The Thesis of the PhD dissertation

Nazlı Ceylan
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WHEAT VALUE CHAIN ANALYSIS OF TURKEY: CONSTRAINTS AND DEVELOPMENT POSSIBILITIES

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1. BACKGROUND OF THE WORK AND ITS AIMS

1.1. Background of the Study

Productivity, competitiveness and sustainability are three important concepts of the modern economic world. These three concepts affect every aspect of our life, from social to environmental issues but most importantly they shape numerous economic activities. Today, success of an economic entity is measured by its productivity and competitive power, as well as sustainability of its activities. In this context, the value-chain approach becomes prominent due to its strong link with these concepts. In simple terms, a value chain can be defined as a series of activities and actors that bring a product from the production stage to its final use, while value is added in each step of this process. From a socioeconomic perspective, value chains can provide great opportunities for social, environmental and economic development if they function effectively. They can also be used as a tool in regional development policies, through the integration of regional clusters with each other or with global markets. Agriculture-based regions especially can generate economic, social and environmental benefits such as an income and employment increase or better use of resources by upgrading the chain and creating added value.

Based on the above-mentioned considerations, my study aims to provide a comprehensive analysis about the wheat value chain in Turkey by addressing the subject from different perspectives. The main reason for examining the wheat sector is the strategic importance of this product at both regional and national levels. In addition to this, staple foods like wheat are the focus of state development policies and food security regulations. Therefore, findings and suggestions based on a holistic value chain analysis in wheat sector are expected to provide a contribution to the sector itself and also to future development policies. The study investigates and compares the comparative

advantage of the wheat sector in Turkey and other major wheat producing/exporting countries that produce and trade considerable amounts of wheat whilst having different market structure and state policies. For example, the European Union (EU-28) member countries are subject to the Common Agricultural Policy (CAP), while in the Russian Federation, the state uses different intervention instruments such as export quotas and tariffs. On the other hand, in Turkey, different policies are applied through import tariffs, export subsidies and farmer support mechanisms to ensure food security and sustainability in the agricultural sector.

Consequently, it is important to reveal how the existing market is structured, how regulations and policies affect the wheat value chain, and at which points in the wheat value chain the challenges occur. A value chain approach plays a substantial role, because the overarching character of the value chain analysis provides a comprehensive breakdown to address these issues. In other words, the analysis does not only take into account efficiency of the production segment of the chain, but also those elements which determine the engagement of specific groups in ultimate markets (KAPLINSKY & MORRIS, 2000). In order to get answers to these questions, a gradual analysis is the main goal of this study. The analyses contain; description of the value chain concept and its importance, drawing an outline of the wheat value chain in Turkey, conducting an overall quantitative analysis, revealing bottlenecks and evaluating policy effects by comparing existing conditions with designed alternative policy scenarios. Therefore, the study provides detailed knowledge about the wheat value chain processes and constraints in Turkey through using various quantitative analysis methods as well as a case study. It also focuses on examining the relationship between existing agricultural policies and market conditions and tries to identify where development opportunities lie. The study substantially relies on descriptive

data, historical and statistical analysis, thus it should be seen as a complement to the existing literature and also a useful guide in the policy-making process.

1.2. Statement of the Problem

Agriculture is a sector of great importance both nationally and internationally in terms of food security and providing raw materials to the industrial sector. With the development of industry and service sectors in developing countries, the agricultural sector, whose share in the economy has decreased gradually, has been facing various problems. While increasing environmental concerns cause agricultural policies to be questioned, value chains are striving to be economically effective and increase their competitiveness to maintain sustainability.

Turkey, as a country with rich agricultural lands also has been affected by these challenges in the agricultural sector. Wheat-planting areas have shown a decreasing trend and wheat yield has remained below the world average in the last decade, despite an increasing population in the country. Furthermore, a significant increase in wheat imports in the last five years also made it clear that the policies towards the wheat industry play a critical role for the sector's future. Therefore, in order to increase efficiency in the wheat sector, the current situation should be analyzed in detail. In this context, the value chain approach offers a comprehensive and inclusive perspective by considering the wheat sector rather than just the production stage.

Policies developed for the entire value chain also contribute positively to regional development through effective integration of regions whose economies are based on agriculture into the value chain. Thus, the outcomes of a holistic research study on the wheat value chain will help the institutions and policy makers to design their plans strategically. This research will contribute knowledge and ideas to the existing literature on constraints that

are experienced by wheat value chain stakeholders. The study will discuss the comparative advantages of the wheat sector, its profitability and competitiveness under existing policies, as well as major constraints experienced by the sector from the sector stakeholders' point of view. Therefore, the study aims to contribute to the current literature by revealing the current situation from the perspective of other stakeholders in the sector, besides the production stage of the wheat value chain. The outcomes of this work can be a guidance document for future researchers, institutions and policymakers and it can also serve as a reference for them to carry forward studies on wheat value chain dysfunctions that affect stakeholders.

1.3. Importance of the Topic

Wheat (Triticum) comes from the Poaceae family. It can be said that wheat is the most common source of nutrients among all agricultural raw materials, as the world population obtains more than 60% of its daily energy requirements from grains, mainly from wheat (AKBAS et al., 2005). Besides being a crucial component of human nutrition, wheat has been one of the most strategic commodities in the world economy since ancient times. Therefore, forming a well-functioning value chain or upgrading an existing one can be a good opportunity for agriculture-based regions to gain competitive power, extend their share of the economy and ensure sustainable production. Modern agricultural value chains are broad, and they have become more sophisticated as countries industrialize and strengthen their share in global markets. The number and size of modern value chains, and thus jobs, will increase in developing regions in parallel with economic growth. However, there are several constraints for developing regions in this context. Countries aiming to increase their competitiveness in the global markets may face some challenges such as market-access restrictions, limited resources, and insufficient infrastructure. A value-chain approach in

agricultural development helps to identify weak points in the chain and to target these points to add more value. Finding ways to improve value chains also can be very important for raising smallholders' incomes. Small-scale producers can hardly survive unless they are integrated into the market. Integrating into better markets can help small-scale producers out of poverty. However, achieving this improvement requires more knowledge and many other value chain stakeholders can contribute to providing this component (NORTON, 2014). An important issue for producers in developing countries is entering value chains and finding ways to improve their competitiveness (TRIENEKENS, 2011). It is necessary to improve smallholder farmers' engagement with value chains that designed to deliver higher value in order to lower their risks and enhance their resilience as well (Agriculture for Impact, 2014). From a regional point of view, it can be said that regional inequalities became more notable following industrial development in Turkey, which created challenges for the regions where the economy was mostly based on agriculture. The working population in rural areas disengaged from agricultural activities and started to migrate to industrial cities. This situation brought many social and economic problems. Therefore, as an important component of rural development, efficient food systems contribute to the improvement of the lagging regions and alleviating regional inequalities. As agriculture in Turkey is characterised by small-medium establishments, it is crucial to create an efficient wheat supply chain to involve them and achieve stronger competition power in international markets. Upgrading value chains can be seen as an important tool for regional economic development, as rural producers are the starting point of most agricultural value chains. Lagging regions, which have an agriculture-based economy, may receive income benefits and also chance to narrow down the regional inequality gap by improving the value chain processes.

In this context, the study contains the following components and tasks: (i) identifying general characteristics of the wheat sector in Turkey, (ii) providing an outline of the wheat industry: starting with the production stage and moving through all value-added points, identifying all major players along the chain, (iii) measuring comparative advantages of the Turkish wheat industry against major wheat producer/exporter countries, (iv) conducting wheat value chain analysis for examining the profitability of producing wheat, alongside measuring the policy impact (v) determining and explaining bottlenecks along the chain with a case study on regional level, (vi) highlighting possible areas to be worked on for sustainable value chain development.

1.4. Research Objectives

The main objective of this study was to investigate the overall conditions and challenges in the wheat sector in Turkey, and to highlight the potential areas for development by revealing the bottlenecks in the sector that were obtained from the analyses.

The objectives of the research can be listed in more detail as follows:

- Investigating the Turkish wheat sector within the framework of the value chain approach.
- Examining the position of the Turkish wheat sector among major wheat producer/exporter countries in the context of comparative advantage.
- Analyzing the policy impact on the Turkish wheat sector.
- Assessing the outcomes of possible different market conditions by generating various scenarios.
- Analyzing the insights of the wheat sector stakeholders on the main areas (financing, infrastructure and technology, marketing and communication)

in the sector, within the scope of a case study to identify potential areas of improvement in the value chain.

1.5. Research Questions

- How is the wheat industry structured in Turkey?
- Does the Turkish wheat sector have a comparative advantage compared to other major producer/exporter countries?
- How do current policies for the wheat industry affect wheat production?
- What are the issues that need to be addressed primarily in the wheat value chain?
- Which areas should be focused on for the effectiveness and sustainability of the wheat value chain?

1.6. Research Hypotheses

Although the processed wheat products industry in Turkey has shown remarkable development in the last decade, the significant increase in import dependency on raw materials in recent years has negatively affected the competitiveness of the sector. Therefore, this research tests the following hypothesis:

Hypothesis 1: Policies aimed towards the Turkish wheat sector should prioritize the low-value segment in order to increase competitiveness.

In this study, the main areas of constraints in the Turkish wheat value chain were grouped into three sub-categories: (i) Marketing and Communication, (ii) Infrastructure and Technology, and (iii) Financing. These sub-categories were analyzed both within the value chain stakeholder context and the spatial context. The reason for revealing whether the above-mentioned sub-categories of the constraints faced by the value chain stakeholders differ based on their location or activity areas is to determine the priority areas, stakeholder groups, and provinces for future actions and solutions directed towards the sector. Furthermore, revealing the differences enables

policymakers or value chain stakeholders to develop better-tailored solutions considering the specific needs of an activity area or the province in which they are located. The following research hypotheses were tested based on the results of the case study survey investigating the opinions of the Central Anatolian Region wheat sector stakeholders:

Hypothesis 2: Financial-related problems in the Turkish wheat value chain are more likely to be severe when compared to infrastructure and marketing-related problems.

Hypothesis 3: Constraints faced by the Turkish wheat value chain stakeholders differ based on their location.

Hypothesis 4: Constraints faced by the Turkish wheat value chain stakeholders differ based on their activity areas.

2. MATERIALS AND METHODS

2.1. Research Design

The study consists of three stages of analyses to measure different parameters for the value chain:

- In the first stage, the general situation of the Turkish wheat sector in the international market has been examined and the revealed comparative advantage of the Turkish wheat sector against the wheat sectors of major producer/exporter countries has been measured.
- In the second stage, the profitability and competitiveness of the wheat sector and the effects of the current policies on the sector were analyzed. Reflections of different market conditions on the sector were measured by creating various scenarios in the second stage of the analysis.
- The third stage of the research presents a regional-scale case study and analysis to reveal the major challenges that are experienced in the sector. For this part of the study, the Central Anatolia Region was selected as the target region as it is the leading region in wheat production in the country. The main constraints in the sector were revealed by statistically analysing primary data obtained from the survey.

2.2. Description of Methods

2.2.1. Revealed Comparative Advantage

The analyses used in this research are conducted at international level, country level and finally at regional level, respectively. The method used in the study for the analysis of the Turkish wheat sector at international level is the “Revealed Comparative Advantage” method (RCA). BALASSA's (1965) RCA index was calculated in this study in order to examine whether the Turkish wheat sector has a comparative advantage compared to other leading wheat producing countries (USA, Russian Federation, and EU-28). The RCA

index is calculated in order to measure the trade specialisation of a specific sector in a country, and it is as follows:

$$RCA_i = \left[\left(\frac{X_{i,j}}{\sum X_j}\right) / \left(\frac{X_{i,w}}{\sum X_w}\right)\right],$$

where $(X_{i,j})$ denotes exports of goods (i) by country (j) and $(\sum X_j)$ denotes total exports by country (j). The denominator represents the share of world exports of the relevant goods $(X_{i,w})$ in total world exports $(\sum X_w)$. If the share of the examined sector in a country's total exports is higher than its share in world trade, the RCA index has a value above 1, which means that there is a comparative advantage. As an indicator of competitiveness, the higher the RCA index is, the higher the competitive advantage of the country. On the contrary, if the RCA index has a value below 1, a country is said to have a comparative disadvantage in the examined sector.

2.2.2. Policy Analysis Matrix

The method used in the study for the analysis at country level is the "Policy Analysis Matrix" (PAM) approach (MONKE & PEARSON, 1989). The purpose of this method - which is used especially in analyses for agricultural markets - is to analyze the impact of existing policies on a particular product's production. The PAM methodology allows for measuring the profitability of producing a certain product, as well as policy impact. In this study, besides examining the effects of the current policies within the framework of the PAM approach, different scenarios were created, and the profitability of wheat production were examined under various possible market conditions. A PAM table consists of three rows: (1) Private prices, (2) Social prices and (3) Divergences; and three columns: (1) Revenues, (2) Costs (tradable inputs and domestic factors) and (3) Profits.

In the context of the PAM approach, private prices refers to the observed market prices of a certain commodity, while social prices in the PAM are defined as the prices that result the highest income generation with optimal use of resources. As seen in Table 1, the matrix requires the calculation of revenues, tradable inputs, domestic factors and ultimately private and social profits for both types of prices. Divergences, which corresponds to the third row in the table, shows the difference between private and social prices in the aforementioned categories.

Table 1: Policy Analysis Matrix

	Revenues	Costs		Profits
		Tradable Inputs	Domestic Factors	
Private Prices	A	B	C	D
Social Prices	E	F	G	H
Divergences	I	J	K	L

Source: (MONKE & PEARSON, 1989)

In the table, the symbol D is refers to private profitability. It demonstrates whether an agricultural system is profitable under existing conditions technologies, prices and policy transfers. On the other hand, the symbol H refers to social profitability and helps to reveal the impact of the policy implications. If the value of social profitability is negative, it means that the system is unsustainable. The difference between private and social prices is shown in the third row of the matrix. The divergences row represents the distortions as result of implemented policies.

i) Private profits (D = A – B – C) are the values of the profits that producers earn within the existing market conditions.

ii) Social profits (H = E – F – G) are the indicators of comparative advantage of an agricultural commodity system.

iii) Divergences are values that represent the transfers, and they are calculated as the differences between private and social valuations of revenues, costs, and profits. There are 4 different types of transfers that can be measured in PAM; (i) Output transfers (I = A – E), (ii) Input transfers (J = B – F), (iii) Factor transfers (K = C – G), and (iv) Net transfers (L = D – H).

There are several indicators that can be derived from PAM:

- The Nominal protection coefficient (NPC): This is the ratio of the observed -private- prices to the world -social- prices.
- The Effective Protection Coefficient (EPC): This coefficient is the ratio of value added (A - B) in private prices to value added (E - F) in social prices.
- The Domestic Cost Ratio (DRC): This is the ratio of social costs of domestic factors (G) to the value added (E – F) in social prices to produce a certain amount of output.
- The Private Cost Ratio (PCR): PCR coefficient is measured by using private prices. It is the ratio of domestic factors (C) to the revenues (A) minus tradable inputs (B).

2.2.3. Case Study: The Central Anatolia Region Wheat Sector

In this part of the study, primary data on regional level was collected and analysed. After using the PAM methodology carried out the analysis of the production stage of the wheat value chain, the challenges encountered in the wheat sector were examined by the quantitative survey method. The region that was chosen for the research is the Central Anatolia Region, which ranks first in wheat production in the country. In addition to wheat production, the Central Anatolia Region stands out in production of processed wheat

products as well. Bottlenecks in the wheat value chain were identified through a questionnaire that was conducted among sector stakeholders in the Central Anatolia Region.

2.2.3.1. Case Study Design

In this study, descriptive design was applied. The primary data was collected by using a quantitative survey method. The opinions of wheat value chain stakeholders in the Central Anatolia Region are analyzed under three subtopics: (i) Infrastructure and technology, (ii) Marketing and communication, and (iii) Financing.

With this research design, it was aimed at taking the opinions of the wheat sector stakeholders on the above-mentioned subtopics as a whole, as well as comparing the sector stakeholders by dividing them into groups. The survey questions were designed to record responses in a Likert-type scale, in order to collect standardised and numerically measurable data. The Likert scale is a rating system to improve the levels of measurement in social research by using standardised responses.

2.2.3.2. Operationalisation of the Case Study

This section explains the various choices made in operationalising the study to address the challenges faced in the Central Anatolia Region of Turkey from the perspective of industry stakeholders.

a. Sources of Data

In addition to primary data sources, secondary data sources were also used for this case study. Primary data was obtained from wheat value chain actors operating in the Central Anatolia Region. Secondary data sources have been extracted from books, industry reports, journal articles and the Internet.

b. Target Population

The target population for the study was chosen from wheat sector stakeholders in the Central Anatolia Region. Sector stakeholders operating in the wheat sector are grouped as follows:

- Wheat trading/transportation firms
- Firms engaged in the production/trade of processed wheat products (wheat flour, pasta, bulgur)
- Firms engaged in seed production/trade
- Feed production/trading companies
- Other industry stakeholders (such as commodity exchanges, public institutions, associations)

c. Research Instruments

Survey method was used to acquire primary data from wheat industry stakeholders on their opinions about sector constraints. The questionnaire consisted of a series of open and closed-ended questions. The questions were designed to examine the opinions of the survey participants under three different fields related to the sector: infrastructure and technology, marketing and information, and financing. Establishments operating in the region were reached via e-mail and telephone during the period of March-April 2021. In this case-study research process, social science research ethical principles such as anonymity and confidentiality were applied.

2.2.3.3. Data Processing and Analysis

A survey was conducted on the market views of wheat sector stakeholders operating in the Central Anatolia Region in Turkey and analysis was conducted of the questionnaire answered by a total of 114 stakeholders. The survey consists of two parts: demographic and 5-point Likert scale (1-Strongly disagree; 2-Disagree; 3-Neither agree nor disagree; 4-Agree; 5-Strongly agree). In the first part demographic data were collected. In the

second part the scale contained 15 questions, which are equally divided into three sub-scales: Marketing and Communication (M), Infrastructure and Technology (I) and Financing (F).

Results were obtained by using Microsoft Excel 365 and IBM SPSS Statistics 21 (2012) package programs. Before analysis, the answers given to the questionnaire in Part 2 were collected for each sub-scale, and for the total scale. Total scores were obtained (M Total, I Total, F Total and Grand Total) to be used as dependent variables. In order to determine the appropriate comparison tests, whether these variables are suitable for normal distribution was determined by K-S (Kolmogorov-Smirnov) Goodness of fit test (MASSEY, 1951). For the comparison of the mean, parametric tests were used if the variable had an appropriate distribution (normal distribution), and non-parametric tests were applied if the variable did not have a distribution suitable for normal distribution. In order to compare the mean of groups with more than two groups such as: (i) provinces of operation, (ii) area of activity, (iii) business sizes and (iv) business structures the ANOVA (Analysis of Variance) test was used parametrically and the Kruskall-Wallis (KRUSKALL & WALLIS, 1952) test was used non-parametrically. If a significant difference was detected, the Least Significant Difference (LSD) test, one of the post-hoc tests, was applied to determine which groups the difference occurred from. Reliability and validity analyses were performed on the Likert scale responses. Cronbach's alpha (CRONBACH, 1951) coefficient method was used to test the reliability of the scale. Cronbach's alpha is a measure of internal consistency that is, how closely related a set of items is as a group. Validity is the extent to which the construct measures what it says it is measuring. Factor analysis was used for measuring the validity of the scale. Factor analysis is a construct validity technique used to reveal whether there is a certain order between the responses of the

respondents in the measurement tool being developed. Various variables can be grouped under several headings with factor analysis. To test the feasibility of factor analysis; the items are desired to be highly correlated, the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy (CERNY & KAISER, 1977) test result is expected to be greater than 0.7, and the Bartlett's test of sphericity is need to be statistically significant.

3. RESULTS AND DISCUSSION

3.1. Revealed Comparative Advantage of Turkish Wheat Sector

According to the TUIK (2020), the wheat self-sufficiency degree for the 2018/2019 period was 100.5% in Turkey. However, in some years, due to shortages in production and quality due to adverse climatic conditions, demand can not be met. The most important reason for the country to import wheat is the gradual increase in the export of products based on wheat, such as flour, pasta, biscuits, etc. (Turkish Grain Board, 2019). Hence, besides wheat trade data, wheat milling sector data was taken into account while analysing the Turkish wheat sector. Table 2 demonstrates the trade performances of Turkey and the major wheat producers/exporters for the years between 2009 and 2018. These analyses were based on the measurement of revealed comparative advantages. The index that was defined above measures the competitiveness of Turkey's trade performance in the wheat and wheat flour sector during the aforesaid period, against the USA, the Russian Federation, and the EU-28.

Table 2: RCA Indices of Turkey vis-a-vis major wheat exporters

	RCA_TR	**RCA_RUS**	**RCA_EU28**	**RCA_USA**
2009	2.15	3.26	0.88	1.79
2010	2.87	2.17	1.00	2.22
2011	2.26	2.57	0.89	2.60
2012	1.95	2.97	0.87	1.83
2013	2.34	2.32	1.00	2.34
2014	2.18	3.91	1.01	1.74
2015	2.65	4.49	1.03	1.45
2016	2.95	5.79	0.99	1.47
2017	2.72	6.56	0.85	1.61
2018	2.57	7.93	0.80	1.41

Source: Author's calculations, based on (International Trade Centre, 2020) data.

In the table, the RCA indices of each country were calculated on a yearly basis for the examined period. For the calculation of indices, the Harmonised Commodity Description and Coding System (HS) classification was used by taking into account the HS codes for wheat (1001) and wheat flour (1101). As seen from the table, RCA values for the wheat sector in Turkey are higher than the threshold value of 1. The RCA indices have shown values between 1.95 and 2.95 in the last ten years and, with the exception of 2012, have been above 2. On the other hand, the RCA analysis results provide a different picture of the Russian Federation. Competitiveness of the industry has been steadily increasing since 2010 and it has reached 7.93 in 2018, the highest in the last decade. Especially since 2014, the Russian Federation seems to have the highest comparative advantage in the wheat sector, among the examined countries. As a result of the calculations made for the EU-28, the RCA values generally remained below the threshold value of 1, although the values reached the threshold occasionally. The RCA index of the USA varied between 1.41 and 2.60 during this period. Although the USA's RCA values are over 1, implying a comparative advantage of the wheat industry, it stands at a point between Turkey and the EU-28, particularly in the last five years. Measurements presented in Table 2 showed that the Russian Federation (RCA_RUS=7.93) had the highest competitive advantage in 2018, followed by Turkey (RCA_TR=2.57), the USA (RCA_USA=1.41), and the EU-28 (RCA_EU28=0.80). High RCA values can be explained by the large share of wheat and wheat flour exports among the total exports of the examined countries. The EU-28 ranks the lowest among the others, mostly showing a comparative disadvantage in wheat production.

Table 3: RCA Indices by country for wheat (HS 1001)

	RCA_TR	RCA_RUS	RCA_EU28	RCA_USA
2009	0.23	3.50	0.88	1.95
2010	0.81	2.39	1.02	2.43
2011	0.01	2.71	0.90	2.87
2012	0.08	3.24	0.86	1.99
2013	0.20	2.54	1.00	2.56
2014	0.09	4.29	1.03	1.89
2015	0.10	4.95	1.06	1.59
2016	0.03	6.44	1.03	1.62
2017	0.04	7.29	0.85	1.77
2018	0.07	8.80	0.80	1.54

Source: Author`s calculations based on (International Trade Centre, 2020) data.

The situation observed in Turkey implies that the structure of its wheat sector has different patterns compared to other examined countries. If the competitiveness of wheat alone were calculated instead of wheat and wheat flour together, the RCA index of Turkey would be below the threshold value of 1 (Table 3), due to the high volume of processed wheat exports and very low wheat exports. The country's high level of wheat imports and wheat flour exports can be interpreted as the wheat flour industry's dependence on imports. This situation also highlights that the Turkish wheat sector is fragile against fluctuations in international markets, as well as domestic dynamics.

3.2. A Policy Analysis Matrix for the Turkish Wheat Sector

The basic outcomes of the PAM analysis are illustrated in Table 4. The comparison between social and private prices and profitabilities of wheat production are also shown in the table. According to the data, when expenses are deducted from the revenue, the average profit of 167.2 TL/Da (D) was received by wheat producers in 2018. On the other hand, the social

profitability of wheat production is calculated 86.3 TL/Da lower (the difference between private and social profitability) which indicates that the farmers were functioning under the conditions of the existing market and state policy. In other words, divergence between private and social revenues implies strong domestic support (input subsidies, deficiency payment etc.).

Table 4: PAM for wheat production in Turkey in 2018

Wheat	Revenues	Tradable Inputs	Domestic Factors	Profits
Private Prices	A	B	C	D
	450.0	92.2	190.6	167.2
Social Prices	E	F	G	H
	337.5	87.8	168.7	80.9
Divergences	I	J	K	L
	112.5	4.4	21.8	86.3
PCR (Private Cost Ratio): C/(A-B)				0.53
DRC (Domestic Resource Cost Ratio): G/(E-F)				0.68
NPCO (Nominal Protection Coefficient on Tradable Outputs): A/E				1.33
NPCI (Nominal Protection Coefficient on Tradable Inputs): B/F				1.05
EPC (Effective Protection Coefficient): (A-B)/(E-F)				1.43

Source: (CEYLAN, 2020)

According to the PAM results, Turkish wheat producers paid higher prices for internal resources. Estimated expenses on domestic production factors were 190.6 TL/Da, while their social prices were 22 TL/Da lower. Similarly, domestic input costs were higher than social costs as the tradable production factors in social prices were 4.4 TL/Da lower than private prices, revealing the distorting effects in the economic system. Wheat producers in Turkey were estimated to pay 92.2 TL/Da for seed, pesticide and fertiliser in the period analysed. In addition to profitabilities and divergences, various indicators were obtained as a result of the PAM calculation. For instance, the effective protection coefficient was measured as 1.43, inferring that the applied policies caused a net positive incentive, or an equivalent subsidy to wheat production. Furthermore, another indicator, the domestic resource cost

(0.68) implies that the value of domestic resources used in wheat production was less than the value added. On the other hand, the policy effects on tradable input markets are represented by the nominal protection coefficient for tradable inputs (NPCI). According to the PAM results, the value of the NPCI was 1.05. NPCI above 1 means that, in the period analysed, private prices of inputs used in wheat production were higher than their social prices. Another indicator, similar but for tradable outputs, is nominal protection coefficient for tradable outputs (NPCO) was 1.33, implying that the government policy was protective against output. In another saying, policy implemented by the government could maintain the price of agricultural production output of domestic wheat at a rate of 33% higher than social prices.

3.2.1. Sensitivity Analysis

The sensitivity analysis helps to measure the effects of different input prices. To conduct sensitivity analysis, various scenarios were analysed: (i) Single input price changes, (ii) Multi-input price changes, and (iii) Changes in fertiliser use and wheat yield.

3.2.1.1. Scenario 1: Single Input Price Changes

Increase in fertiliser prices by 30%:

Production costs play a significant role in the profit obtained for wheat production. The increase in the prices of the inputs used in wheat production causes the profit to decrease and the farmers to decide to plant more profitable products. A 30% rise in fertiliser costs (DAP and AS) by 30% cause a 13% increase in costs of tradable inputs in total and consequently 8% decrease of the profit. In case of the projected scenario, producers still get profit from wheat cultivating activity, however the sector's competitiveness decreases. Divergence effect is positive for fertilisers and the NPCI value increases from 1.05 to 1.18 while the EPC value decreases from 1.43 to 1.39.

Decrease in fertiliser prices by 30%:

A fall in fertiliser costs (DAP and AS) by 30% causes a 13% decrease in costs of tradable inputs in total and consequently an 8% increase of the profit. The NPCI value falls to below 1, to 0.92, indicating the private prices of fertilisers are lower than their social prices.

3.2.1.2. Scenario 2: Multi-input Price Changes

Increase in fertiliser, pesticide and wheat seed prices by 25%:

A 25% increase causes overall costs to increase by 9% and profits to decrease by around 15%. The EPC value decreases from 1.43 to 1.34 and the NPCI value increases to 1.31, demonstrating that the market prices will be 31% higher than world prices in this scenario.

Decrease in fertiliser, pesticide and wheat seed prices by 25%:

The reverse effect is observed in the case of a possible decrease in multiple-input prices as overall profit of wheat cultivation increases by 25%. As a result of this scenario, the cost of tradable inputs become 21% lower than their social cost. The NPCI value significantly falls to below 1, to 0.79, implying that the market prices of tradable inputs are lower than their world prices in case of a 25% decrease scenario.

3.2.1.3. Scenario 3: Changes in Fertiliser Use and Wheat Yield

Increase in fertiliser use by 30% and increase in yield by 20%:

In case of higher fertiliser use, the overall cost of tradable inputs increases around 12%. On the other hand, higher yield, in turn, leads to a further increase in revenue. Private revenue inreases around 11%, while social revenue increases 20%. As a result, farmers receive higher profits compared to the basic scenario. The profit raises 24%, from 167.2 TL/Da to 207.2 TL/Da. The overall effect of the above-mentioned changes in social costs and revenues on the comparative advantage of wheat can be seen in the DRC

value. The DRC value changes from 0.68 to 0.55, pointing out a higher comparative advantage than the basic scenario.

3.3. Case Study: The Central Anatolia Region

The case study results are presented in this chapter. Table 5 shows the frequencies and the percentages of the cities of stakeholders.

Table 5: Distribution of activity areas

Area	*Frequency*	*Percent*
Seed	24	21.1
Grain Trade/Transport	24	21.1
Feed	20	17.5
Processed Wheat Products	38	33.3
Others	8	7.0
Total	114	100.0

Source: Author, based on survey data.

Reliability and validity analyses were performed on the Likert scale responses. Cronbach's alpha (CRONBACH, 1951) coefficient method was used to test the reliability of the scale. Cronbach's alpha is a measure of internal consistency that is, how closely related a set of items is as a group. As a result of the analysis, the Cronbach α coefficient calculated for the scale was 0.846. This coefficient shows that the scale is highly reliable. Validity is the extent to which the construct measures what it says it is measuring. Factor analysis was used for measuring the validity of the scale. Factor analysis is a construct validity technique used to reveal whether there is a certain order between the responses of the respondents in the measurement tool being developed. Various variables can be grouped under several headings with factor analysis. To test the feasibility of factor analysis; the items are desired to be highly correlated, the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy (CERNY & KAISER, 1977) test result is expected to be greater than 0.7, and the Bartlett's test of sphericity is need to

be statistically significant. In this study, the KMO sample fit coefficient for the scales was 0.826, and the Bartlett Sphericity test 2 (chi-square) value was found to be 488.850 (p = 0.000). This means that Explanatory factor analysis can be used for validity of the scale. According to the analysis, M, I and F subtotals are highly correlated with each other and all the p values are <0.01 which means the correlation coefficients are statistically significant. According to the results, the scale was properly divided into sub-scales and the validity of the scale was shown.

3.3.1. Distribution of the Data

Table 6 shows the Kolmogorov-Smirnov Goodness of Fit test results. K-S Goodness of Fit test is suggested the following hypothesis; if the significance level of the test is above 0.05 then the tested data conforms to normal distribution. According to this table "M total", "F total" and "Grand Total" variables are normally distributed (p>0.05). However, the "I total" variable is not suitable to normal distribution (p<0.05). Therefore, parametric tests were conducted to analyze "M total", "F total" and "Grand Total" variables, and non-parametric tests were applied for the "I total" variable.

Table 6: Kolmogorov-Smirnov test results

Variable	*Z-value*	*P-value*
M total	0.980	0.275
I total	1.446	0.028
F total	0.998	0.237
Grand Total	0.858	0.385

Source: Author, based on survey data.

3.3.2. Mean Difference Test Results Between Provinces

The results given in Table 7 show whether there is a difference in terms of the answers given to the questionnaire between the participants in different

provinces. “M total”, “F total” and “Grand total” variables are tested with ANOVA since they are normally distributed, “I total” data were tested with Kruskal-Wallis because it does not fit the normal distribution. For “M total” variable there is a significant difference among provinces.

Post-hoc tests could not be conducted for this case, due to the low number of participants corresponding to some provinces. However, an interpretation can be made by using the rank median of the provinces. According to rank medians the difference is due to the fact that the Eskişehir, Konya and Yozgat provinces gave more positive answers compared to others, thus having higher medians in the M sub-scale. Also, according to $p<0.10$ “Grand total” variable has a significant difference among provinces. The difference is due to the fact that the establishments, which operated in the Eskişehir, Aksaray and Niğde provinces, were more optimistic about the conditions of the wheat sector.

Table 7: Mean difference test results between provinces

Variable	*Test statistics*	*P-value*
M total	2.420	0.006*
I total	15.562[1]	0.158
F total	0.103	0.442
Grand Total	0.858	0.080**

[1] Kruskal-Wallis test statistics
* Significant result according to $p<0.05$
** Significant result according to $p<0.10$
Source: Author, based on survey data.

3.3.3. Mean Difference Test Results Between Activity Areas

Table 8 shows whether there is a difference between the participants in different activity areas in terms of the answers given to the questionnaire. Same as above “M total”, “F total” and “Grand total” variables are tested

with ANOVA. Since they are normally distributed, “I total” data were tested with Kruskal-Wallis because it does not fit the normal distribution. According to p<0.06 “M total” variable has a significant difference among activity areas.

A LSD test, one of the post-hoc tests, was used to detect the differences between activity areas. According to LSD test result, the difference is due to the fact that the answers of participants from “Seed” and “Feed” areas have higher means than the “Grain trade/transport”. This means participants from “Seed” and “Feed” areas gave more positive answers to the questions in the M sub-scale. Also, according to p<0.10 Grand total variable has a significant difference among activity areas. Like “M total” the difference is due to the fact that the answers of participants from the “Seed” group has a higher mean than the “Grain trade/transport”. It is also worth noting that, according to the analyses results, there is no significant difference in the answers given between establishment sizes as well as between organizational structures.

Table 8: Mean difference test results between activity areas

Variable	*Test statistics*	*P-value*
M total	2.371	0.059*
I total	5.127[1]	0.274
F total	1.572	0.191
Grand total	2.051	0.097**

[1] Kruskal-Wallis test statistics
* Significant result according to p<0.06
** Significant result according to p<0.10
Source: Author, based on survey data.

Table 9 shows the mean and the standard deviation values of the answers of the survey questions according to the different activity areas. The results are shown as subtotals and the grand total of the scale.

Table 9: Mean and std. dev.[1] values of the total answers according to activity area

		N	*Mean*	*Std. Dev.*
M total	Seed	24	18.00	3.65
	Grain Trade/Transport	24	15.17	3.23
	Feed	20	17.15	3.57
	Processed Wheat Products	38	16.16	3.13
	Other	8	16.25	4.40
	Total	114	16.52	3.52
I total	Seed	24	19.00	2.38
	Grain Trade/Transport	24	16.79	4.61
	Feed	20	17.75	3.73
	Processed Wheat Products	38	17.24	3.05
	Other	8	17.63	5.55
	Total	114	17.63	3.66
F total	Seed	24	16.50	3.13
	Grain Trade/Transport	24	14.42	3.76
	Feed	20	15.70	3.08
	Processed Wheat Products	38	15.89	3.32
	Other	8	17.13	4.19
	Total	114	15.76	3.44
Grand Total	Seed	24	53.50	7.16
	Grain Trade/Transport	24	46.38	10.29
	Feed	20	50.60	9.03
	Processed Wheat Products	38	49.29	8.07
	Other	8	51.00	12.60
	Total	114	49.91	9.09

Source: Author, based on survey data.

[1] Standard deviation

As can be seen from the table, while the "Seed" group gave the most positive answers (mean value = 18.00) to the questions in the "Marketing and communication" category in the survey, the "Grain trade/transport" group gave the lowest (15.17). Similarly, the "Seed" group gave the most positive answers (19.00) to the questions in the "Infrastructure and communication" category, while the least positive answers came from the "Grain trade/transport" group (16.79).

In the “Financing” question category, which shows the least positive answers among all categories, the "Other" group had the highest mean value (17.13), the "Grain trade/transport" group had the lowest (14.42). When looking at the “Grand Total” including all the question categories, it is possible to see that the "Seed" group has the highest mean value among the sector stakeholders. The "Grain trade/transport" group has the lowest mean in the “Grand Total”.

4. CONCLUSION AND RECOMMENDATIONS

This chapter of the study presents a summary of the research, conclusions and recommendations based on the obtained results from analyses. The chapter highlights findings that were determined in line with the questions in the study. The main purpose of this study is to analyze the wheat value chain in Turkey in detail, and to reveal the major bottlenecks in the value chain and also to examine where the development opportunities exist, in line with the research results. As examined in detail in the previous chapters, the analysis was carried out in three stages to find answers to the following through different methods selected in accordance with each stage:

- To examine the Turkish wheat sector in detail within the framework of the value chain approach
- To reveal the position of the Turkish wheat sector among major wheat producer/exporter countries in the context of comparative advantage
- To analyze the policy impact on the Turkish wheat sector
- To assess the outcomes of possible different market conditions by generating various scenarios
- To obtain the insights of wheat sector stakeholders on the main areas (financing, infrastructure and technology, marketing and communication) in the sector by conducting a case study in the region that ranks first in wheat production.

4.1. Summary of Findings

Preliminary results of this research showed that there have been significant changes in the Turkish wheat value chain in the last decade. The most striking of these changes are the increase in flour exports, a rising trend in wheat imports, a decrease in wheat cultivation areas and the fact that wheat yield is still below the world average. Having a significant place in wheat production and processed wheat product exports in the world, Turkey has

strong potential in terms of the development of the wheat value chain. Therefore, by analyzing the current situation in detail, it is possible to establish a more effective and sustainable wheat value chain with policies tailored towards the sector. In order to reveal the current situation in the sector in more detail, a three-stage analysis was conducted. These analyses were selected to conduct a detailed study from the general to the specific, in other words from the international level to the country level and then to the regional level. While the international level here denotes the comparison of the countries, the analysis at the country level is the analysis of sector data in a way that reflects the country in general. Finally, analysis at the regional level involves choosing a region that best reflects the sector and collecting primary data from that region. In the first stage, the competitiveness of the Turkish wheat industry was examined within the frame of the "Revealed Comparative Advantage" approach. According to the results of the analysis, the RCA index of the Turkish wheat sector (wheat and wheat flour) calculated for 2018 was 2.57. This coefficient shows that the sector has a comparative advantage. Later in the analysis, the RCA indices of the major wheat producer/exporter countries were calculated in order to make a comparison. As a result, the country with the highest RCA value by far is the Russian Federation (7.93 for 2018), followed by Turkey (2.57), USA (1.41), and EU-28 (0.80). The RCA index values calculated for these countries showed the same order for the period 2009-2018. The fact that the sector has a certain degree of comparative advantage can be explained by Turkey's high flour exports. When only wheat is taken into account and wheat flour export figures are not included, Turkey's RCA index is the lowest compared to the countries mentioned.

In the second stage of the wheat value chain analysis, the sector was examined more closely. At this stage of the analysis, the Policy Analysis

Matrix methodology was applied, and in addition to assessing the profitability of wheat production in Turkey, diverting effects of existing policies on the sector were also examined. As a result of the analysis, it was determined that wheat production in Turkey was profitable, but input prices were higher than world prices and government supports had a significant share. In the next step called "Sensitivity Analysis", various scenarios for the wheat market were produced and the possible consequences of these scenarios were examined. Three different types of scenarios were examined within the scope of sensitivity analysis: (i) single input price changes, (ii) multi-input price changes and (iii) changes in fertilizer use and wheat yield. In the first scenario, the possible impact of changes in fertilizer prices was analyzed. The results showed that a 30% increase in fertilizer prices caused a 13% increase in tradable input costs and 8% fall in profit. On the other hand, a 30% decrease in fertilizer prices had the opposite impact and caused the NPCI value to fall to below 1, to 0.92, implying that the private prices of fertilisers would be lower than their social prices in this scenario. The second scenario examined the effects of multi-input price changes. Results of a 25% increase in tradable input prices (fertilizer, wheat seed and pesticide) caused a 9% increase in overall costs and a 15% fall in profits. In this scenario, the NPCI value rose to 1.31, indicating that market prices would be 31% higher than world prices. In the case of a 25% decrease in input prices, the NPCI value would drop to 0.79, which means market prices of tradable inputs would be lower. In the last scenario, changes in fertilizer use and wheat yield were analyzed. A 30% increase in fertilizer use and 20% increase in yield resulted in approximately a 12% surge in tradable input costs and 11% increase in private revenues. In this scenario, profit would increase 24% and the DRC value would change from 0.68 to 0.55, indicating a higher comparative advantage than the base scenario.

A case study was conducted in the third and final stage of the wheat value chain research. For the case study the Central Anatolia Region was chosen as it has the highest wheat production among the seven geographical regions of Turkey, and also has a significant share in the processed wheat products industry. A total of 114 sector stakeholders from different categories participated in this study in order to determine the insights of the wheat value chain stakeholders on the sector, and consequently the challenges in the sector. The survey questions were designed to obtain opinions of the sector stakeholders about the market under three sub-groups: (i) Infrastructure and technology, (ii) Marketing and communication and (iii) Financing. Each question category consisted of five relevant questions and the answers to the survey questions were designed according to a five-scale Likert-style, from 'strongly disagree' to 'strongly agree'. As a result of a statistical analysis of the data collected by the survey method, it was found that the Central Anatolia Region wheat sector stakeholders gave the most positive answers to the questions in the "Infrastructure and technology" category, followed by "Marketing and communication" and "Financing" with mean values of 17.63, 16.52 and 15.76, respectively. The noteworthy points in the answers given to the questions regarding the opinions of the sector stakeholders are as follows:

- More than half of the industry stakeholders (57%) stated that the wheat grown in the region is suitable for the industry's needs. The Central Anatolia Region plays an important role not only in wheat production, but also in the production of processed wheat products. In the wheat industry, wheat quality needs of each sub-sector differ. For example, to the survey question of whether the quality of the wheat grown in the Central Anatolia Region is suitable for the sector's needs, "Seed" and "Feed"

groups gave a relatively more positive opinion than the “Processed wheat products” group.

- When asked whether it is easy to access information such as price, production expectations and legal regulations in the sector, 73.6% of the participants stated that access to information in the sector is easy. On the other hand, the rate of those who find the events and platforms where the sector stakeholders come together insufficient was 53.5%.
- Another noteworthy result of the survey is that 82% of the participants expressed an affirmative opinion when asked whether the use of certified seeds positively affects wheat quality and yield. Therefore, it can be said that the sector has high awareness and positive opinions about certified seeds.
- More than half of the stakeholders answered positively to the questions about the adequacy of logistics, infrastructure, technology and storage in the region.
- While the question about whether access to finance is easy or not in the sector was answered positively with a rate of 42%, and 44% of the survey participants stated that subsidies are insufficient. On the other hand, the rate of those who think that the basin-based support model contributes to the sector is approximately 39%.

4.2. Testing of Hypotheses

Hypothesis One: Policies aimed towards the Turkish wheat sector should prioritize the low-value segment in order to increase competitiveness.

A country's comparative advantage in a sector is of great importance in terms of the development and sustainability of that sector. Therefore, one of the main objectives of this study is to examine the position of the Turkish wheat sector among major wheat producer/exporter countries in the context of comparative advantage and ask the research question if the Turkish wheat

sector has a comparative advantage compared to other major producer/exporter countries. To answer this research question, Balassa's "Revealed Comparative Advantage" methodology was applied to the Turkish wheat sector and to the USA, Russia, and the EU. According to the analysis results, the Turkish wheat sector has a decent comparative advantage when wheat and wheat flour are taken into account together. However, when only wheat is taken into account, it is revealed that the sector does not have a comparative advantage. When the major wheat producing and exporting countries are compared, it is observed that Russia has a very high comparative advantage in the wheat sector in both cases.

In order to ensure the sustainability of the sector and to alleviate the vulnerability of the downstream parts of the value chain due to import dependency, policies aimed towards the Turkish wheat sector should prioritize the low-value segment in order to achieve stronger competitiveness. The comparative advantage analysis results support the hypothesis, therefore the hypothesis one is accepted.

Hypothesis Two: Financial-related problems in the Turkish wheat value chain are more likely to be severe when compared to infrastructure and marketing-related problems.

Constraints occurring in value chains may differ according to the structure of the chain as well as the conditions and development level of the country in which it is located. In order to identify potential areas of improvement in the value chain, it is first necessary to determine which area has the most problems. Therefore, another major research objective of this study is to analyze the insights of wheat sector stakeholders on the main areas in the sector (financing, infrastructure and technology, marketing and communication), within the scope of a case study to identify potential areas of improvement in the value chain.

Quantitative survey results revealed that the wheat sector stakeholders have the least positive opinions in the Financing category, while the most positive opinions were given in the Infrastructure and technology categories. The results of the quantitative survey analysis support the hypothesis, therefore the hypothesis two is accepted.

Hypothesis Three: Constraints faced by the Turkish wheat value chain stakeholders differ based on their location.

The third hypothesis examined whether there is any significant difference in the opinions of wheat sector stakeholders between the provinces in which they operate. Results of the statistical analysis showed that, for the M (Marketing and communication question category) total variable, there is a significant difference among provinces ($p<0.05$). Therefore, among three question categories, only the "M total" hypothesis three is accepted, and the "I total" (Infrastructure and technology) and "F total" (Finances) variables hypothesis three is rejected.

Hypothesis Four: Constraints faced by the Turkish wheat value chain stakeholders differ based on their activity areas.

The fourth hypothesis investigated whether there is any significant difference in the opinions of wheat sector stakeholders between the activity areas of the establishments. According to $p<0.06$ the "M total" variable has a significant difference among activity areas. Therefore, the hypothesis four is accepted only for the "M total" variable. An LSD test was conducted to obtain more detailed results. Results of the test showed that the "Seed" and "Feed" groups had a higher mean than the "Grain trade/transport" group. In other words, survey respondents from the "Seed" and "Feed" groups gave more positive opinions on the "Marketing and communication" questions. In addition to this, the "Grand total" variable showed a significant difference among activity areas, according to $p<0.10$. This result is mostly based on the

fact that the "Seed" group had a higher mean than the "Grain trade/transport" group.

4.3. Recommendations

According to the results of this research, in order to achieve a more competitive and sustainable wheat value chain in Turkey, the policies mainly need to focus on reducing the cost of wheat production, increasing wheat yield, financing, and integrating small-scale industry stakeholders into the wheat value chain.

- Increasing smallholder engagement with the value chain is essential for effective and sustainable rural development. In order to integrate the producers into the value chain in the wheat industry, which is characterized by small and medium-sized producers, their bargaining power needs to be strengthened. Besides, they must be aware of the quality needs in middle and downstream segments of the chain and produce according to the quality needs. Integration of disadvantaged stakeholders to the value chain can be achieved through collaborations aimed at both increasing added value and participation in the chain. Therefore, it is beneficial to adopt an inclusive approach, involving all value chain stakeholders in policies developed to increase the competitiveness of the wheat sector.
- Financing of agriculture is very important due to the seasonal nature of agricultural production and the corresponding fluctuating incomes of sector stakeholders. As the research results indicated, financing is one of the main challenges that stakeholders encounter in the wheat value chain. The share of agricultural supports as a portion of GDP is relatively low in developed countries. Therefore, although the results of this research showed that more than one third of wheat sector stakeholders found the government support insufficient, it will be more sustainable to solve the

financing problems by expanding and encouraging the use of alternative financing instruments in the agricultural sector besides government subsidies and bank loans. The licensed warehousing system, which offers an alternative for financing in the wheat market, has gained momentum in Turkey. For instance, the TMEX (Turkish Mercantile Exchange) -where electronic warehouse receipts issued by licensed warehouse enterprises can be traded- was established in 2018. Therefore, informing sector stakeholders more effectively about the latest developments and opportunities, as well as promoting alternative financing sources in the wheat value chain, should be prioritized.

- Enhancing platforms and events where stakeholders come together in the value chain is beneficial for strengthening market linkages. It is one of the noteworthy outputs of this research that the results of the survey revealed that platforms and events where stakeholders of the sector come together were considered insufficient.
- Increase in wheat production volume can be achieved by expanding the cultivation area or by increasing the yield. Since there is a certain limit of cultivation areas, the focus should be on increasing the wheat yield in order to enhance wheat supply and reduce the import dependency of the processed wheat products industry in particular. However, efficiency and production increase may not be sufficient, therefore, enhancing product quality in line with the needs of sector stakeholders is important for the self-sufficiency and competitiveness of the sector.
- In addition to the issues mentioned above, improving post-harvest processes and decreasing waste along the chain also plays a significant role in the better functioning of the food value chain. A sustainable way to use limited resources effectively is to reduce food waste and loss. One of the most important challenges in the process of preventing food waste

and loss is measuring the amount of waste along the value chain. Therefore, it would be beneficial to channel regulations in this direction, and then developing policies by taking both international and regional good practices as an example.

5. NEW SCIENTIFIC RESULTS

5.1. New Scientific Achievements/Observations

As a result of the “Revealed Comparative Advantage” analysis, “Policy Analysis Matrix” and the case study based on the Central Anatolia Region wheat value chain stakeholders’ opinions about the sector; the following novel outcomes were explored:

1) Based on the results of the "Revealed Comparative Advantage" analysis, it can be established that the Turkish wheat sector is not competitive in the low-value segment. The RCA analysis revealed that, while the sector has a comparative advantage when flour exports are taken into account, it is not competitive when only wheat is taken into account.
2) Input prices and productivity are two important points to be considered for the production stage of the wheat value chain. The PAM analysis revealed the profitability of wheat production as well as the distorting effects of subsidies. In addition, according to the results of the analysis, wheat production activity is more costly for Turkish farmers compared to foreign wheat producers, as the input prices used in wheat production in Turkey are higher than world prices. Based on the results of the sensitivity analysis, it was found that, even though increasing fertilizer use notably raises the cost of production, overall profit would be higher than the basic scenario due to the greater yield.
3) According to the results of the quantitative survey conducted on the opinions of the sector stakeholders, it can be established that the most challenging constraints in the Turkish wheat value chain are related to financing. It was seen that the subgroup of questions answered least positively was the "Financing" group.
4) The case study results showed that the least challenging constraints in the Turkish wheat value chain are related to infrastructure. It was found that

the subgroup of questions answered most positively was the "Infrastructure and Technology" group.

5) It is important that the policies to be developed for the wheat value chain are inclusive of each sector stakeholder and respond to their needs. For instance, among the opinions of sector stakeholders, a remarkable difference was observed between *stakeholders* in the question category of "Marketing and communication".
6) In the context of sustainability, it is crucial that the policies to be developed for value chains also take into account spatial differences and focus on regional needs and potentials rather than one-size-fits-all approaches. According to the opinions of sector stakeholders, a significant difference was observed between *provinces* in the question category of "Marketing and communication".

5.2. Future Research Areas

- Comparison of wheat sector by region in terms of marketing and communication, financing, and infrastructure and technology. Identifying regional differences and similarities and revealing their main causes.
- A detailed examination of the significant differences in the views among provinces in the field of “Marketing and Communication” (as revealed in this study) in the context of the cause-effect relationship.
- A detailed examination of the significant differences in the views among activity areas in the field of “Marketing and Communication” (as revealed in this study) in the context of the cause-effect relationship.
- Applicability of methods focusing on climate change and environment in value chain development. What are the best practices against climate change and environmental risks?

6. BIBLIOGRAPHY

1. Agriculture for Impact (2014): Small and Growing: Entrepreneurship in African Agriculture, *A Montpellier Panel Report,* June 2014.
2. AKBAS, B. - DIGDEM, I. - UFTADE, G. (2005): Orta Anadolu Bölgesinde Tohumluk Olarak Kullanılan Buğday Tohumlarında Virüs Varlığı. *Bitki Koruma Bülteni*, 45(1-4), p. 56.
3. BALASSA B. (1965): Trade Liberalization and Revealed Comparative Advantage. *Manchester School of Economic and Social Studies*. 33: p. 99–124.
4. CERNY, B.A., - KAISER, H.F. (1977): A Study of a Measure of Sampling Adequacy for Factor-Analytic Correlation Matrices. *Multivariate Behavioral Research*, 12(1), p. 43-47.
5. CEYLAN, N. (2020): Policy Assessment of Wheat Production in Turkey. *Problems of World Agriculture*, 20(2), p. 4-11; DOI: 10.22630/PRS.2020.20.2.8
6. CRONBACH, L.J. (1951): Coeficient Alpha and the Internal Structure of Tests. *Psychometrika*, 16(3), p. 247-334.
7. IBM CORP. Released (2012): IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.
8. International Trade Centre (2020): *ITC Trade map, International Trade Statistics.* [Online] Available at: https://www.trademap.org/Country_SelProduct_TS.aspx?nvpm=1%7c%7c%7c%7c%7c1101%7c%7c%7c4%7c1%7c1%7c2%7c2%7c1%7c2%7c1%7c1%7c1 [Accessed 20.02.2020].
9. KAPLINSKY, R. - MORRIS, M. (2000): *A Handbook for Value Chain Research* (Vol. 113). Brighton: University of Sussex, Institute of Development Studies.

10. KRUSKAL, W. - WALLIS, W. (1952): Use of Ranks in One-Criterion Variance Analysis. *Journal of the American Statistical Association*, 47(260), p. 583-621.
11. MASSEY, F. (1951): The Kolmogorov-Smirnov Test for Goodness of Fit. *Journal of the American Statistical Association*, 46(253), p. 68-78.
12. MONKE, E.A. - PEARSON, S.R. (1989): *The Policy Analysis Matrix for Agricultural Development* (Vol.201).Ithaca:Cornell University Press.
13. NORTON, R. (2014): *Agricultural Value Chains: A Game Changer for Smallholders*, Devex Impact, [Online] Available at: https://www.devex.com/news/agricultural-value-chains-a-game-changer-for-small-holders-83981. Search engine: Google. Key words: agricultural value chains. Date of search: 2020.04.30.
14. TRIENEKENS J.H. (2011): Agricultural Value Chains in Developing Countries A Framework for Analysis, *International Food and Agribusiness Management Review*, Wageningen.
15. TUIK (2020): *Turkish Statistical Institute, Agricultural statistics database*. [Online] Available at: https://data.tuik.gov.tr/Bulten/Index?p=Bitkisel-Urun-Denge-Tablolari-2018-2019-33740.
    [Accessed: 04.11.2020].
16. Turkish Grain Board (2019): *2018 Yılı Hububat Raporu*. Toprak Mahsulleri Ofisi, Ankara.

7. PUBLICATIONS

CEYLAN N. - ABOELNAGA S. (2018): The Effects of European Union Cohesion Policies on Regional Disparities in Last Decade, In 3rd International Young Researcher Scientific Conference: *Sustainable Regional Development - Challenges of Space & Society in the 21st Century*, Gödöllő, Hungary, p. 343-355. ISBN: 9789632697307

CEYLAN, N. (2018): Evolution of Value Creation, From Profitability to Sustainability. In: KÁPOSZTA J., NAGY H. (eds.), 5th VUA YOUTH SCIENTIFIC SESSION: *Smart Developments and Sustainability*, Gödöllő, Hungary, p.182-188. ISBN: 978-963-269-788-8

CEYLAN, N. (2019): Regional Development Practices in Turkey. p. 129-140, In: NAGY, H. (ed.), *Regional Policy in Practice in Selected African, Asian and European Countries*. Rzeszow.

CEYLAN, N. (2019): A Comparative Analysis of the Wheat Value Chains in Hungary and Turkey. *Studia Mundi – Economica,* 6(3), p. 68-81.

CEYLAN, N. (2019): Revealed Comparative Advantage of Turkish and Hungarian Wheat Sectors. *Problems of World Agriculture/Problemy Rolnictwa Światowego,* 19(34) p.16-22.

CEYLAN, N. (2020): Policy Assessment of Wheat Production in Turkey. *Problems of World Agriculture/Problemy Rolnictwa Światowego,* 20(35): 2 p. 4-11.

CEYLAN, N. (2020): Intra Industry Trade Performance of Turkish Grain Sector vis-a-vis EU28, In International Conference on Social Science & Humanities, 2020, *PEOPLE: International Journal of Social Sciences: Proceedings* p. 20-20.