	3.458,5	24,5	3.423,9	28,5	608,4	08,2
El Taref	3.223,9	16,6	3.426,1	24,3	4.522,3	37,6	4.882,7	65,4
Annaba	2.558,7	13,2	1.591,1	11,3	1.295,9	10,8	598,0	08,0
Others	1.266,3	6,5	449,8	3,2	134,0	1,4	165,0	2,2

Regarding the spatial distribution of industrial tomato production, Table 4 presents the details of the evolution of the quantities produced and received for the main regions. It becomes evident that the regions situated in the industrial tomato pole hold a substantial share in both production and reception capacity. Specifically, the neighboring regions of Skikda and Annaba are experiencing a clear downward trend in both product flows, reflecting a decline in both production and reception capacity. On the other hand, Guelma and El Tarf show notable net growth in both flows, indicating an increase in both production and reception capacity within these regions. This highlights the dynamic changes in the spatial distribution of industrial tomato production across different regions and the interregional competition in the production and reception of industrial tomatoes by neighboring competing firms.

**Table 4.**

Evolution of industrial tomato quantities produced and received by region

Regions	2018		2019		2020		2021	
	Prod.	Recep.	Prod.	Recep.	Prod.	Recep.	Prod.	Recep.
Skikda	241,9	36,7	171,1	30,3	69,82	26,7	55,0	39,2
Guelma	180,0	250,4	153,2	233,6	229,7	269,8	312,5	74,2
El Taref	108,3	94,5	114,2	111,8	186,2	186,2	127,6	119,9
Annaba	65,9	75,1	57,8	35,2	48,1	64,7	17,0	70,1
Others	45,4	185,6	22,8	88,2	4,4	40,2	4,9	48,1

However, this distribution is directly linked to the dynamics of the participation rate of farmers and the cultivated area, both of which are experiencing a clear decline in the regions under consideration. The decreasing participation rate of farmers and the decline in cultivated areas in these regions have a direct impact on the distribution of industrial tomato production and reception capacities among the neighboring competitors.

#### 4.2 Analysis of actors' behavior

After conducting a comprehensive examination of the overall structure of the industrial tomato sector in Algeria, the research study now shifts the focus to investigate the physical and relational flows between the two key actors involved and their performance in terms of contractual commitment. The data available allows us to explore the distribution of industrial tomato producers across different canneries. Table 5 illustrates this distribution for the six canneries with the largest number of producers supplying their processing units.

**Table 5.**

Distribution of contracting tomato growers by canneries

Canneries	2018	2019	2020	2021
CAB	990	907	632	119
Aurès	336	280	153	46
Nouvelle ère	246	191	159	57
El Bousten	160	137	152	100
Izdihar	195	155	152	45
CARA	202	19	128	158
<b>S/Total</b>	<b>2129</b>	<b>1689</b>	<b>1376</b>	<b>525</b>
Others	1584	938	491	395
<b>Total</b>	<b>3713</b>	<b>2627</b>	<b>1867</b>	<b>920</b>

Notably, throughout the years, these six canneries consistently dominate the market, generally accounting for more than half of the total producers. Among them, the CAB cannery stands out as the market leader on the national territory, consistently holding a significantly higher number of producers compared to the others. However, examining the dynamics sheds light on the competitive aspect, as each cannery experiences regressions in their number of contracted

producers over time. This reflects the changing landscape of the industrial tomato sector and the competitive nature among the leading canneries.

The downward trend in the number of contracting growers poses a challenge for all canneries engaged in contracts, even with low tomato supplies (caused by the import of TCT<sup>9</sup>). Notably, the CAB, which previously handled more than 1 000 contracts annually in previous campaigns, barely reached 119 contracts in 2021.

A similar pattern emerges in terms of the production delivered to each cannery. Table 6 presents the results of the distribution of contracted and actually delivered industrial tomato productions for the six canneries that received the major shares. The CAB consistently remains in the first position, significantly surpassing the combined sum of the following five canneries, except for the last year, 2021. The supply provided by these top six canneries far exceeds the quantity collected by all other canneries combined in this market. This points to a high degree of concentration in the sector. Despite the evident decline in production received, the sector continues to endure persistent concentration.

**Table 6.**  
 Repartition of industrial tomato production delivered by cannery (in 1000 tons)

Canneries	2018	%	2019	%	2020	%	2021	%
<b>CAB</b>	217,65	<b>33,9</b>	203,64	<b>40,8</b>	310,76	<b>57,2</b>	44,36	<b>12,6</b>
<b>Nouvelle ère</b>	56,31	<b>8,8</b>	39,90	<b>8,0</b>	36,42	<b>7,8</b>	37,11	<b>10,6</b>
<b>CARA</b>	15,49	<b>2,4</b>	3,19	<b>0,6</b>	24,80	<b>5,1</b>	36,11	<b>10,3</b>
<b>Abidi</b>	15,29	<b>2,4</b>	13,32	<b>2,7</b>	1,81	<b>0,4</b>	25,43	<b>7,2</b>
<b>SICS</b>	29,94	<b>4,7</b>	21,80	<b>4,4</b>	5,91	<b>1,3</b>	24,00	<b>6,8</b>
<b>El Bousten</b>	20,30	<b>3,2</b>	19,91	<b>4,0</b>	22,55	<b>4,8</b>	21,43	<b>6,1</b>
<b>S/Total</b>	354,98	<b>55,3</b>	301,77	<b>60,5</b>	413,99	<b>76,5</b>	188,42	<b>53,6</b>
<b>Others</b>	287,38	<b>44,7</b>	197,28	<b>39,5</b>	124,23	<b>23,5</b>	163,05	<b>46,4</b>

At the level of contractual relations maintained through formal production contracts, it is crucial to analyze the performances achieved through this practice and its dynamics. An aggregated and cumulative perspective is particularly useful for gaining an overview. Table 7 presents the distribution of contract performance for the six major canneries in terms of the cumulative number of contracts (second column). The third column indicates the number of tomato growers with a complete contractual default (or those who are completely disengaged), and the next column shows those who have partially fulfilled their contracts (delivering 1 to 70% of the contracted quantity<sup>10</sup>), while the last column represents those who have fully honored their contractual commitments.

**Table 7.**  
 Repartition of contract performances by canneries in terms of the cumulative number of contracts for the Top 6

Canneries	Cumulative number of contracts	complete contractual default (for 0%)	Partial contracts fulfillment (1 to 70%)	Complete contractual commitment (70 to 100%)
<b>CAB</b>	2 648	170 (06.4%)	1 657 (62.6%)	821 (31.0%)
<b>Nouvelle ère</b>	653	13 (02.0%)	269 (41.2%)	371 (56.8%)
<b>CARA</b>	507	172 (33.9%)	274 (54.0%)	61 (12.0%)
<b>Abidi</b>	198	15 (07.6%)	98 (49.5%)	85 (42.9%)
<b>SICS</b>	192	39 (20.3%)	40 (20.8%)	113 (58.9%)
<b>El Bousten</b>	494	226 (45.7%)	93 (18.8%)	175 (35.4%)

Over four successive years, the CAB holds the largest share in terms of the number of contracts (2 648 contracts), far surpassing the combined total of contracts for the other five major canneries each year. Notably, the first two large canneries (CAB and Nouvelle Ère) maintain low levels of full contractual defaults (6% and 2% respectively). In contrast, the SICS cannery boasts the highest level of contractual commitment accomplished by contracting producers, with a rate of 58.9%. This information sheds light on the varying levels of performance and commitment among the major canneries in the industrial tomato sector.

To gain a comprehensive understanding of contractual performance at the aggregate level, the first two degrees of contractual commitment are combined into one category titled "low contractual performance," while keeping the third type unchanged as "contractual commitment." This simplifies the analysis for a clearer overview. Figure 3 depicts a histogram illustrating the dynamics of contractual performance in the industrial tomato sector, considering the two

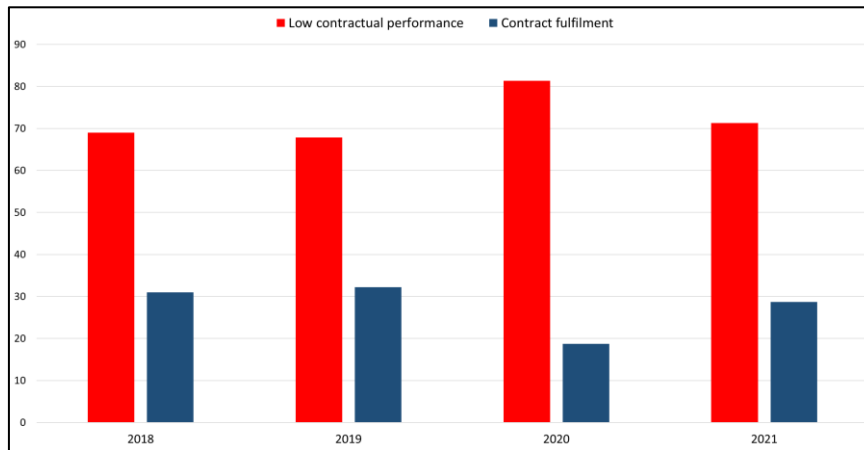
<sup>9</sup> For Triple Concentrate of Tomato.

<sup>10</sup> The threshold of 70% is based on field experts' opinions regarding the environmental and technical constraints.



levels of performance. Notably, low contractual performance predominates, accounting for an average of almost 72%. In other words, more than two-thirds of farmers who contract their industrial tomato production with a cannery breach their production contracts, either partially or completely. On the other hand, the fraction of contracting producers with a high level of performance, those who honor their contract terms, represents less than a third (averaging almost 28%). This information highlights the significant challenge of ensuring strong contractual compliance among industrial tomato producers, as the majority tend to face difficulties in fully meeting their contractual obligations with the canneries.

The dynamics of contractual performance between tomato producers and their co-contracting canneries present an alarming signal of the complications encountered in the vertical relationship between these two segments. Canners that engage in production contracts within the existing mechanism struggle to reach their anticipated or planned capacity in the long term, exposing them to a non-negligible risk of default. Similarly, tomato-producing farmers face the perception that delivering their production and honoring their contract could result in a significant opportunity cost and potential profit losses.



**Figure 2.** The dynamics of contractual performance in the industrial tomato sector in Algeria

Through the exploration of the structural aspects of the industrial tomato sector in Algeria, all the elements of the analysis presented will be thoroughly discussed to draw lessons, address critical issues, and identify implications for public policy. It is clear that the current situation of the sector demands attention and proactive measures to tackle the challenges and enhance the efficiency and stability of the tomato supply chain.

### 4.3 Facts, challenges, and policy implications

Based on the previously explored structure, derived from empirical analyses resulting from the dataset, certain factual observations can be made about the current state of the industrial tomato sector. Regarding the processing segment, it seems that it suffers from severe concentration, as could be indicated by a computed concentration index, which ranges from 0.68 in 2018 to 0.87 in 2021. This high level of concentration (compared with a study by Benmehaia and Brabez, 2018 for the computed underlying ratio in 2016) has the potential to weaken the overall performance of the sector and consolidate the power of processing firms in the market. The oligopolistic structure of the tomato processing market indicates a possible trajectory toward sector monopolization or, to a lesser extent, the marginalization of new or relatively small-scale entrepreneurs who may intend to enter the market.

On the side of tomato-producing farmers, despite the downward trend in their numbers and their declining participation in the production contract mechanism, this segment is witnessing a significant disengagement, with many farmers abandoning the activity. As a result, the industrial tomato production activity is becoming less attractive, posing a problem for processing firms. These processing firms are facing challenges in securing a stable supply of tomatoes as their traditional suppliers are disappearing. The declining attractiveness of industrial tomato production is leading firms to explore alternative options, such as "importing the TCT" (Tomato Concentrate and Tomato Paste), which touches upon a critical aspect of the country's food security. This situation presents a major concern for policymakers, as this segment can be considered the Achilles heel of the industrial tomato supply chain. Efforts are needed to address the disengagement of farmers and incentivize their continued involvement in the production of industrial tomatoes, thereby strengthening the overall resilience of the sector and the country's food security.

The performance in the vertical relationship between these two segments appears to be weakening over time. This assessment is made based on an examination of the interactions and flows between the two actors. Interestingly, this level of performance seems to be independent of the sector's structure, as all firms, regardless of their differences, are

deeply involved and affected. Given that the actors involved are presumed to pursue their own interests and adhere to the imposed incentive structures, it becomes crucial to investigate the root cause of this concerning situation, which may lead to a potential crisis. Are there issues with the public regulatory mechanism? Is there a lack of incentives in the production contract structure? Could the simplicity of contractual clauses be insufficient, or even a contributing factor? What about the supposedly negotiated prices? And who benefits from this situation? These questions are fundamental and closely linked to the problem of public regulation, which has a direct impact on the country's food security issue.

We now shift our focus to highlight the various challenges presented by the current situation and the potential implications for public policy. Any observer of the dynamics within this sector cannot overlook the shortcomings in regulation and the failure of the existing contractual mechanism. A primary contributing factor to this issue is the cumbersome bureaucratic procedure governing the contractual process. The slow payment of bills and premiums emerges as the main reason leading to the disengagement of contracting producers, to the extent that may increase capital constraint issues facing farmers (Cai and Ma, 2015). Addressing this challenge necessitates a thorough examination of the level of rigor within the concerned administrations (both public and private) and diligent monitoring of the payment settlement procedures. Next, let us examine the structure of the contracts themselves. While simplicity is desirable, it should not come at the cost of overlooking important elements. Currently, the contractual agreements only specify the area and quantity to be produced, often according to an expert. However, the absence of enforcement clauses has proven to be a significant factor contributing to the substantial disengagement observed. This raises the imperative of incorporating stronger incentive structures within the production contracts, potentially achieved through the inclusion of enforcement clauses. By taking these aspects into account and addressing the challenges, policymakers can work towards fostering a more conducive environment for both tomato-producing farmers and canneries. This, in turn, can lead to a more stable and efficient industrial tomato sector that better serves the country's food security objectives.

The seasonal variability of tomato prices plays a significant role in the decisions made by industrial tomato producers, and it is a key determining factor for farmers in deciding whether to produce industrial tomatoes. Surprisingly, the price received by tomato growers is not subject to negotiation at all. This raises concerns about the process of price formation within this sector. The absence of negotiated prices in the contracts leaves the contracting producers with a contingent choice: they must either deliver their production despite unfavorable market prices or breach the contract if the market prices are more favorable. In reality, the "imposed" price is set by the large canneries based on a minimum production cost, and this price is often not updated regularly (precisely 9 DZD in 2010 to 14 DZD in 2021). This situation calls for careful examination. The challenge at hand is to restore the balance of power and bargaining capacity between the involved parties. It is essential to establish a fair negotiation process through a regulatory framework that can lead to a reasonable and equitable price suitable for both producers and canneries. By addressing these fair pricing issues, policymakers can work towards building trust-based relationships in supply chains (Nakandala *et al.*, 2020; Oyedijo *et al.*, 2023; Swinnen *et al.*, 2021) that benefit all stakeholders involved.

The issue of regulating the industrial tomato sector should be prioritized by public policy, considering its significance in the Algerian consumption pattern and its implications for food security. The strategies pursued by the actors in this sector are entirely legitimate. Tomato producers aim to secure favorable business deals to ensure their survival, while canneries strive to meet the increasing domestic demand for processed tomato products. However, the current situation does not bode well, as it leads to increased reliance on external markets through the importation of TCT. This heavy reliance on imports exacerbates the country's vulnerability to external factors. The primary beneficiaries of this situation are likely private import lobbies and TCT exporting countries. To address these challenges and reach the country's food security objectives, immediate corrective measures are necessary. Therefore, fostering a robust and sustainable industrial tomato sector should be a priority. Policy decision-makers must be fully aware of the complexities and implications of this situation, as it can lead the country further into the mire of food dependency.

The issues discussed in this study are mirrored in the context of the tomato sector in Brazil and Italy, as highlighted by various studies. In Brazil, the findings of Zylbersztajn and Nadalini (2003, 2007) emphasize the critical role of contracts in coordinating between farmers and the processing industry. Yet, they point out significant challenges in contract enforcement and frequent opportunistic behavior by farmers. Both the Brazilian and Algerian contexts suffer from weak public enforcement mechanisms and bureaucratic inefficiencies that undermine contractual stability, resulting in high rates of contract breaches. Farmers often take advantage of better market opportunities when contractual prices are unfavorable, leading industries in both countries to consider relocating or restructuring their contractual approaches due to these persistent enforcement issues. Similarly, the Italian tomato sector, as studied by Bertazzoli *et al.* (2020), Samoggia *et al.* (2022), and Čechura *et al.* (2024), suffers from market concentration where larger firms exert considerable bargaining power over smaller farmers. In Italy, the formation of Interbranch Organizations (IBOs) and Producer Organizations (POs) proved to balance this power disparity by fostering better coordination and price streamlining among value chain actors. This approach parallels efforts in Algeria, where forming cooperatives seeks to enhance farmers' negotiating power and ensure fairer pricing and value distribution. These coordination mechanisms in both regions are critical in mitigating the negative impacts of market concentration, promoting dialogue, and setting

reference prices to stabilize market relations. Encouraging similar initiatives in Algeria could potentially lead to more equitable and stable market conditions.

## 5 Conclusion

This study aimed to explore the structure of the industrial tomato sector in Algeria as a whole and to draw some lessons and challenges. For this, the study used an exhaustive dataset on the two essential segments in the sector, production and processing, over four consecutive years (2019-2021) with all the actors in the two segments. This dataset was supplemented by aggregated data from the public office's statistics and reports from previous years. The purpose of this exploration was to provide an overview of the industrial tomato sector on a national scale.

The main findings of this study can be summarized as follows: The processing segment suffers from severe market concentration, as indicated by the concentration index of 0.87 in 2021, reflecting a high level of concentration and an oligopolistic structure with weak competitive dynamics. On the other hand, the production segment is witnessing a significant disengagement of tomato growers, with a declining participation rate in the contracting mechanism in recent years. Moreover, the contractual performance in the vertical relationship between these two segments appears to be weakening, raising concerns about the current situation.

After having established the analyses and findings necessary for a diagnosis, this study was able to land on some implications for public policy in order to get aware of current issues. The main challenges for this sector can be summarized as follows: Questioning the level of rigor of the administrations involved, both public and private; implementing a more incentive-based contractual structure by including enforcement clauses in the regulation; and restoring the balance of bargaining power of the contracting parties to achieve a fair price that benefits both parties. Cooperatives could be a powerful hybrid form to achieve such balance (Mishra *et al.*, 2018). Urgent corrective measures are needed to realign the country's objectives regarding food security.

This study paves the way for further future research aiming at analyzing the sector in more detail and finding solutions to the various problems encountered in the vertical relationship between tomato producers and canneries in Algeria. The availability of comprehensive data on the contractual relationship shed light on the individual or aggregate behavior of the parties involved. An accurate assessment of performance levels and their dispersion, both longitudinally and spatially, provide beneficial information on the sector's near future. Research focusing on explaining these behaviors would also be of great importance, examining factors such as regional disparities, farm size effects, profitability, and the size-performance relationship, among others. These investigations hold significant interest for the stakeholders involved and for public policy, offering guidelines to support the implementation of policies aligned with the national strategy on food security guidelines.

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