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FOREWORD

Mokrani et al. analyze the sustainability of Tunisian olive growing system. The results showed that those who adopt the modern management of the olive tree are more sustainable than the traditional type. The traditional mode of management and the lack of innovation threaten future farming and viability of traditional olive tree farms. Given that, the most traditional farms are family farms and involve poor households, and to ensure inclusive development of these social categories, decisionmakers must enhance the adoption of new technologies and new management methods for better economic viability and moving up at the scale of sustainability.

Boudiche et al. analyze food quantitative security policy impact on Tunisian consumption model versus Mediterranean diet and to readjust policies for qualitative food security. Variables of consumption evolution were determined by linear regression: price, income, location, domestic production and a quality factor measuring the conformity degree with Mediterranean diet. Paper shows that in Tunisia, food consumption has known an important change and has deviated from the Mediterranean diet which used to characterize. In order to achieve a better adherence to Mediterranean diet, new measures and synergy should take place at several levels policy makers, producers and consumers.

Sandri et al. estimate the overall impact of digitalization on employment. Paper analyzes the impact of economic growth and digitalization on unemployment change, evaluating a modified version of Okun's Law on a balanced panel data set for 58 countries between 2013 and 2019. The results from the estimation of a fixed-effect model show the empirical validity of Okun's law for the sampled countries and a significant contribution of digitalization on unemployment reduction.

Aytop and Çankaya deals with the effect of consumers' perceptions of GI on purchasing intention. The SEM results indicated that food with GI perception had a statistically significant and positive effect on the intention to purchase foods with GI. Consumers want to buy geographically marked foods as they are "healthier", "higher quality", and "more reliable". Consumers have positive opinions about foods with GI, and are willing to pay more for them. Monitoring the production processes of GI foods that are more delicious, healthier, reliable, and ensuring the continuity in product quality will increase the demand of consumers for geographically marked foods.

Li et al. examine the factors that influence the adoption of technological innovation in Ghanaian agribusinesses. Structural equation modeling was used to examine data collected from 1526 agribusiness employees in Ghana using a convenience sampling technique and a questionnaire survey. The findings indicate that internal, and external factors have an impact on information and communication technology, and new materials and technology, but no or little impact on biotechnology respectively. Also, the study reveal that human capital factors have a substantial impact on information and communication technology, new materials and technology and biotechnology. The study underscores the need for agribusinesses to focus on internal and human capital factors since they increase employees' productivity and efficiency.

Consumers' food safety perceptions in three Mediterranean countries is analyzed by *Bouranta et al.* The results indicate that there is a significant heterogeneity in consumers' food safety perceptions in the three countries. The Spanish sample has the greatest level of trust in the supply chain in terms of food safety and the highest level of illusion of food control. The Italians evaluate the food characteristics and the QMS-FSMS's labeling higher than the Spanish and the Greeks. This multinational study brings to light the different types of food safety concerns of consumers from three Mediterranean countries.

Cento and Bahşi deals with the problems of many Syrians that have had to flee their country and seek refuge in neighbouring countries and faced a great deal of financial and social problems in their new countries of residence. The authors evaluate the circumstances of Syrian individuals under temporary protection status in Turkey in the agricultural sector from the perspective of farmers. According to the findings of the research, 61.5% of agricultural businesses in Gaziantep employ Syrian refugees, mainly during harvesting season. The main reason for farmers opting to employ Syrian workers under temporary protection order is low wages (78.8%). Despite the presence of legal regulations in Turkey outlining how refugees can become a part of the labour force, these haven't prevented the prevalence of off-the-books employment.

Minotti explores how the ongoing changes of the organic sector are reflected in consumers' perspectives of organic agriculture and their preferences for organic food quality in Italy. Three main groups of consumers were identified: "Mainstreaming for the better good", "Critical supporters looking for more", "Organic intensification supporters". Despite each ideal-typical group showing different perceptions of the future of the organic movement, they all shared similar policy implications. Three main topics of discussion emerged from the results of this study which are: the expectations of the consumers towards the future of the organic movement, the role of trust in purchasing behaviors and the importance of supporting rural development.

Sustainability assessment of Tunisian olive growing systems

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Abstract

This paper aims to assess and to analyze the sustainability of Tunisian olive growing system. Results show two types of farms in this sector. The first one is the traditional farms. The second is the modern farms. The Sustainable Value method (SV_method) inspired from the “ADVANCE” approach showed that those who adopt the modern management of the olive tree are more sustainable than the traditional type. In fact, the modern group presents a positive Sustainable Value. However, the traditional group recorded less efficient values than the Benchmark. Indeed, its Sustainable Value is negative, which means that the farms belonging to this group are not economically viable. Therefore, the traditional mode of management and the lack of innovation threaten future farming and viability of traditional olive tree farms. Furthermore, since most of these farms are familial type, the cultural utility, which explains the current existence of these farms, will be insufficient and decision-makers must enhance the adoption of new governance models.

Keywords: Olive tree, Sustainability, Viability, Institutions, Opportunity costs, Added value, Performance.

1. Introduction

In Tunisia, olive growing is a strategic sector. The area occupied by olive trees exceeds one third of the useful agricultural land and currently holds 1,788,000 hectares, representing 80 percent of the total area devoted to tree crop plantations (Weber *et al.*, 2020). With 5 percent of the world's total olive oil exports, Tunisia is the second world producer after Spain. This sector contributes about 50% of Tunisian agro-food exports (ONAGRI, 2017). On the social level, it accounts for 65% of all farmer's jobs in Tunisia and provides more than 40 million working

days per year. It also operates more than 1700 oil mills (Bayoudh, 2014). Therefore, it is a factor of stability and a source of income for the populations in rural areas.

The olive tree area has increased in the last two decades (Figure 1). Demand and prices increase are the major factors of this expansion of olive tree area. In addition, the climatic variability and water scarcity lead to the transformation of production systems towards olive growing systems (Sansa *et al.*, 2018). Due to low water and soil resources requirements, the olive tree is a crop that the public authorities have sought to promote and farmers embrace

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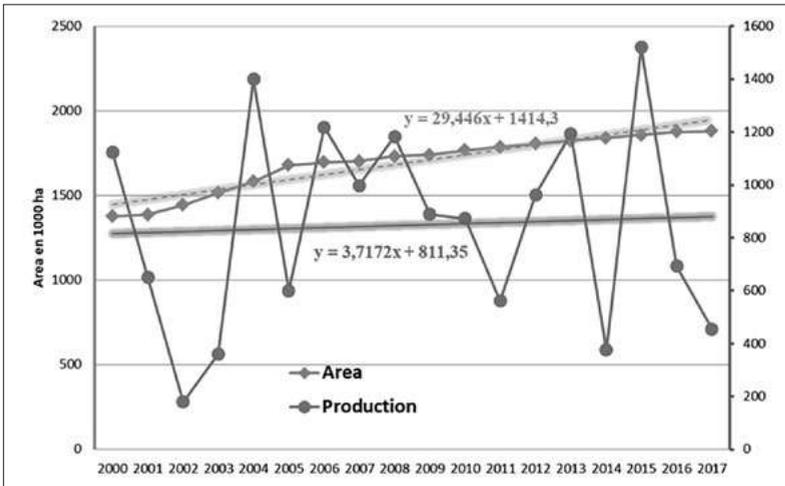


Figure 1 - Area and production evolutions of olive tree.

Source: DGPA, 2016-2018; Sai and Msallem, 2005; DGDEA, 2017.

this choice, by reason of the resilience of the olive tree to climate change.

Area increases were accompanied by a small production increase. In fact, despite the new extensions of the areas, the olive production has increased slightly from an average of 826,300 tons/year during the decade 2002-2011 to 867,000 tons/year during 2012-2017. However, analysis of the evolution of yields shows a downward trend (Figure 2). The average yield of olive farms was around 489 kg/ha during 2002-2011. This yield is very low compared to the potential of olive trees, which can exceed 900 kg/ha. Moreover, Tunisia lags behind its competitors in the EU and the MENA region in terms of olive yield during the same period.

Yield decreases are an indicator of efficiency and performance drop of Tunisian olive oil sector. This can threaten farmers' incomes and farms 'sustainability level'. If promoting the need for

sustainable farming has become universal, agreement as to what is required to achieve it has not. This paper aims to analyze the sustainability of the Tunisian olive sector and its determinants. Results can constitute a crucial step for decision-makers and other stakeholders to accomplish Sustainable Development Goals in this sector.

The most common definition of sustainability comes from the 1987 Brundtland Commission report for the United Nations. It defines the concept as "meeting the needs of the present without compromising the ability of future generations to meet their own needs". Farming sustainability is characterized by simultaneous concern for the environment, maintaining social equity and ensuring economic profitability of the conducted activity. Supporting farm viability is one of the key objectives of agricultural sustainability. Economic viability measurement has received consideration

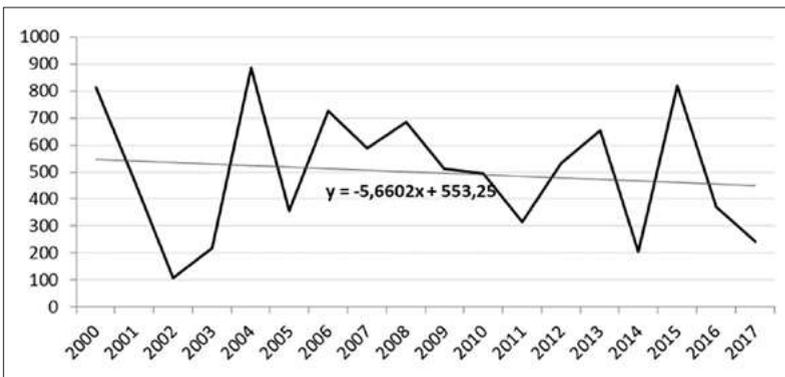


Figure 2 - Evolution of olive yields in kg/ha.

Source: Sai and Msallem, 2005; DGPA, 2016-2018; DGDEA, 2017.

at different periods in different areas, often at periods of difficulty within the sector. For researchers in the USA and Canada, viability is defined as the income needs for family farms (Adelaja *et al.*, 2004; Frawley and Commins, 1996). The main issue among European researchers focuses on farm viability as an opportunity cost measure (Aggelopoulos *et al.*, 2007; Scott, 2001; Argilés, 2001; Vrolijk *et al.*, 2010; Berkum *et al.*, 2016). The most common principle of farm viability for these approaches is a comparison between the income produced by farms and a reference income (O'Donoghue *et al.*, 2016).

In the Tunisian context, concerns have been raised regarding sustainability of different sectors. Particular attention was given to the sustainability of agricultural sectors by several Tunisian researchers (Laajimi and Ben Nasr, 2009; Ben Nasr *et al.*, 2014; Ben Abdallah *et al.*, 2018; M'hamdi *et al.*, 2017; Attia *et al.*, 2021; Jellali *et al.*, 2021).

Several methods have been used to assess farms sustainability. The IDEA method ("Indicateurs de Durabilité des Exploitations Agricoles" or Farm Sustainability Indicators), which is a global method for evaluating the sustainability of farming systems according to the agro-ecological, socio-territorial and economic dimensions and the five properties of sustainable agriculture (autonomy, territorial anchorage, global responsibility, robustness, productive capacity and reproductive capacity of goods and services) is one way of giving practical expression to the concept of sustainable farms (Zahm *et al.*, 2008; Alary *et al.*, 2022). A "self-assessment" tool shows technical weaknesses and possible avenues for progress (Vilain, 2008; IDEA, 2021). Laajimi and Ben Nasr (2009) and then Ben Abdallah *et al.* (2021) used the IDEA Method to assess the sustainability of Tunisian olive sector. They showed that organic olive farms are more sustainable than conventional framers.

As well, Life Cycle Assessment (LCA) is a method of quantifying the environmental impacts of a product throughout its life cycle (e.g. agriculture, transport, packaging etc.). This method takes into account all stages of a product's life cycle. Additionally, it takes into account several major environmental issues, not only climate but also water quality, air quality,

soil impact, and climate change. At each stage of the chain, material, energy and pollutant emission balances are carried out and aggregated in the form of a set of environmental indicators (AGRIBALYSE, 2020). Ben Abdallah *et al.* (2021) used this method to analyze and to compare olive cropping systems in Tunisia. Results showed that innovative systems are more sustainable than traditional ones.

One of the recent famous methods for measuring firm sustainability that incorporates the environmental, the social and the economic dimensions, is the Sustainable Value (SV) approach. It is called the triple bottom approach and it simplifies the measurement of company sustainable performance by expressing sustainability in monetary value called "sustainable added value (Hahn *et al.*, 2015; Kassem *et al.*, 2016). This approach is now widely used to assess agricultural sustainability in many regions around the world and it shows relevant and satisfactory results (Van Passel *et al.*, 2009; Gómez-Luciano, 2019; Halland *et al.*, 2020; Thomas *et al.*, 2020; Triyono *et al.*, 2021; Cammarata *et al.*, 2021; Moretti *et al.*, 2021). Hence, and according to data availability, the SV approach was adopted here to assess the sustainability of Tunisian olive farms. The first part of the paper will present the methodology adopted. The second part will be dedicated to the presentation and discussion of the results obtained.

2. Materials and methods

2.1. The sustainability assessment method "Sustainable Value Approach"

Compared to other methods, the Sustainable Value Approach measures the use of natural, physical and human capitals in a new way. It translates the environmental and sustainability terms and performances into investor and manager languages. From this point of view, farms create value whenever they use inputs and resources more efficiently than other farms. Hence, the ADVANCE guide published by (Figge *et al.*, 2006; Hahn *et al.*, 2007), provides a comprehensive and a practice method to assess environmental performance of firms in various sectors.

According to this approach, in order to assess

farms' sustainability, we need to assess the use of the entire bundle resources and capitals. However, in the conventional economic approach analysts focus on only financial capital. Therefore, to assess sustainability of Tunisian olive farms we calculate the "Sustainable Value", which takes into account economic, social and environmental capital. Hence, a farm creates Sustainable Value when the economic, environmental, and social resources used are more efficient than the "Benchmark". This value is intended by calculating the opportunity cost of these resources.

2.1.1. Capital and resources identification

In our case, we focus on the performance of both human and natural capitals used by farms in olive production. For the human capital, labor, particularly family labor measured by the share of the farm manager's time devoted to the farm, reflects the human capital. This share is evaluated at 20% of the farmer's time for traditional farms and at 40% of the farmer's time for modern farms. Since the olive tree is mainly carried out in rain-fed mode, the natural capital was limited to land resources measured by the farm area.

2.1.2. The choice of Benchmark

In our case, this is the estimated "added value" for each farm. We will compare the observed value added of the farms to the frontier farm. The economic viability of a farm is assessed by its capacity to remunerate the production factors used at their opportunity costs. These costs would be approximated by the long-term remuneration of the production factors taken into account. The long-term equilibrium ensuring these remunerations would be characterized by constant returns to scale. In the case of these returns, and in application of Euler's identity, the "added values" generated by the different farms would be just sufficient to remunerate the factors of production.

$$VA_j = \sum_{x_i=1}^n X_i \frac{\partial Y_j}{\partial X_i} \tag{1}$$

With:
 VA_j : Value generated by the farm j
 X_i : The production factor (i) to be remunerated
 $\frac{\partial Y_j}{\partial X_i}$: Marginal productivity of factors x_i equal to its opportunity cost in the long-term equilibrium.

The following model is used to estimate the marginal productivities of these factors of production as an acceptable approximation of their opportunity costs:

$$VA_j = \alpha L_j + K_j + \epsilon \tag{2}$$

With:
 VA_j : Added value generated by the farm j
 L_j : Family labor force used by farm j
 K_j : Value of the land planted for farm j
 α and β : coefficients to be estimated
 ϵ : Error term.

2.1.3. "Sustainable Value" estimation

Firstly we proceed by the calculation of the "added value" of the Benchmark for each resource used, and this by the calculation of the "Efficiency of Benchmark" by dividing the "added value" of the Benchmark (Y^*) by the amount of resource used X_i^* .

$$SV_B = \frac{Y^*}{X_i^*} \tag{3}$$

Then we proceed by the calculation of the "added value" achieved by the olive farm by subtracting the intermediate consumption from the profit. Then we calculate the "Efficiency of Exploitation" which is calculated by the "added value" of the farm divided by the amount of resource used. The "Contribution Value" calculation expresses the difference between the value added created by the farm and the opportunity cost of each resource used. This is done by comparing the value added with the calculated opportunity cost, which represents the value added that should have been created by each resource used.

$$SV_{ji} = \frac{Y_j}{x_{ji}} - \frac{Y^*}{x_i^*} \tag{4}$$

With:
 SV_{ji} : Sustainable Value generated by the farm j using the resource i
 Y_j : Added value generated by the farm j
 Y^* : Added value generated by the Benchmark
 X_{ji} : Quantity of resource i used by the farm j
 X_i^* : Quantity of resource i used by the Benchmark.

Finally, the “Sustainable Value” is calculated by dividing the sum of the “Contribution Value” by the number of resources considered. Value is created only when the value added exceeds the cost.

$$SV_j = \frac{1}{R} \sum_{i=1}^R SV_{ji} \quad (5)$$

With:

SV_{ji} : Sustainable Value generated by the farm j using the resource i

R : number of resources used by the farm j .

2.2. Data collection and study area

2.2.1. Study area

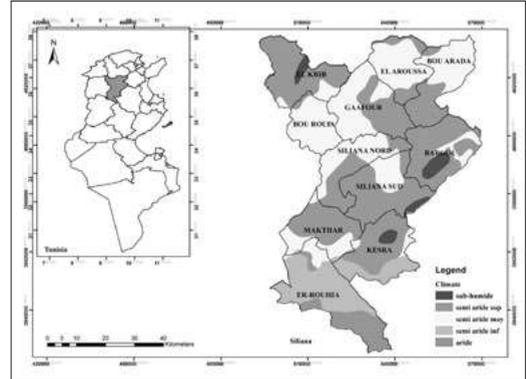
Based on the research activities carried out by the researchers of the Olive Tree Institute (Mokrani *et al.*, 2019; Hammami *et al.*, 2018; Sai *et al.*, 2013), the governorate of Siliana has been identified as a region that best illustrates the above-mentioned problem. The situation of our study area in the north of Tunisia is a faithful representation of our problematic of the low productivity growth of the olive sector and is in line with our observation that the extensive solution has reached its limits, hence the necessity to act through the intensive solution for better productivity results.

In our study area, the olive tree is expanding. In addition, there has been a transformation of the total cultivation system due to the reduction of risk, the relatively lower cost, and the adaptation to climatic conditions, in addition to sufficient rainfall to move farmer towards olive growing.

In addition to a promising olive oil market which attracts farmers thanks to the increase in exports. Indeed, the exported quantities of olive oil in 2010 were equal to 108800 T to reach 372800T in 2020, passing by 288500T in 2015 (ONAGRI, 2021).

The prices of extra virgin olive oil are following an upward trend to reach 3.28 euros/kg in Spain, 4.23 euros/kg in Italy, 3.05 euros/kg in Greece and 2.67 euros/kg in Tunisia. This will continue until September 2021. However, this upward trend remains quite high compared to the previous year. Indeed, the average price of olive oil during the first three months of the 2021/2022 campaign has increased by 40% compared to the

Figure 3 - Location and bio-climate of the Siliana study area.



same period of the previous campaign with a variation from 21% to 56% (ONAGRI, 2022).

2.2.2. Data and survey

Data used here were collected by a survey conducted among 21 farms. To assess value we proceed by: firstly, a farm’s characterization, then an identification of inputs and resources used by the farm, the production level, and the production value. The sample shows two types of farms. The traditional farms constitute the first type. The term “traditional” refers to farms that are related to climatic conditions and to olive growers who adopt the extensive system to manage their olive groves. They are characterized by low productivity and an economic viability of their farms that is threatened in the long term. The modern farms represent the second type. “Modern” refers to farmers who follow the technological package recommended by the specialized institutions. They provide the necessary inputs to the olive grove. They represent a higher productivity and economic viability by ensuring the sustainability of their farms.

The parent population was identified from the list of all olive farmers in the study area provided by the regional services of the Ministry of Agriculture, i.e. about 300 farmers. This list, with the help of local services, was subdivided into two groups of farmers according to their membership in the two types of management systems, modern or traditional. The modern farmers represent 40% of the total number of farmers on the list and the remaining 60% are traditional farmers. A random sample

Table 1 - Average's characteristics of two farms types.

<i>Characteristics</i>	<i>Traditional Farms group</i>	<i>Modern Farms group</i>
Added Value (TD)	3059	7317
Area (ha)	7	5
Yield (Tonne/ha)	1	2
Number of olive tree / ha	106	99
Ploughing cost (TD)	1477	1013
Total labour force (TD)	3884	2959
Pruning cost (TD)	1129	746
Fertilisers cost (TD)	0	437
Farmers age (years)	53	56

was drawn from these two groups. The structure of this sample is consistent with the structure of the parent population. Since the same practices and farm's characteristics are observed within the same group. Such a size was considered sufficient. It is composed of 13 farmers from the traditional group and the remaining 8 modern farms.

3. Results and discussion

3.1. Resource identification

Results show the existence of two groups of management of olive trees: traditional one and modern one. The traditional one is characterized by farmers who have chosen to follow the traditional olive tree management. Their behavior is limited to the use of traditionally accepted resources such as soil ploughing, pruning every two years, dry farming of the olive tree and

some are following the advice of referent farmers. Like leaders with long experience in olive management, who have remained a little permeable to official technical recommendations. Moreover, the modern ones are managed by "Intensifier" farmers who adopt new technologies to develop their farms and listen to the advice and recommendations of the extension services provided by the Ministry of Agriculture. They mainly adopt fertilizers as a modern technique to improve the productivity of their olive groves.

It should be noted that, according to the survey, the lack and scarcity of labor, accentuated by the orientation of young people towards other activities, could explain the presence of family labor in the two types of farms considered in our work. In addition, most farms are rainfed and irrigation is only present on a few farms, although it is complementary. Thus, the natural capital considered here is land.

According to Table 2, the traditional farms with 13 farmers in the sample record an average farm land around 7 ha and an average physical capital around 51692 dt. While the average of farmland is around 5ha to the modern farms including 8 farmers and an average physical capital of 35000 dt.

3.2. Benchmark

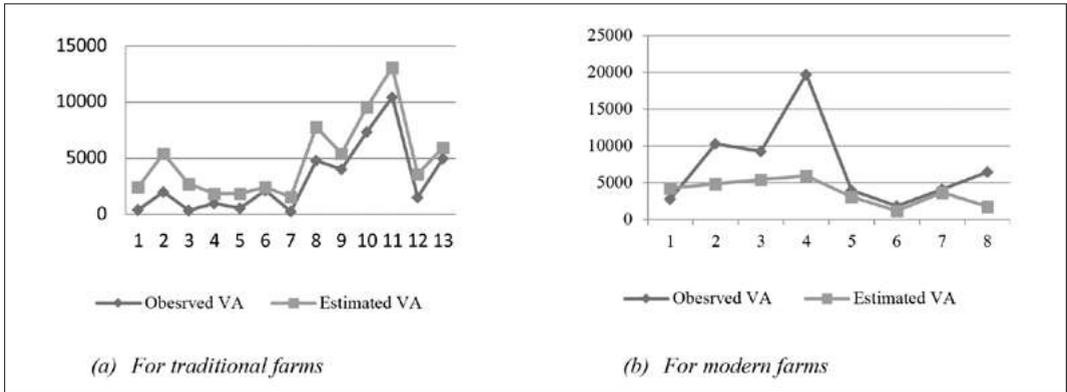
Using the model in equation (2), we estimated the value added used as a Benchmark for each farm.

Results show that the observed value added of modern farms (Figure 5b) is higher than the estimated value added. However for the traditional type of farms (Figure 5a), the observed value added is less than the estimated

Table 2 - Descriptive analysis of resource's exploitations.

		<i>Human capital (days/year)</i>	<i>Natural Capital (ha)</i>	<i>Physical capital (DT)</i>
Traditional Farms	Min	90	1.5	10500
	Max	1320	22	15400
	Average	420	7	51692
Modern Farms	Min	240	2	14000
	Max	1200	10	70000
	Average	600	5	35000

Figure 4 - Model results and comparison between observed and estimated value added of the farms.



value added. In other words, using all resources could produce more observed value added than estimated value added for modern farms. For example, the farm (4) in the modern group obtained observed value added around 19760 dt while estimated value added is around 5954 dt. For traditional farms, they could be using resources in a more productive way to improve its value added to reach estimated value added which is a Benchmark in our case.

3.3. “Contribution Value” of each resource

The results obtained allowed us to assess the “Contribution Value” of each resource used of the 21 olive farms surveyed. Figures below (5a, 5b, 5c) illustrate the resource value sustainability that expresses the comparison of the added value with the calculated opportunity cost, which represents the added value that should have been created by each resource used. In fact,

Figure 5 - Resources used Value Sustainability: (a) Labor Value Sustainability; (b) Capital Value Sustainability; (c) Soil Resource Value Sustainability.

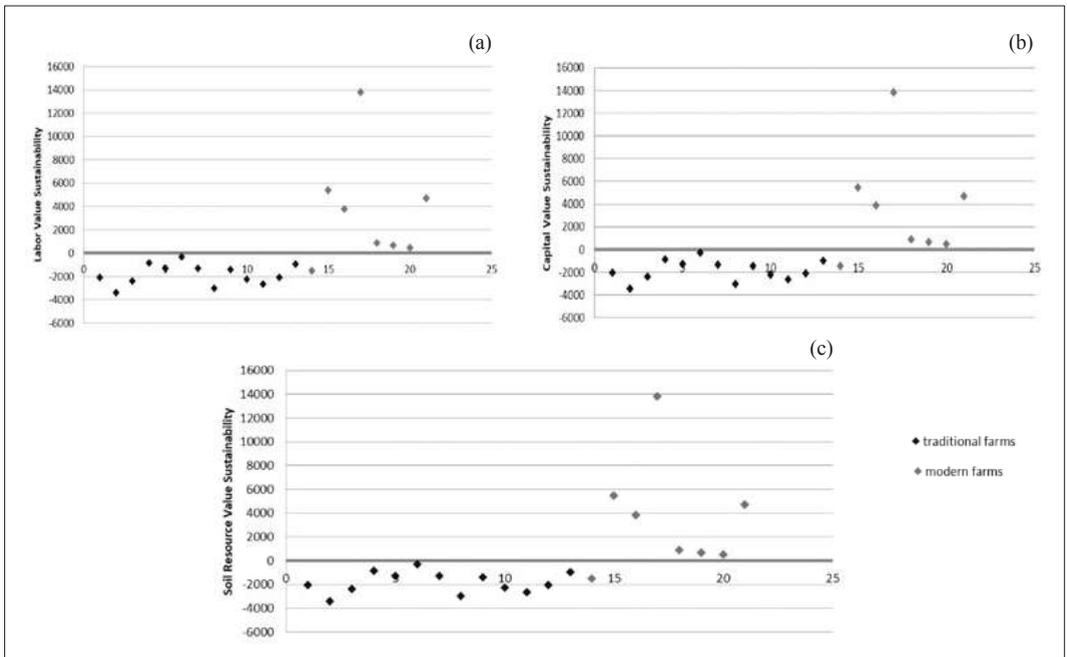
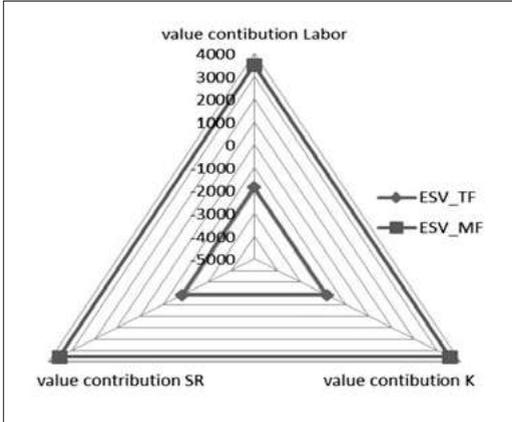


Figure 6 - The average of the “Contribution Value” relating to each resource.



ESV_TF: Estimated Sustainable Value for the traditional farm; *ESV_MF*: Estimated Sustainable Value for the modern farm.

the group of farms with a positive “Labor Value Sustainability” (figure a) represents the modern farms. As for the farms recording negative “Labor Value Sustainability”, they are represented by farms whose farmers have chosen to follow the traditional olive tree management. In other words, its value added is lower than the opportunity cost of resources used.

Figures (5b) and (5c) show the same result of farm sustainability values for both traditional and modern groups. Although the modern group

indicates a comforting economic viability, as a whole. In other words, its added value produced is higher than the opportunity cost of each resource used. Poor plantation management or other personal constraints could explain the economic unsustainability of the other group members’ farms. The low productivity registered at farm level and the choices of olive tree management not oriented towards the technology adoption, can explain a negative result of the traditional group.

Figure 5 shows the average “Contribution Value” of each resource. Generally, it is negative for the traditional group and positive for the modern group, which is in line with the above results.

3.4. Farm Sustainable Value

Using the input efficient resource as a Benchmark to calculate the Sustainable Value of all farms, the Figure 6 illustrates the Sustainable Value from lowest to highest one relative to all the surveyed farms. The “Sustainable Value” shows that two management categories of olive tree farms with different behaviors have generated different “Sustainable Value” of which those adopting modern olive management are positive. Indeed, the farms, for example, 15, 16, 17, 18, 19, 20, 21, perform better by adopting the technological package recommended by the specialized institutions and have a positive Sustainable

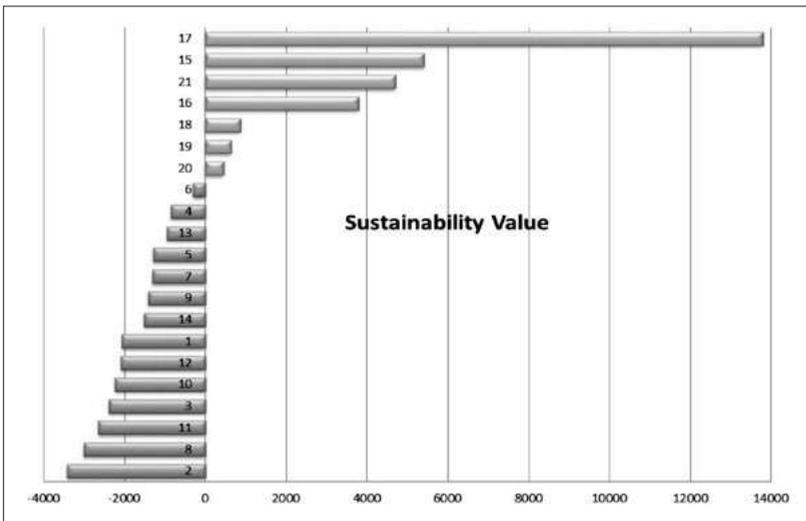


Figure 7 - Economic Sustainability Value of farms.

Value, as shown in Figure 6. In our case, farmers mainly use fertilizers to boost the productivity of their olive groves. That is, the values recorded by these farms are higher than the performance achieved by the Benchmark. This would indicate that the modern farms use all their resources in the most productive way.

However, the traditional group records less efficient values than the Benchmark. Indeed, its Sustainable Value is negative, which means that the farms belonging to this group are not economically viable. Indeed, these farms are related to climatic conditions and to olive growers who adopt the extensive system to manage their olive groves, like farms 2, 8, 11, 3, 10 as shown in Figure 6, which limits the achievement of a positive “Sustainable Value”. In this case, farms can improve their Sustainable Value by applying their resources in a more productive way to moving towards the added value estimated that represents the long-term economic stability of farms. It is therefore preferable that they move towards the behavior of the modern group to avoid their long-term disappearance and improve the olive tree productivity of their farms. The negative results for the traditional group may indicate that the lack of non-agricultural employment opportunities and the desire to maintain the social status of landowner are explanatory elements for such a situation, which is not in line with the economic rationality that is supposed to guide the behavior of micro-economic agents.

The “Farm Sustainable Value” results also confirmed that modern and innovative farms moving towards the adoption of the technology package are more efficient and favors the sustainability of their farms, compared to the traditional or conventional olive groves that rely on extensive management of their production system.

5. Conclusions

This study proposes a new approach to assess the performance of Tunisian olive tree farms. This approach takes into account the principle of balance between the three pillars of sustainability, namely economic profitability, social equity and respect for the environment.

The application of the “Sustainable Value method” led to the assessment of Sustainable Value of each factor used in the olive production process, which allowed classifying farms according to both viability levels and sustainable values achieved.

The results showed two types of farms. The modern farms with a high level of viability and good economic performance and the traditional farms with a very low economic performance. In fact, for second type of farms, the values generated for each capital (Natural capital, physical capital and human capital) used are lower than the opportunity costs. The low “added values” and the technical inefficiency of resources threaten the economic viability of these exploitations. The current existence of these operations is explained by a cultural utility.

Overall, it appears that the two types of Farms have two different rationales: the economic rationality for the modern farms and the cultural rationality for the traditional farms. Given that, the most traditional farms are family farms and involve poor households, and to ensure inclusive development of these social categories, decision-makers must enhance the adoption of new technologies and new management methods for better economic viability and moving up at the scale of sustainability.

Thus, it is preferable to orient farmers more towards the modern olive management system. Moreover, to accommodate their situations by encouraging them to take advantage of the extension which needs to be intensified. In addition, it is recommended to have feedback from the farmers’ experiences and to establish a continuous communication between the two interveners.

In the end, our study represents an extract of the situation of the olive-growing system in Tunisia, hence the interest to extend the study areas and to design other corresponding typologies according to an economic model. It is desirable to think of integrating the biophysical factor and the climate change impact to try to better explain and enhance the change of vocation of agricultural land. In our case, it is the change from cereals to olive trees in the northern region.

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Enhancing quality-driven food consumption policies in Tunisia

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Abstract

In Tunisia, food security policies' objectives are increasing production to satisfy the growing demand and reduce the food deficit rate (35% per year). Since 1980, intensive production system and government subsidies for basic commodities were used to enhance food availability. This article aims to analyze food quantitative security policy impact on Tunisian consumption model versus Mediterranean diet and to readjust policies for qualitative food security. Based on five-year National Statistics Institute surveys on household consumption from 1985 to 2015, ANOVA analysis shows the need to address rural and urban consumption separately. Three groups were identified through clustering by consumption deviation degree compared to 1985. Variables of consumption evolution were determined by linear regression: price, income, location, domestic production and a quality factor measuring the conformity degree with Mediterranean diet. In order to achieve a better adherence to Mediterranean diet, new measures and synergy should take place at several levels policy makers, producers and consumers.

Keywords: Food security, Mediterranean diet, ANOVA, Clustering, Linear regression, Tunisia.

1. Introduction

One of the main concerns in developing countries is to ensure food security for their population. This issue has gained importance due to the international price increase, climate change and limited access to natural resources. In order to reach such an objective, a global approach is required not only to increase production and availability of food to satisfy growing demand but also to provide higher quality of food.

Supplying food with the required quality has become a priority seeing the changes observed in food habits in the wake of urbanization and

the improvement of lifestyles. These changes have led to a decline in the adoption of traditional Mediterranean diet, which has then led to the appearance of chronic diseases in the region (FAO, 2014).

Several scientific works confirmed that the Mediterranean diet, formerly adopted in the Mediterranean countries, is considered as a nutritional and healthy food model with important benefits for the population (Ridolfi *et al.*, 2020; Dogui *et al.*, 2021; Med diet project, 2017). Declared an "intangible heritage of humanity" in 2010, the Mediterranean model is not a homogeneous model in the Mediterranean area due to

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regional social, cultural and economic variations (UNESCO, 2010; Khaldi *et al.*, 2016). According to Rastoin and Ghersi (2010), the Mediterranean diet is placed at the center of this “territorialized food system”. The Mediterranean diet is based on organoleptic and cultural products and contributes in achieving food systems sustainability (biodiversity, social, governance), food security and nutrition in the Mediterranean countries and worldwide. Among its multi-dimensional benefits are the sustainable consumption and health preservation; the territorial development (adaptation to natural resources, quality linked to origin); the historical, cultural and social anchorage based on local experiences, social preferences and the sustainability of production systems. (Lacirignola and Capone, 2009). However, this model has been lost during the three past decades due to the changing urban lifestyles (Da Silva *et al.*, 2009; Malassis and Al-laya, 1996; Lacirignola *et al.*, 2015).

In Tunisia, the main objective of food security policies since 1980 was to increase the production in response to the increasing consumers’ needs and to reduce the food deficit (35% on average a year) while ensuring the equilibrium of the trade balance (Khaldi and Naili, 1995). This choice was based both on the adoption and the extension of an intensive production system and on a subsidy policy of basic products to protect the purchasing power of the consumers.

Despite the progress realized in terms of production (quantity and diversification), this model has not succeeded in reducing the food deficit related to basic products, which became a chronic problem, in particular for cereals (60% of deficit). This model also led to the overuse of natural resources (50% of deficit in water), the erosion of biodiversity (almost total disappearance of the local varieties of agricultural species) and the loss of authentic and local products. At the same time, changes in food habits have been observed in transformed food products containing higher energetic values and low nutritional quality which have generated chronic diseases and caused 50 % of deaths in Tunisia (El Ati *et al.*, 2012).

Food security as defined by the FAO “is reached when all the population has, at any time,

a physical and economic access to sufficient, healthy and nourishing food allowing them to satisfy their energetic needs and their food preferences for a more healthy and active life” (FAO,1996). This definition refers to another objective, which is the improvement of the nutritional state of the population. More recently, the renewed approach of food security has been how to ensure a sufficient amount of food that “aims at the efficiency during the food chain and at sustainable food practices” (CIHEAM, 2012).

This article seeks to assess the impact of the food security policies on the distortion of consumption of the Mediterranean diet according to a quantitative approach and evaluate the consequences of negligence of food security, according to a qualitative approach, at the levels of both public authorities and consumers.

The specific objective is to analyze the trends of consumption during the past thirty years in Tunisia and compare this with the degree of distortion impacting the Mediterranean food model and identify the socio-economic factors behind this trend. For this purpose, we study, at first, the food security policies focused on the intensification of production and the subsidies in Tunisia. Then, we analyze the impact of food security policies on the evolution of demand. To deepen this subject, we propose an empirical study of the consumption behavior based on clustering methods of foodstuffs and an econometric model to explain the determinant factors of consumption. Finally, we try to propose alternative policies for sustainable qualitative food security.

2. Food security policies in Tunisia

The approach proposed for the assessment of food security is based on the analysis at two levels: supply and demand. The study will focus on the structural characteristics and the degree of consumers’ needs satisfaction.

2.1. Food supply

In Tunisia, food security is strongly linked to the agricultural production system. The agricultural sector has a great contribution to the economy with a significant part of GDP (12%), and

Table 1 - Evolution of the production for the main food products.

<i>Production (1000T)</i>	<i>1985-1995</i>	<i>1995-2005</i>	<i>2005-2015</i>	<i>2010-2020</i>	<i>Average growth (%) 1985-2020</i>
Durum wheat	790.64	1043.56	1080.30	996.84	17
Bread Wheat	190.45	219.93	248.89	180.84	14
Legumes	57.33	48.15	82.17	86.58	28
Fresh vegetables	1612	2219.95	3048.64	3839.89	38
Fruits	687.62	854.54	1068.11	1156.3	26
Olive oil	131.18	141.55	172.73	194.3	15
Milk products	417.27	802.64	1078.09	1352.02	64
Eggs	1042.73	1408.45	1735.45	1863.39	30
Beefmeat	36.47	48.46	53.21	54.8	22
Sheepmeat	40.72	52.70	58.22	55.7	20
Poultry	54.78	102.27	162.59	182.5	74
Fish	90.7	94.98	109.97	122.1	11

Source: NAOT, 2020, Annual statistics.

employment (16%). The main characteristic of agricultural production is the dominance of the small family exploitations, which account for 80% of the total lands with less than 10 ha owned by old farmers who are often uneducated. Despite their dominance, they control a small proportion of the total land (10%) (NOAT,¹ 2020).

While family farmers produce generally for their own subsistence and sell to local markets, the large and modern exploitations, which cover 90% of farmlands, supply products to the national and international markets. They generally have a higher productivity and efficiency level.

To ensure food security for the population during the past three decades, the government concentrated its efforts on these bigger exploitations using an intensive and modern model of production in order to respond to the increase in demand (35% during the 1985-2015 period due to the demographic average growth (1.5%), the increasing level of urbanization (60%) and income growth (2.8%) (INS, 2017).

Agricultural intensification allows a significant growth for milk (64%), poultry (74%), vegetables (38%) and fruits (26%) (Table 1). However, for basic products such as cereals (14% for bread wheat

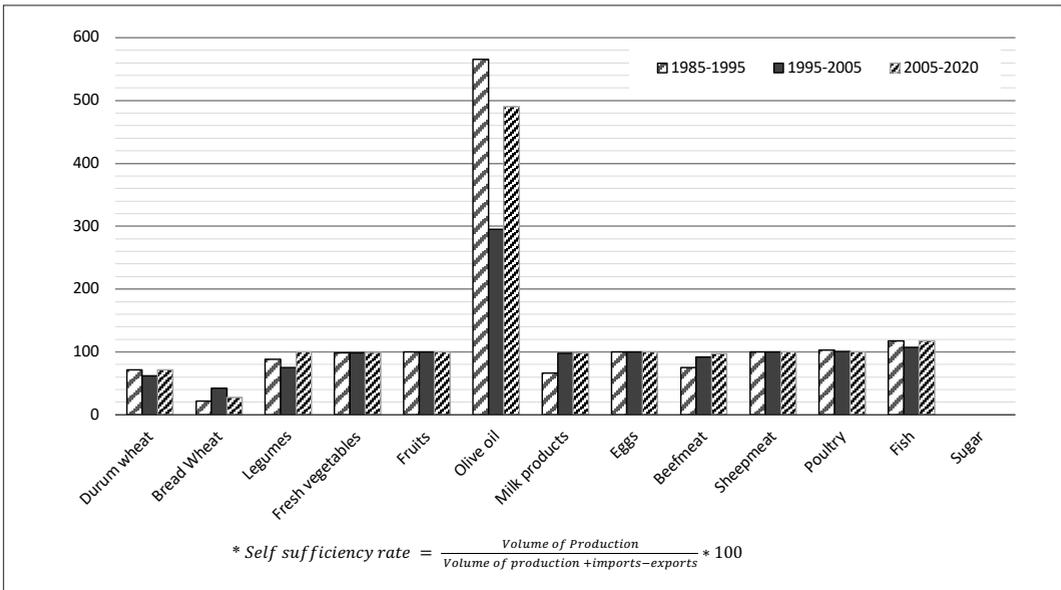
and 17% for durum wheat), domestic production could not reach self-sufficiency in Tunisia.

Table 2 shows that for these products the self-sufficiency rate remains low (27% for bread wheat and 71% for durum wheat). Consequently, for cereals, Tunisia is always dependent on the world market. Considering that cereals provide 50% of consumer calorie ration (INS, 2017), we confirm that these calories depend strongly on imports (60%). For the other products, the self-sufficiency rate improved strongly especially for milk (98,5%) thanks to the national strategy of the dairy sector applied since 1995 (Ben Said *et al.*, 2001; Boudiche *et al.*, 2006), legumes fruits, fresh vegetables, beef meat, sheep meat, poultry, eggs due to the development of new production technologies and the introduction of new varieties and breeds. In the case of olive oil, the high rate of self-sufficiency is due to the importance of local production (180,000 T in average).

The high level of olive oil exportation (70% of local production) is usually encouraged by the government in order to cover the food imports, especially sugar, seed oil, coffee, tea and other agro-food products. Although Tuni-

¹ National Observatory of Agriculture of Tunisia <http://www.onagri.nat.tn>.

Figure 1 - Evolution of self-sufficiency rate* of agricultural and food products (%).



Source: Ministry of Agriculture, Hydraulic resources and fishery (MARHF), Annual statistics, over several years.

Table 2 - Amount of subsidies for food products (2015).

	Sale price (TND)	Cost price (TND)	Amount of the subsidy (TND)	The subsidy (%)
Bread (400g)	200	430	230	46.5%
Semolina (kg)	650	1030	580	56.3%
Flour (kg)	730	1190	560	47.1%
Milk (l)	1250	1420	53.7	4.9%
Couscous (kg)	795	1415	620	43.8%
Pasta (kg)	805	1425	620	43.5%
Seed Oil (l)	900	2500	1600	65.0%
Sugar (kg)	970	1420	450	31.7%

Source: Trade Ministry, 2017.

sia is the second largest exporter of olive oil in the world after the EU, while the domestic consumption is under 6 kg/person/year compared to the seed oil consumption which is more than 22 kg/person/year covered totally by imports. Tunisia is characterized with a high dependence on export earnings from olive oil where the exposure to food security risks is directly related with the olive oil price fluctuations and its competitiveness in the world market. In comparison with other south Mediterranean countries, food security depends more on oil

exports and are more pronounced for Algeria, Libya, Egypt and other Arab countries (Lacirignola *et al.*, 2015).

This food security policy, focused on quantitative considerations, is strongly dependent on imports of basic products (bread wheat and seed oil) that the government imports with lower international prices, in its search for the equilibrium of the trade balance (Khaldi *et al.*, 2016). This raises the question of food security in the context of the volatility of international commodity prices.

2.2. Subsidies policy in food demand

In order to protect the purchasing power of consumers, the government grants direct subsidies for basic food products (bread, flour, pasta, sugar, milk, seed oil) considered essential in the Tunisian diet. The food subsidies represent the largest part of the total subsidies in Tunisia (70%) with a value of 2100 million TND² in 2020 where cereals constitute 78% of the total and 20% of which has been allocated to seed oils from the nineties until today.

By creating the general box of compensation (CGC) in 1970, the government could finance subsidies on the prices of basic foodstuffs. According to a study carried out by the ABD in 2013, this has led to changes in the eating habits of both low and high income social categories, with an increasing trend towards subsidized foodstuffs with low nutritional value (soybean, rapeseed, sunflower oil, etc.) at the expense of other healthy food such as olive oil (ABD, 2013). The attraction of these subsidized products such as vegetable oils is explained by their price that is lower than that of olive oil (a gap of 1 to 3) and the communication campaigns in favor of these oils. In 2019, Tunisia imported 160,000 tons of seed oils whose subsidy expenses reached approximately 250 million TND. According to the Ministry of Trade and Export Development, the

state subsidy is 1.6 TND per liter, i.e. 65% of its actual value, knowing that the price of a liter of vegetable oil, excluding subsidies, is 2.5 TND sold at 0.9 TND (NOAT, 2020) while Tunisia is ranked the second olive oil exporter after the European Union with an average of 190,000 tons in 2020 (Arfaoui *et al.*, 2021).

The amount of these food subsidies reach 2400 million Dinars (TND) in 2020 (Figure 2) and covers 46.5% for bread, 56.3% for semolina, 43.8% for pasta and 50% for seed oil (Table 3).

In general, the consumption of high-calorie foods, carbohydrates and lipids was encouraged instead of healthy products such as olive oil, durum wheat, vegetables and legumes, the consumption of which in the last period increased in both urban and rural areas (Figure 3).

Moreover, these subsidies still apply to the whole population and not only to the disadvantaged, the poor and marginalized categories. In 2015, the last national survey on consumption and budget (INS) highlighted that Tunisian poor households received only 12% of the subsidies compared to 34,5% in favor of the wealthy population (INS, 2017).

This social policy, adopted since 1970 helped ensure the food security of the population but contributed to changes in consumer behavior.

In fact, the calorie portion reached an average

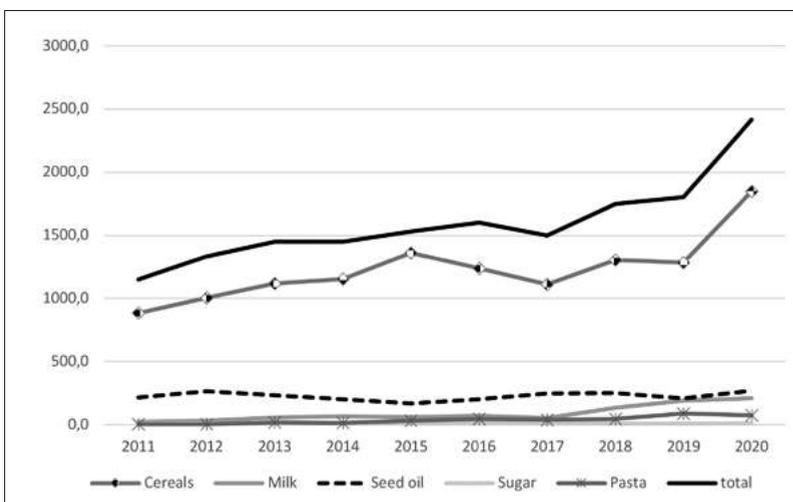


Figure 2 - Evolution of food subsidies in Tunisia (Million DNT).

Source: Trade Ministry, several years.

² 1 TND= 0,308 EUR.

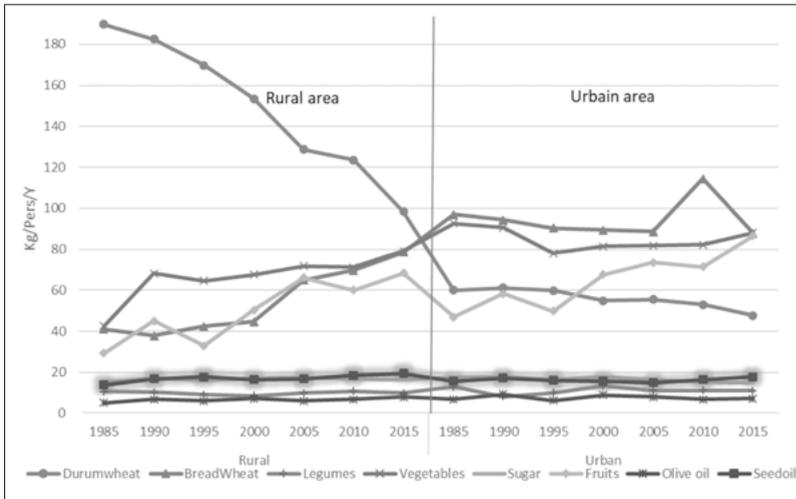


Figure 3 - Consumption trend by product at national level (Kg/person/year).

Source: INS, 2017; Five-yearly on national household consumption survey.

of 3500 Kcal/day/person (INS, 2017). However, 54% of calories came from cereals and 17% from seed oil which explains the nutritional transition (Khalidi *et al.*, 2016).

In Tunisia, the chronic diseases associated with food are currently increasing causing 60% of deaths. Obesity has affected half of the population (33.7% overweight and 26.2% are obese (Ministry of Health, 2019; Dogui *et al.*, 2021), which is twice as much as the world average (11.7%) (FAO, 2014). Cardiovascular diseases affect 28.7% of the population and diabetes 18%. Other factors also cause these diseases, especially the new lifestyles on the back of women's employment that accounts for 45% of the total workforce. This has an impact on consumer habits which are geared more towards the easy ready-made food products (local or imported) which are underpinned by strong marketing campaigns made by the large distribution through supermarkets and hypermarkets more present in urban areas. At the same time, out of home meals which are becoming more common strengthen consumption of high-calorie food.

The next step of this study proposes to verify if food security is in conformity with the nutritive and health requirements for the population and tries to evaluate the impact of food policy on consumer behavior. The impact analysis is appreciated through the degree of distortion with the traditional and healthy Mediterranean diet and the socio-economic factors determining this transition.

3. Methodology

The data used in this analysis is from the national consumer survey (realized every 5 years starting from 1985 by the National Institute of Statistics: INS). The household consumption of Twenty-eight products in global, rural and urban areas are used.

As a first step, an ANOVA (analysis of variance) was applied between the rural and urban areas in order to prove if the use of global consumption offers a good approximation (weighted average between rural and urban consumption) (Annex 1). Results reveal a significant difference in food consumption evolution between urban and rural zones concerning certain products (durum wheat, bred wheat, fresh vegetables, meats, fish, milk, eggs, coffee and tea. However, there were no differences in the remaining products (legumes, fruits, poultry meat, fresh milk, olive oil, seed oil and sugar).

This first result indicates that the use of global quantities consumed (weighted average of rural and urban areas together) will not allow us to draw relevant conclusions on the consumption trends during the twenty years studied since 1985. These differences of consumption trends in rural and urban areas can be explained by factors related to the economic, social and cultural conditions of each environment. Thus, for the rest of analysis rural and urban consumption are used separately.

The quantities consumed of Twenty-eight selected products are measured on different units conforming to the nature of each product (like bread, eggs, etc.) causing a problem when all quantities are treated together. To avoid this problem of unit measures, an alternative was adopted to replace the quantities consumed by the consumption evolution rate (CER) considering 1985 as a base year calculated as follows:

$$CER \text{ of year } n = \frac{\text{Consumption of year } n - \text{Consumption of 1985}}{\text{Consumption of 1985}}$$

After calculating the CER, we reapplied an Anova analysis comparing variances between rural and urban areas using the CER, to prove the stability of data. The results indicate that among 28 selected products, only two (olive oil and coffee) showed a significant difference in consumer behavior which confirms the efficiency of using this rate.

In the next step, we used the Hierarchical clustering method by regrouping foodstuffs in homogeneous groups based on CER during the period 1985-2015. Hierarchical clustering was realized by the SPSS software (V 20).

Finally, we tried to identify for each cluster of foodstuffs, the determinant factors of consumption by establishing a demand function including: price, consumer income and geographical area. We also introduced domestic production to verify the link between national production and consumption. To check if consumers are aware of the benefits of the Mediterranean diet for their health, quality of food products was introduced as a qualitative variable (dummy variable 1 if the product conforms to the Mediterranean diet and 2 if it does not).

The “double logarithmic function” was used to estimate a demand function in order to interpret the estimated parameters such as elasticity (income and price). (Khaldi *et al.*, 2009; Khaldi *et al.*, 2007). The reduced functional form of the model was:

$$C=f(Y, P_i, P_j, M, s) \tag{1}$$

The linear regression function was:

$$\text{Log}C_i = \text{Cte} + \alpha_1 \text{Log}P_i + \alpha_2 \text{Log}(PR_i) + \alpha_3 \text{Log}(Y) + \delta_1 A + \delta_2 Q \tag{2}$$

Where

Cte: constant of the model

C_i: Consumption of product I

P_i: Price of product I

PR_i: National production of product I

Y: Annual Income of the consumer

A, and Q are qualitative variables indicating respectively area of habitation and the quality of the product (depending on its conformity with the Mediterranean diet) introduced as a variable dummy.

α_i and δ_i are the parameters to be estimated.

The data for production are extracted from statistical annual series published by the Ministry of Agriculture during the period 1985-2015. With regard to demand, we analyzed the evolution of household consumption for all food products. The data of consumer’s income was provided also from INS’s national survey during the period 1985-2015 (INS, 2015).

The model was estimated for each foodstuffs group using the Least Squares method (LS) (Eviews.5 software).

4. Results and discussion

4.1. Clustering of foodstuffs according to the evolution of their consumption

The CERs of the products were analyzed by Hierarchical Classification Average which made it possible to bring out 3 homogeneous groups. The common factor at the level of each group is the degree of evolution of its consumption compared to the reference year (1985). Indeed the consumption of certain products changed little, even decreased. On the other hand, for other products, the consumption increased moderately. For certain products one noted very high increases compared to the consumption of 1985. It is according to these evolutions that one interpreted the products of each group.

Clustering analysis showed three homogeneous groups (Table 3) and Annex 2:

Group 1: with low and negative growth, constituted by cereals, vegetables, beef meat and sugar;
Group 2: with medium growth, constituted by dairy products, fruits, seed oils, ovine meat;

Table 3 - Hierarchical clustering.

<i>Cluster 1 (6 products)</i>	<i>Cluster 2 (5 products)</i>	<i>Cluster 3 (3 products)</i>
Durum wheat	Milk products	Poultry
Bread wheat	Fruits	Fish
Legumes	Olive oil	Eggs
Fresh vegetables	Seed oil	
Sugar	Sheep meat	
Beef meat		

Source: Our calculation from SPSS.

Group 3: with high and positive growth such as poultry, fish and eggs.

4.2. Distortion of consumption with the Mediterranean food model

Group 1: Table 5 shows that rich fiber products (durum wheat, legumes) with positive effects on health were identified with a negative rate of evolution. However, concerning bread wheat and sugar with negative effects on health, results showed that their consumption did not increase. This constitutes a positive indicator as these are unhealthy high-calorie products (Khalidi and Saadia, 2017). Despite the fact that these two products are subsidized, their consumption has not increased because Tunisian consumers have reached a saturation level. On the other hand, referring to demand theory, an improvement of income does not increase the consumption of these basic products.

For beef meat included in group 1, and not recommended in the Mediterranean diet, the negative trend is due to the highest consumption price index (Ameur *et al.*, 2016; Boudiche *et al.*, 2015). The vegetables considered with a positive effect on health showed a low evolution rate.

In relation to food transition, in the first group we confirm that the subsidy policies adopted by the Tunisian government increased the consumption of high-calorie products to the detriment of healthy food products, indicating a change in the traditional diet of the Tunisian consumer.

Group 2: with medium growth includes fat products such as sheep meat and seed oil with a negative effect on health. The consumption of sheep meat has increased in spite of its negative effects

on health. This could be explained by the importance of this food product in Tunisian culture (religious links). However, scientists have proven that high quantities of sheep meat consumption could damage health (cholesterol, important protein source, etc.). Nevertheless, sheep meat has always been present in the Mediterranean diet.

The medium evolution also concerns olive oil which, in fact, must have higher evolution taking into account the volume of production in Tunisia and its benefit for health in accordance with the Mediterranean diet. Regarding vegetable oils, the increase of olive oil price and the increase of the exported volumes led to a substitution of olive oil by subsidized seeds with low price. Consequently, olive oil, which is a main component of the Mediterranean diet, is less consumed in Tunisia (7,4 kg/person/year in 2015) compared to seed oil (18 kg/person/year); (Arfaoui *et al.*, 2021).

Concerning dairy products, Tunisian consumption is oriented more to highly processed products (particularly, yoghurt and cheese) to the detriment of those traditionally transformed especially in rural areas.

Fruits are more consumed by Tunisians as a result of the evolution and diversification of their production encouraged by the government at the agricultural level. This constitutes a positive indicator of food transition in conformity with the Mediterranean diet.

Group 3: with high and positive growth, we find eggs, poultry and fish. The Tunisian government authorities have strategically promoted the production of this kind of product since the 1980s. This boosted the production of such products and generated an increase in demand. Tunisians have consumed higher quantities of poultry in the past years (especially after the revolution of 2011) as a consequence of the price increase in red meat. Poultry, recommended by nutritionists, represents a direct substitute of red meat because its consumption increased from 4.5 to 15.2 kg/person/year in the period 1985-2010 while beef meat decreased from 5.2 to 2.9 in the same period.

For fish, the high evolution concerns the cheap species (sardines and mackerels) and especially blue fish (such as gilt-head bream and wolfish) from aquaculture which has developed in the

last years (5.000-10.000 T/year) to provide the market with other protein sources. However, compared to other Mediterranean countries, the quantities consumed still remain low at the national level (7,4 kg/pers./year in 2015 in Tunisia) compared to a similar producer, Greece, where consumption is more than 16,8 kg/pers./year.

4.3. Impact of socio-economic factors and quality on consumption trends

The assessment of the demand function for the three groups of food products was realized by the method of Least Squares (LS) (Eviews.5 software). The parameters estimated for each group are shown in Table 4.

Table 4 shows that the chosen variables account for 92%, 86% and 96% of the demand variation of the foodstuffs for groups 1, 2 and 3 respectively.

As the functional specification of the model is in double log, the parameters related to prices and income is their elasticity. All the price's elasticities present negative signs indicating that the quantity consumed decreases when the price increases. The highest direct price elasticity is shown in group 1 (-1.26) which means that the demands for those products are very sensitive to their price variations. Products of groups 2 and 3 revealed inelastic demands due to their lower elasticity (0.83 and 0.88 respectively).

These differences in elasticity values between groups seem to be contradictory, especially for the first group dominated by basic commodities (durum and soft wheat, sugar, legumes, fresh vegetables and beef meat). The theory predicts

the lowest values of elasticity for basic products indicating no changes in their demand. The Tunisian policies for cereal products and sugar (price setting and subsidies) are the main factors of these results. In fact, low prices for these products encourage their consumption as they are considered cheaper compared to other products without subsidies. This social policy, applied since the 70s in order to protect the purchasing power, initially for the poor category, is now critical because all the categories of population take benefits from it. Consequently, due to low prices, the demand for cereals increased to 195kg/pers./year, mostly composed of bread wheat (bread constitutes 33% of the total) (INS, 2015). For a more qualitative food policy, the question is how to guide consumers in the case of subsidized products towards healthy products with regard to the Mediterranean diet (Boudiche *et al.*, 2016; Yiannakou *et al.*, 2021).

With regard to products in groups 2 and 3, results show less elastic demand. Especially milk and seed oil prices are fixed in order to encourage their consumption but the price is not only responsible for the increase in their demand due to the influence of other factors such as income.

The income elasticity is lower than 1 for all groups which means that all food products are normal goods. This result is in accordance with the decrease in the food budgetary part (45% in 1990, 38% in 2010 and 26% in 2015). The highest elasticities are observed in group 2 and group 1 which can be explained by red meat, olive oil and fruits where consumption is higher in urban areas and in high income categories.

Table 4 - Estimation of the demand function for groups of food products.

Parameters	Group1		Group2		Group3	
	coefficient	t-student	coefficient	t-student	coefficient	t-student
Constant	-0.89*	1.49	-1.29*	1.94	-3.3**	4.39
Price	-1.26**	15.35	-0.83**	10.4	-0.88**	3.77
Income	0.61**	3.63	0.72**	3.86	0.38**	3.43
Production	0.14**	3.78	0.08	0.27	-0.06**	5.02
Area of habitation	0.62	0.87	0.17	2.17	0.27**	5.11
Quality	-0.015	-0.31	-0.05	-0.89	2.43**	7.13
R-squared	92		86		96	

*Significant at 10%; **Significant at 5%.

Regarding the production, low values of elasticity production-consumption are observed for the first and the second groups (0.14 and 0.08) and negative values for the third group (-0.06). For the first group, the higher effect of local production could be explained by the influence of cereals, vegetables, legumes, and beef meat on domestic consumption. For the third group, the results indicate that production progress has a negative effect on consumption which could be explained by the saturation of the poultry and eggs demand provided by industrial firms.

Thus, for all groups, we can conclude that production stimulates demand in terms of diversification rather than in terms of the quantities consumed.

The area of habitation effect is observed in groups 2 and 3, indicating differences between urban and rural consumer behavior. Positive and significant signs of parameters for these two groups showed that these products (eggs, poultry, fish, dairy products and fruits) are more consumed in urban areas. In contrast, for the products of group 1, especially basic products, consumption is the same in urban and rural areas which could be explained by the generalization of subsidies for all the population.

The effect of quality is shown only in group 3. This result reveals that the Tunisian consumer is generally unaware of the quality of the consumed products and their relationship with the highly beneficial Mediterranean diet (olive oil and fruits in group 2, durum wheat, legumes and vegetables in group 1). However, for group 3, the consumption of fish and poultry (recommended by the Mediterranean diet in substitution for red meat) is due to the consumers' awareness of their benefits, a fact stimulated by affordable prices.

This research shows that in Tunisia, food consumption has known an important change and has deviated from the Mediterranean diet which used to characterize Tunisian food habits until the 80's. This is in line with data that show a decline in adherence to the Mediterranean food model in all Mediterranean countries (Da Silva *et al.*, 2009; Vareiro *et al.*, 2009). Due to the social policies based on providing large quantities through price subsidies, high fat and sweet products have been privileged to ensure minimum necessary calories such as seed oil, white bread, wheat and sugar to

the detriment of rich fiber products (durum wheat, legumes and vegetables).

While food security policy has strongly contributed to reaching food auto sufficiency in various products (milk, vegetables, poultry and eggs), it has not ensured qualitative security. As social policies are highly based on low prices through subsidies and fixed prices for bread wheat, sugar and seeds oil which became important components of Tunisian food, leading Tunisia to the second world rank in the consumption of bread and pasta (Khaldi *et al.*, 2016; INS, 2015). These subsidized products responding to high population demand are not in conformity neither with qualitative food security nor with Mediterranean diet. These results are consistent with those proven by Ameur *et al.* (2016) and Souissi *et al.* (2019) who explained the effect of price on increased consumption of subsidized foodstuffs and its consequences in terms of qualitative insecurity (Padilla *et al.*, 2005).

5. Conclusion and policy measures

Food security policy in Tunisia has greatly contributed to the increasing of food availability, but has not helped to ensure quality and healthy food consumption. Considering the negative changes of diet in general, the issue of qualitative food security has become now an imperative in the orientation of the food security policy in Tunisia. Thus, alternative food security policy options, emphasizing qualitative food consumption in conformity with the Mediterranean diet, should enable to provide positive effects in terms of sustainable food consumption. This imperative requires a more appropriate approach with integrated interventions among different levels of the food chain: the producer, the consumer, the public authorities and the local authority.

At the level of policy makers, higher priority should be given by authorities in providing sufficient food quantities to citizens with medium and low income providing at the same time quality food products in order to reduce diseases linked to the distortion of the Mediterranean diet nutrition model. In this respect, it becomes today necessary that the authorities give the priority to guarantee healthy local products with high nutritional value to the population and the young generation. This

could be possible through a better organization and performance of agro food sectors creating efficient links and coordination between all the operators in the value chain, either at the level of institutions (agriculture, industry, health) or at the level of professionals involved in the issue of qualitative food security through a participatory manner. On the other hand, new food policies should opt for less importation of basic products (bread wheat, sugar and oilseeds) reducing the pressure on the state budget due to the high food subsidies and the increased demand of these basic products which have negative effects on human health. Those subsidized basic products generate food waste particularly of bread which receives huge public financial support (40%). Therefore, subsidies should be prioritized and oriented especially to low-income population.

At consumer level, food and nutrition demand policy should focus on higher awareness-raising actions to enhance the consumption of alternative products (olive oil, fish, durum wheat, etc.) and push him towards qualitative food security and Mediterranean diet. This imperative is based on the enhancement of local traditional products and related sustainable production practices with a view to containing this trend and bringing the consumer back to the Mediterranean diet and its sustainable health benefits. In particular, public health institutions and civil society should increase their efforts in raising consumer awareness to reduce the consumption of high-calorie food and the side effects of junk food on health by encouraging nutritional food as recommended by the Mediterranean diet.

The qualitative food security of the population would be ensured by an adequate support for farmers to be engaged in local productions with high added value and for industrialists to produce lower calorie and healthier products. In addition, efforts are required to promote quality local products to consumers, a synergy between institutions and operators and the development of local food value chains.

Farmers should contribute in enhancing a qualitative food security through the promotion of the specific quality and labels in local products especially for small farms (with 1-10 ha) that represent 80% of the total farms in Tunisia. This requires adapted financial support and incentives to pre-

serve natural resources and local products with highest added value and then improve their income and in the same time reducing poverty and unemployment in rural areas.

Better governance should be set up towards these farmers, small and medium firms and traders in order to guarantee their viability to supply markets with higher quality products. Also, women and young graduates should be encouraged to contribute to the promotion of qualitative food security through measures and financial programs focusing on start-ups and entrepreneurship especially in rural areas and to produce local products with specific quality (label products, AOC, and organic food among others).

At agricultural research level, it seems necessary to build a scientific knowledge system (agricultural, economic, social, cultural, nutritional, and culinary) and prospective studies on consumption. It is also important to consider innovative plans and training to better communicate information to these farmers. This could be reached through the role of NGOs and agricultural cooperatives.

The work carried out focuses on consumption trends taking into consideration the Mediterranean diet. The results obtained confirm generally the deviation from this model on the basis of the INS five-yearly data. However, it is necessary to deepen the analysis of consumption by direct surveys of consumers (by type of income, region) in order to better understand their perceptions and preferences and the main constraints to the adoption of the Mediterranean diet. A further research on subsidy policy should also be explored with the aim of better targeting low-income populations for quality food. The question is how to support policies that incorporate the characteristics of this model? How can food subsidies target towards the population classes who need them most in order to improve the quality of their food model with more alignment to the Mediterranean diet (e.g. a subsidy for the consumption of olive oil and a price control system for fruit and vegetables). This research provides an opportunity for further studies on food consumption policy reforms and future research in favor of healthy food practices by revising the subsidies policy in order to reallocate subsidies to Mediterranean diet products such as olive oil, durum wheat, legumes and fish to replace highly

subsidized products such as seeds oil, sugar, white bread and wheat.

In addition, the issue of qualitative food security is addressed by considering product groups that are close to the Mediterranean model. It is interesting to orient the research towards the quality analysis of the foodstuffs groups (nutritional quality). For this purpose, national surveys should be conducted in order to determine the adherence of the population to the Mediterranean diet allowing the measurement of indexes and scores (Ridolfi *et al.*, 2020; Lacirignola *et al.*, 2015; Souissi *et al.*, 2019; FAO, 2016; Visinoni *et al.*, 2017).

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Annex 1 - Anova results: Comparison of rural and urban foodstuffs consumption

Foodstuffs	Anova with quantities consumed		Anova with consumption evolution rate (CER)	
	F	Signification	F	Signification
Durum wheat	96,063	,000	,503	,495
Bread Wheat	69,078	,000	7,925	,018
Legumes	2,249	,160	3,498	,091
Fresh vegetables	29,011	,000	1,651	,228
Fruits	3,289	,095	1,804	,209
Sheepmeat	19,884	,001	1,530	,244
Beefmeat	48,055	,000	,000	,990
Poultry	2,426	,145	,496	,497
Fish	59,109	,000	6,351	,030
Milk products	33,411	,000	,122	,734
Eggs	8,729	,747	4,598	,058
Olive oil	1,670	,712	19,976	,001
Seedoil	,142	,738	9,635	,011
Sugar	,117	,003	2,266	,163

Source: Our calculation from SPSS.

Annex 2 - Results of clustering of food staffs

Product	Means	Std Deviation	Clusters
Durum wheat	-0.140	0.107	1
Bread wheat	0.085	0.317	1
Legumes	-0.10	0.131	1
Fresh vegetables	0.161	0.075	1
Sugar	0.149	0.065	1
Beef meat	-0.292	0.210	1
Milk products	0.198	0.442	2
Fruits	0.445	0.456	2
Olive oil	0.577	0.407	2
Seed oil	0.468	0.157	2
Sheep meat	0.621	0.243	2
Poultry	0.636	0.710	3
Fish	0.531	0.709	3
Eggs	0.776	0.824	3

Source: Our calculation from SPSS.

The effect of digitalization on unemployment reduction

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Abstract

Digital transformation and the digitalization of economic activity are ongoing trends profoundly shaping the global economy. Digitalization reflects digital inputs in the production process and new household and government consumption modes, investment possibilities, and financial instruments, increasingly envisaged by digital technologies and tools. This is also impacting the labour markets, on the one hand substituting machines to labour for routinized tasks and thus decreasing the demand for soft skills labour; but on the other hand, increasing the need for new professions revolving around new production and consumption modalities and digital skills. Considering these contrasting effects, it is essential to estimate the overall impact of digitalization on employment. Therefore, this study captures the impact of economic growth and digitalization on unemployment change, evaluating a modified version of Okun's Law on a balanced panel data set for 58 countries between 2013 and 2019. The results from the estimation of a fixed-effect model show the empirical validity of Okun's law for the sampled countries and a significant contribution of digitalization on unemployment reduction.

Keywords: *Digitalization, Digital economy, Unemployment, Panel data, Fixed effect model.*

1. Introduction

Digital transformation is one trend that is currently reshaping the global economy. Without any doubt, digitalization is deeply affecting societies, economies, and the development of business. Digital transformation has also been labeled the “fourth industrial revolution” (World Economic Forum, 2018).

The decline in information technology prices, which started by the mid of the 1990s, paved the way for the increased importance of Information Technologies (IT) and investment as a source of productivity and caused a related surge in economic growth (Jorgenson, 2001).

The digital economy has often been labeled an engine of innovation, competitiveness, and economic growth. This seems to be particularly true for the industrialized countries who have been putting efforts into creating a suitable environment for digitalization, including digital infrastructure and high-quality internet, widespread connectivity, and access to training and support on digitalization and transformation strategies (Kravchenko *et al.*, 2019). Digitalization has also been read as an enabler of more environmentally friendly circular economies, as it increases resource efficiency by reducing waste, boosting product longevity, and minimizing transaction costs (Antikainen *et al.*, 2018).

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Still, there is no clear consensus on what is meant with digital transformation and digital economy, which also affects the possibility of measuring and comparing the degree of digitalization of different economies and societies. In general, reviewing existing definitions of the digital economy, they have in common that they all discuss the digital economy in a narrow sense, primarily identifying it with the digital sector, but then discuss the need to capture the pervasiveness of the use of digital technology in economic value creation. The problem becomes then to draw boundaries, as “increasingly the digital economy has become intertwined with the traditional economy making differences between them less clear” (OECD, 2013).

The COVID-19 containment measures have further accelerated digitalization (Dutta and Lanvin, 2020), with more and more businesses integrating digital processes in their operations and more and more customers moving towards online channels (McKinsey, 2021). At the same time, the pandemic provided an occasion to reflect on the existing digital divide and made differences between “network-ready economies” and “laggards” (Dutta and Lanvin, 2020) more apparent.

Digitalization and the related computer-based automation of routinized functions will impact labor demand and affect wage levels (Acemoglu and Restrepo, 2018). Thus, digitalization can have in principle contrasting effects on the labor markets: On the one hand, digitalization and automation can be expected to decrease the demand for low skilled labor force (Acemoglu and Autor, 2011), but on the other hand, it can be expected to increase the need for new skills profiles. Cross-country differences can be reasonably expected. The industrialization level, which goes together with digital readiness, educational profile, and wage levels, may represent a factor affecting the effect of the digital transformation on the labor markets.

Even though the employment effects of digitalization are very present in the political and academic debate, empirical evidence trying to quantify the overall effect of digital transformation at macroeconomic level is still scarce and non-conclusive. At best of our knowledge,

this study is the first contribution estimating the overall effects of digitalization on unemployment for a large sample of industrialized and less developed countries. This is done by evaluating a modified version of Okun’s law capturing the impact of economic growth and digitalization on unemployment change. Digitalization was estimated by calculating a digitalization index based on the IMD World Digital Competitiveness score by the Institute for Management Development (IMD, 2020). The econometric model is estimated with fixed country effects on a balanced set of panel data from 58 countries from 2013 to 2019.

2. Digitalization and the digital economy

A massive surge in the use of information and digital technology for business can be traced back to the mid of the 1990s, which witnessed a sustained decrease in the prices of IT and IT equipment (Jorgenson, 2001). Since then, digitalization has become more and more of a global trend and an engine for economic growth (Kravchenko *et al.*, 2019). In a narrow sense, digitalization can be defined as “the process of transforming analog material into binary electronic (digital) form, especially for storage and use in a computer” (Pearce-Moses, 2005).

Digitalization is thus converting materials from the analog format that people can easily read to a digital format, readable by machines only (Singh, 2017). On the other hand, the digitalization of business is a broad concept encompassing digital technologies to change a business model and provide new opportunities to generate added value (Gartner, 2020). More specifically, digitization, digitalization, and digital transformation can be identified as the three stages of the digital transformation of business (Verhoef *et al.*, 2019).

The impact of digitalization and digital technology goes, however, beyond the firm level and can be discussed at the macroeconomic level, where it is more and more spoken of the digital era (Shepherd, 2004), digital economy, digital society (OECD, 2020), digitalized economy (Bukht and Heeks, 2017), fourth industrial revolution (World Economic Forum, 2018), and information society (Golinski, 2012). The

plurality of concepts used to capture the transformation brought about by digital technologies on the (global) economy reflects the difficulty of its definition. A consensual definition of it would also be a prerequisite for its measurement, or, as with the International Monetary Fund (IMF), the “lack of a generally agreed definition of the “Digital Economy” or “digital sector” and the lack of industry and product classifications for internet platforms and associated services are hurdles to measuring the Digital Economy” (IMF, 2018).

To formulate an encompassing and viable definition of the digital economy, the Organization for Economic Cooperation and Development (2020) reviews existing definitions and classifies them into more traditional reports that are focused on aggregate indicators such as value-added or employment contribution of relevant sectors, input-based, that is included in the digital economy all sectors making use of digital inputs, and into flexible definitions, focused on the intensity of use of digital technologies. Based on that, OECD (2020) defines the digital economy as incorporating “all economic activity reliant on, or significantly enhanced by the use of digital inputs, including digital technologies, digital infrastructure, digital services, and data. It refers to all producers and consumers, including government, that are utilizing these digital inputs in their economic activities” (OECD, 2020). Based on this definition, however, different measures of the digital economy can coexist: more precisely, the economic activity from producers of Information and Communication Technology (ICT) goods and information services represents a core measure of the digital economy, which can be expanded to the value-added derived from digital input, but also to the value-added of firms whose activity is significantly enhanced by the use of digital technologies. Such a broad measure of the digital economy, even though legitimate in principle, points to the difficulty of marking the boundaries of the phenomenon.

According to the International Monetary Fund (2018), the digital economy can be narrowly defined as “online platforms, and activities that owe their existence to such platforms, yet, in a broad sense, all activities that use digitized data

are part of the digital economy: in modern economies, the entire economy” (IMF, 2018). Therefore, in its attempt to quantify digitalization’s value-added, the IMF prefers to rely on the digital sector, which “covers the core activities of digitalization, ICT goods and services, online platforms, and platform-enabled activities such as the sharing economy”.

To foster digitalization and boost the digital economy is defined as referring to “a broad range of economic activities that include using digitized information and knowledge as the critical factor of production, modern information networks as a virtual activity space, and the effective use of ICT as a crucial driver of productivity growth and economic structural optimization” (DETF, 2016). Among the considered aspects to be addressed while trying to foster the digital transformation of the economy, the Digital Economy Task Force (DETF) has been considering its impact on the labor market and the need to address the digital divide issue to make digitalization more inclusive. This was done by also considering the “mismatch between the new skills required by the digital economy and the existing skill set of many workers, with this as a particular challenge for developing and least developed countries (DETF, 2020).

Among the challenges involved in measuring the digital economy, which includes all digital-enabled economic activity (Bukht and Heeks, 2017), is that with the steadily increasing importance of digital technologies and input for all sectors of economic activity, the digital economy is blurring with the economy as a whole. Trying to narrow the concept down, Bukht and Heeks (2017) prefer to speak of the “digitalized economy” to refer to the broad picture while delimiting the digital economy to “all extensive applications of digital technologies plus the production of those digital technologies” (Bukht and Heeks, 2017). Digital technologies are finding applications in almost all sectors of economic activities to involve sectors that were traditionally excluded by digital transformation. In this regard, Valls Bedeau *et al.* (2021) presents an interesting discussion of the potential contribution of digital technologies for the sustainability of food systems and agriculture.

The plurality of definitions formulated regarding the digital economy translates into alternative operational purposes and thus indexes and measures. To capture the development of digitalization and enable cross-country comparisons, the availability of time series data and index coverage in countries are essential elements.

The Digital Economy and Society Index (DESI) measures digitalization of economies and societies along the main dimensions of connectivity that is infrastructure development, human capital, citizen use of the internet, integration of digital technology (captured as digitalization of business and online sales channel development), and digital public services. The DESI was developed with specific reference to the countries of the European Union and has been compiled for the EU member states since 2015 (European Commission, 2020).

To quantify propensity to exploit ICT opportunities, the World Economic Forum launched in 2002 and substantially redesigned in 2019 the Networked Readiness Index (NRI). The index currently covers 134 economies and assesses their performance over the four main pillars of Technology, People, Governance, and Impact. Unsurprisingly, according to the NRI, the top 10 performing countries are high-income economies. There is a positive relationship between GDP per capita and NRI score (Dutta and Lanvin, 2020).

The Digitization Index (DiGiX) “assesses the factors, agents’ behavior and institutions that enable a country to fully leverage Information and Communication Technologies (ICTs) for increased competitiveness and well-being.” (Cámara and Tuesta, 2017). The DiGiX is computed based on principal component analysis so that weights are endogenously determined and have been estimated since 2015 in 100 countries. Its main dimensions are infrastructure, households’ adoption, enterprises’ adoption, costs, regulation, and contents.

For this study, we have chosen to rely on the IMD World Digital Competitiveness Ranking, which compares the digital competitiveness of 63 countries, rating them with a score between the minimum of 0 and the maximum of 100. The score is calculated based on the three Digital Competitiveness Factors of Knowledge, Tech-

nology, and Future Readiness. Each of these factors is composed of 3 sub-factors: talent, training and education, and scientific concentration for knowledge, regulatory framework, capital and technological framework for technology, and adaptive attitudes, business agility, and IT integration for future-readiness. As for other indexes, also according to the IMD Digital Competitiveness Ranking, the top-performing countries are high-income countries. Further, the ranking supports the idea that strong and stable institutions are prerequisites for digital competitiveness and thus key to investment in the sector. This is corroborated by the strong positive correlation between low risk of political instability and IMD Digital Competitiveness Score. The choice to rely on this indicator as a proxy for the digital readiness of the different economies was motivated by its focus on conducive factors for the digital transformation and not only on the infrastructure, as well as by the existence of a complete panel of data for 58 out of the total of 63 considered countries between 2013 and 2020. In addition, the IMD framework (and in particular its sub-component Knowledge) is very accurate in capturing the type of skills available in an economy, with skills being notably at the core of the debate on the employment consequences of technology and digitalization.

3. Digitalization and unemployment

Digitalization calls for drastic alterations in business models (Verhoef *et al.*, 2019), and enterprises worldwide are digitalizing operations in pursuit of aspects that aid the organization to effectively and efficiently operate and achieve a competitive advantage.

This can be obtained through reduced costs and improved operational efficiency, customer understanding and satisfaction, increased employee productivity, increased innovativeness, and positive customer perception. Digitalization of business operations can lead to significant changes in the labor demand. At this moment, contrasting effects can be expected, as digitalization links to the automation of certain routinized and control functions, reducing thus the need for such soft skills professions, while it

can increase the demand for labor force with advanced digital skills, as well as the labor demand of new professional figures, made necessary by the new modality of production and sales channels (delivery for online sales channels). In this regard, Fossen and Sorgner (2019) categorize digitalization into destructive and transformative digitalization. Destructive digitalization refers to the automation of specific jobs and tasks that replace labor with machines and can also be defined as computerization or automation (Frey and Osborne, 2017). Transformative digitalization, on the contrary, refers to settings where labor productivity is enhanced by digital technologies and the interaction between workers is facilitated by ICT equipment.

Digitalization has been thus discussed in its capacity to alter equilibria on the labor market (Acemoglu and Autor, 2011; Acemoglu and Restrepo, 2018). Several studies have been documenting and analyzing the effects of digital transformation on the labor market. These research efforts can be read as part of the long-standing tradition investigating the employment effects of technological change and relate to the skill bias of technical change (Tinbergen, 1974, 1975). The concept of skill bias, which has been empirically shown to have accelerated in the 1980s and 1990s (Autor *et al.*, 1998), posits that technology adoption reflects into an increase of demand for more skilled workers. More recently, the skill bias is assuming different forms and seems to be more leading to job polarization, that is with a reduced demand for middle-skilled workers vis a vis an increase in the demand for low- and high-skilled workers (Acemoglu and Autor, 2011).

The effects of digitalization will reflect into structural changes in employment (Brynjolfsson and McAfee, 2011) and it can be reasonably expected that forms of employment no longer matching technological development will be replaced by other forms (Eichhorst and Buhlmann, 2015; Rinne and Zimmermann, 2016). It is still not clear, whether the overall trend will be rather towards increased job polarization, upskilling, or job loss (Eurofound, 2015).

It is of utmost importance to understand the overall impact of digitalization on unemploy-

ment. Several studies have been trying to provide an answer estimating the automation potential of jobs, focusing on probability of an occupation being automated (e.g. Frey and Osborne, 2013, and Dengler and Matthes, 2015, for the United States; Bonin *et al.*, 2015, for Germany). However, the empirical results based either on micro-surveys or on experts' evaluations differ based on the dataset adopted, on the focus on professions rather than on activities, and on the country of reference.

In regard to the effects of digitalization on the labor markets, the digital divide across countries (Corrocher and Ordanini, 2002) can be expected to impact, too, with pronounced cross-country differences, potentially augmented by expanded offshoring possibilities (Acemoglu and Autor, 2011).

In contributing to this debate, this study adopts an aggregated macroeconomic perspective and aims at quantifying the overall effect of digitalization for a sample of both industrialized and less developed countries.

4. The effect of digitalization on unemployment – Econometric model and estimation results

A variation of Okun's law was estimated to capture the net effect of digitalization on unemployment empirically. Okun's law, proposed and empirically tested in the seminal work by Okun (1962) concerning the United States, relates to an empirical regularity concerning the relationship between actual output growth and the change in unemployment.

Many studies have confirmed the validity of this applicable law for the United States (e.g., Gordon and Clark, 1984; Kaufman, 1988; Knoester, 1986; Prachowny, 1993; Smith, 1975; Weber, 1995; Nektarios, 2019). Moreover, Okun's law has been found to hold also for other countries, even though with significant heterogeneity across economies (Ball *et al.*, 2013; Moosa, 1997). Okun's law provides a measure for the elasticity of output growth relevant to the unemployment rate. The fit of Okun's law is typically more pronounced (in the sense that the negative relationship generally is steeper) for advanced countries; in other words, "less sophisticated an economy is

the less responsive is the labor force to changes in GDP” (Farole *et al.*, 2017).

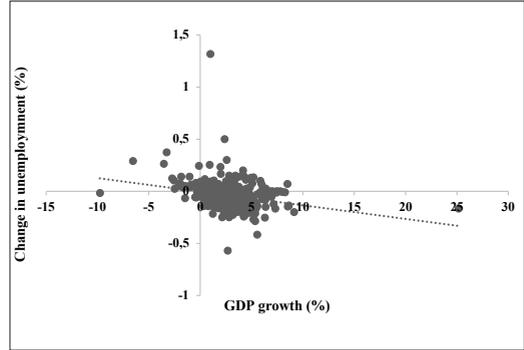
Few notes are due in regard to the choice of the model and its relation to the existing literature on the determinants of unemployment. In general, as due to its stability, the Okun’s Law is considered a suitable paradigm to explain unemployment based on macroeconomic data. An alternative paradigm is represented by Philipps Curve, which postulates the existence of a short term negative relationship between inflation and unemployment (Phillips, 1958). There is however a growing body of evidence questioning the validity of Philipps Curve (Elliot, 2015; Pallis, 2006; Dritsaki and Dritsaki, 2012) or, better, pointing to the fact that the relationship between inflation and unemployment could have a different sign depending on labour market institutions and characteristics (Lui, 2009). Besides economic growth and inflation (as respectively postulated by the Okun’s Law and by Philipps Curve), labor productivity (Gordon, 1997; Bräuning and Pannenberg, 2002), population growth, together with variables modeling institutional characteristics (Krugman, 1994) have been discussed in the literature. Also Foreign Direct Investment and foreign debt have been shown to be related to unemployment (Jude and Silaghi, 2015, respectively Nguyen, 2018). There is no conclusive evidence on the determinants of unemployment, in the sense that their significance and effect strongly differ across countries. As a result, most of the studies trying to empirically rationalize unemployment have been focusing on one specific country or on small groups of countries with similar institutional characteristics (Folawewo and Adeboje, 2017).

Okun’s law postulates the existence of a negative relationship between the change of unemployment and real economic growth. This can be expressed by the following equation (Knotek, 2007) (Eq. 1), where ε_t represents the error term and t the period.

$$\Delta U_t = c + \beta_1 GDPgr_t + \varepsilon_t \quad (1)$$

As shown in Figure 1, the data considered for the present study provides evidence of a Downward association between the change of unemployment and economic growth. This re-

Figure 1 - Okun’s law for the sampled data.



veals that Okun’s law applies to the considered countries.

To measure the impact of digitalization on unemployment, we added an index obtained normalizing the IMD Digital Competitiveness Score (DIGIT) to Okun’s law as a further explanatory variable. Herewith, the model (Eq. 2) to be estimated becomes:

$$\Delta U_{it} = c + \beta_1 GDPgr_{it} + \beta_2 DIGIT_{it} + \varepsilon_{it} \quad (2)$$

The dependent variable is change in unemployment ΔU of country i at time t ; the explanatory variables include the natural economic growth $GDP\ gr$ and the Digital Competitiveness Score $DIGIT$.

The estimation is based on a balanced panel dataset between 2013 and 2019 for 58 countries covered by the IMD ranking. Even though the IMD ranking includes 63 countries, some countries had to be excluded to have a balanced panel, as, for those countries, not all of the years were covered.

Figure 2 ranks the countries considered according to the normalized IMD Digital Competitiveness Score for 2019. The top-performing country was the United States, followed by Sweden, Switzerland, and Finland.

Even though data for 2020 would have been available, that year was excluded due to the emergency and extraordinary circumstances created by the COVID-19 pandemic. Data for unemployment and GDP growth refer to the World Development Indicators (2019). Table 1 presents some descriptive statistics on the set of variables used for the estimation.

Figure 2 - IMD Digital Competitiveness Ranking for the year 2019.

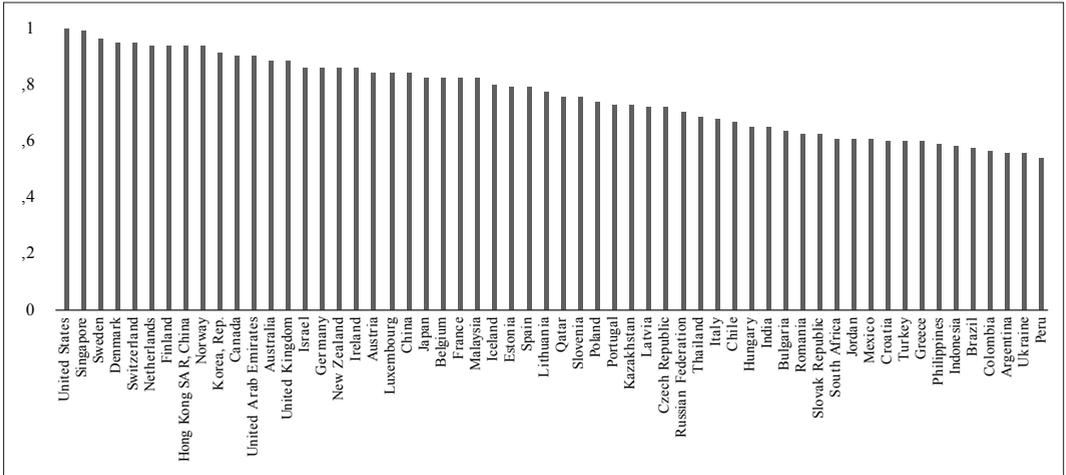


Table 1 - Descriptive statistics.

	<i>Change in unemployment</i>	<i>GDP growth</i>	<i>DIGIT</i>
Mean	-0.0399	2.7623	0.6931
Median	-0.0517	2.5350	0.7150
Std. Dev.	0.1246	2.4171	0.1819
Minimum	-0.5689	-9.7730	0.3190
Maximum	1.3200	25.1760	1.0000
Count	406	406	406

Table 2 - Correlation Matrix.

	<i>Change in unemployment</i>	<i>GDP growth</i>	<i>DIGIT</i>
Change in unemployment	1.000		
GDP growth	-0.253	1.000	
DIGIT	-0.114	-0.019	1.000
	0.022	0.708	

The correlation matrix for the variables used in the model specification is provided in Table 2. The correlation results indicate a negative relationship between the change in unemployment and GDP growth and digitalization. There is no correlation between GDP growth and digitalization which assures us that including both variables in our model will not introduce multicollinearity and bias the results.¹

The Unit Root test shows that all variables are stationary. To determine the most appropriate model to estimate equation (2), we compare a pooled regression model, a fixed-effect model (FEM), and a random effect model (REM). Assuming homogeneity in all cross-sections, pooled regression models are appropriate without coun-

try-specific effects. This is not the case for our data, so that pooled regressions models cannot be meaningfully used. On the other hand, fixed and random effect models differ in assuming country-specific results: the fixed effect model defines heterogeneity as a time-invariant individual intercept. In contrast, the intercept is modeled as a random outcome variable in the random effect model. Further, the REM relies on the assumption of a standard mean intercept value of the cross-sections and models individual differences in the intercept values of each cross-section via the error term (Greene, 2003; Gujarati and Porter, 2009).

Diagnostic tests (relying on the statistical software STATA and EViews) reveal that the most appropriate analysis model is the fixed ef-

¹ Additionally, we use VIF to detect the severity of multicollinearity. The value of VIF is 2.11 indicating no multicollinearity.

fect model. According to the redundant stationary effect test (with a cross-section F of 2.750, $p=0.0000$), the null hypothesis can be rejected, implying that the fixed effect model (FEM) is more appropriate than the pooled Ordinary Least Squares (OLS). With a cross-section random of 8.15 ($p=0.0170$), the null hypothesis of the Hausman Test could be rejected.

The results of the FEM are presented in Table 3.

Overall, all of the estimated coefficients of the fixed effect model (FEM) are highly significant. The F statistics (3.379) value supports the estimated model's overall significance. The Durbin Watson test for autocorrelation indicates (with a value of 2.482) that there is no serial correlation. The estimation confirms the existing relationship between change in unemployment and GDP growth and provides evidence for a negative effect of digitalization on the change in unemployment. This significant result corroborates the nexus between digitalization and labor market dynamics and thus helps to contextualize better the role of digitalization in creating job opportunities. The overall result shows that improving digital readiness is associated with an increase in employment levels or decreased change in unemployment as with the estimated model. This can be generally read as a call towards investing in creating suitable conditions for digitalization and reducing the digital divide. This can be par-

ticularly challenging for less developed countries, which are disadvantaged in terms of digital infrastructure, penetration of digital technologies, and state of the art education to equip people with digital skills. As also captured by the IMD score and its sub-components, the digital transition requires appropriate skills and knowledge, as well as a suitable regulatory framework, technology adoption, and IT readiness. Limited financial and institutional capabilities of less developed countries may delay the digital transformation. However, the digital divide also exists among different social groups within the same economy, with different levels of digital literacy and asymmetric access to digital technologies.

At this moment, every country needs to envision strategies to promote widespread re- and up-skilling (Dutta and Lanvin, 2020).

5. Conclusions

Digitalization and the transformation towards the digital economy are changing the way production, consumption, and work are organized. While these trends have been ongoing since the 1990s, they have witnessed an acceleration over the last decade and a decisive push during the time of the COVID-19 health emergency.

Digital transformation has been discussed as a source of competitive advantage and an engine of economic growth. However, digital transformation is disruptive of old equilibria and may imply profound changes in the global economic system. Its impact on the labor markets is currently widely discussed without conclusive evidence, so far. The overall result of digitalization in terms of employment creation or instead unemployment is, in principle, uncertain. While, on the one hand, the automation of routinized tasks reduces the demand for unskilled labor, digitalization is creating the demand for new professions revolving around new modes of production and consumption. It is essential for governments worldwide to understand the digital revolution's overall impact on employment, boost desirable effects, and increase preparedness to mitigate eventual negative implications and support the social groups who may be left behind. Therefore, the present paper captures the overall impact of digitalization on unemploy-

Table 3 - Estimation results.

<i>VARIABLES</i>	(1) <i>Change in unemployment</i>
<i>DIGIT</i>	-0.2732** (-3.50)
<i>GDP growth</i>	-0.0190** (-2.82)
Constant	0.2018** (3.54)
Observations	406
R-squared	0.3656
within Adjusted R-squared	0.113
F test	0.000161
<i>Robust t-statistics in parentheses</i>	
<i>** p<0.01, * p<0.05, * p<0.1</i>	
<i>Estimations were done using STATA and Eviews</i>	

ment. This relied on a modified version of Okun's law, regressing unemployment reduction against economic growth and a normalized coefficient for digitalization. The estimation was conducted for a balanced panel data set from 58 countries between 2013 and 2019.

For the sake of the present analysis, the simple but stable framework of the Okun's Law provides a suitable model to test for the effects of digitalization on a sample of countries with different characteristics, different levels of development, different labor productivity, and different subsets of skills. On the other hand, some institutional characteristics are captured in our model by the digitalization coefficient used, which includes aspects related to skills, regulatory framework, technology, and business agility.

The results corroborate the significance and validity of the model, estimated via a fixed-effect model, and reveal a significant and negative effect of digitalization on unemployment change. This means that an increase in the digitalization readiness of countries leads to a substantial reduction in unemployment.

Based on this evidence, we conclude that digitalization can be a chance for employment creation worldwide. We recommend that governments and the international community activate strategies to reduce the digital divide across and within countries to make the digital transformation a source of inclusive development. At country level, investments in education, digital literacy, up-, and re-skilling are mostly needed, to prepare the labor force to the digital skills requested by the labor markets. International support will be also needed to encourage and enable less developed countries to improve their digital infrastructure and the penetration of digital technologies.

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Do consumers intend to purchase the food with Geographical Indication?

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Abstract

This research aims to determine the effect of consumers' perceptions of GI on purchasing intention. Data were obtained from surveys conducted with 384 consumers in Turkey. Structural equation model (SEM) was used to analyze the data. According to the results, 62.5% of the consumers have information about foods with GI while 58.9% of the consumers consume foods with GI. The SEM results indicated that food with GI perception had a statistically significant and positive effect on the intention to purchase foods with GI. Consumers want to buy geographically marked foods as they are "healthier", "higher quality", and "more reliable". Consumers have positive opinions about foods with GI, and are willing to pay more for them. The fact consumer perceptions do not change is closely related to the performance of products with GI. Monitoring the production processes of GI foods that are more delicious, healthier, reliable, and ensuring the continuity in product quality will increase the demand of consumers for geographically marked foods.

Keywords: *Consumer behaviour, Food consumption, Geographical indication, Structural equation model.*

1. Introduction

The tricks in the food industry, health problems and especially the COVID-19 pandemic lead consumers to consume products that are healthier and more reliable (Cacic *et al.* 2011; Şahin and Meral, 2012; Dhamotharan *et al.* 2015; Kos Skubic *et al.*, 2018), well-known in origin, their composition, and the way they are produced and processed (Grunert *et al.*, 2000; Salaun and Flores, 2001; Guerrero *et al.*, 2010; Meral and Şahin, 2013; Doherty *et al.*, 2015) and environmentally friendly (Kumar *et al.*, 2017; Alamsyah *et al.*, 2020; Aytop *et al.*, 2021).

One approach of informing and developing consumer awareness of a product's sustainabil-

ity features is through product labeling (Erraach *et al.*, 2021). Geographical indication is one such labels. Geographical indications (GIs) are signs documenting the origin of the food, its characteristic features, and its connection to the area where it is produced. GI is "a sign indicating the food identified with the traditionally, area, region, or country in which it originates in terms of a distinct quality, reputation or other features." GI registration can be completed in two ways; protected designation of origin (PDO) and protected geographical indication (PGI). If the production, processing, and rest of operations of the product take place in the geographically indicated area, the PGI is registered. If at least one of the production, processing, or

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rest of operations takes place geographically (specified area, PDO is registered (EU, 2012). GIs have an important tool in developing countries (Bowen, 2010) where the economy is based on agricultural products and industrialization requires technological developments (Addor *et al.*, 2003). Geographical indication may ensure consumers of the excellent quality of food products, which is a possible major reason for providing geographical information with food. Several empirical studies have examined the impact of location information on consumer food decisions; however, most of these studies were undertaken in industrialized countries. However, little information is available on the importance of geographical information in food products (Lee *et al.*, 2020). Because it is a tool that can be used to identify the exceptional quality of agricultural products, maintain the sustainability of a defined indigenous production region, and support the development of rural communities, a geographical indication label could be adopted in developing countries to further improve the livelihood of farmers (Rangnekar, 2004; Kan and Gülçubuk, 2008; Jena and Grote, 2010; Kneafsey *et al.*, 2013; Cei *et al.* 2018; Lee *et al.*, 2020). Using geographical indications to protect commodities from unfair competition is critical (Dokuzlu *et al.*, 2020).

A rising part of the population is concerned about food safety and quality and considers provenance to be a helpful quality indicator (Teuber, 2011). Consumers believe that products with GI have superior quality and taste compared to other products (Van Ittersum *et al.*, 2000; Teuber, 2011; Vecchio and Annunziata, 2011; Verbeke *et al.*, 2012; Meral and Şahin, 2013; Likoudis *et al.*, 2016; Ahrendsen and Majewski, 2017; Kos Skubic *et al.*, 2018; Roselli *et al.*, 2018). The fact that products with GI inform consumers about the reliability, quality and origin of the product causes the consumers to increase the price they are willing to pay (Bramley *et al.*, 2009; Vecchio and Annunziata, 2011; Aprile *et al.* 2012; Deselnicu *et al.* 2013; Lefèvre, 2014; Bishop and Barber, 2015; Lu and Sajiki, 2021; Zhang *et al.* 2022).

Based on the literature in this research, it is assumed that geographical indication contributes

to the producer and the regional economy, more delicious, better quality, healthier, more reliable, more troublesome, and accepted by consumers. It is assumed that consumers who intend to purchase food with GI pay more for geographically marked foods, consume them in the future, and increase their consumption in the future.

The aims of this study are to determine consumers' perception of foods with GI, the status of consumption of foods with GI and the factors that influence consumers' purchase intent of foods with GI in Turkey. In this respect, the results of this study are expected to contribute significantly to decision-makers working in the field of GI.

In the light of this information, the effect of geographical indication perception on consumers' intention to purchase products with geographical indications was analyzed using the structural equation model. The research questions were as follows. Do the observed variables (contributing to the producer and the regional economy, more delicious, better quality, healthier, more reliable, more troublesome) affect the intention to purchase geographically indicated foods? (1) What is the degree of influence of this factor? (2) Which factors are more effective? (3) The hypothesis of the research is that geographical indication perception directly affects the intention to purchase products with geographical indications.

2. Material and method

The main material of this study is data obtained from online surveys conducted with 384 consumers online in November and December 2020. The sample is representative of the population in rural and urban areas of Turkey. Before the data collection process started, pilot interviews were conducted with 30 people and errors in the questionnaire form were corrected. A simple random sampling method was used to determine sample size. The following formula has been used because the number of universe units is over 10000 (Özdamar, 2003):

$$n = \frac{p \cdot q \cdot z^2}{d^2}$$

where p is the probability of consumers in the universe consuming foods with GI (0.2), q is

the probability of consumers in the universe not consuming foods with GI (0.8), α is 0.05, z is 1.96, and d is the sampling error (0.04). According to this formula, the sample volume was determined to be 384.

Structural equation model (confirmatory factor analysis and path analysis) is used in the analysis of the data. Statistical analysis was performed using the AMOS software.

2.1. Structural Equation Model

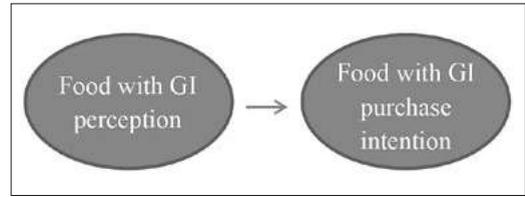
Structural equation model (SEM) is the ability to test direct and indirect relationships between observable and unobservable variables in a single model (Ullman and Bentler, 2003; Mueller and Hancock, 2018; Dash and Paul, 2021). In a single study, researchers can ask more complicated research questions and test multivariate models using SEM (Weston and Gore, 2006).

SEM can simultaneously multiple regression analyse at the same time. Some authors refer to SEM as causal modelling, causal analysis, simultaneous structural modeling, covariance structure analysis, path analysis, and confirmatory factor analysis (Tabachnick and Fidell, 2001). Model creation, parameter identification and estimate, data-model fit evaluation, and prospective model re-specification are all part of the SEM process. This method assesses the fit between correlational data from experimental or non-experimental research and one or more competing causal theories that have been created a priori; most SEM applications are not built for exploratory purposes (Mueller and Hancock, 2018).

The data acquired to validate the sophisticated theoretical model generated using this method are usually linked. The model-data fit is the term for this connection. With available empirical data, any theoretical model can be examined for this type of fitness. SEM is a large sample approach that typically requires a sample size of 200 (Weston and Gore, 2006). The sample size is often determined by three factors: the type of distribution (observed variables), model complexity, and the estimation method utilised (Hayes *et al.* 2017).

The basic hypothesis of this study relies on the assumption that foods with GI perception

Figure 1 - Model design.



affect the intention to purchase foods with GI. The structural equation model (SEM) was used to test this hypothesis. The data used in the structural equation model were expressed on a 5-point Likert scale (1: strongly disagree, 5: strongly agree).

SEM design is given in Figure 1. In the model, the effect of foods with GI perception on the intention to purchase foods with GI was analyzed. In addition, foods with GI perception latent variable are represented by six observed variables (coded variables; c1, c2, c3, c4, c5, c6), and foods with GI purchase intention are represented by three observed variables (coded variables; c7, c8, c9) in the model. SEM was used to determine the effect of food with GI perception on GI food purchase intention.

Confirmatory factor analysis and path analysis are techniques offered by SEM. Confirmatory factor analysis was applied to the data to collect the observed variables under a broad and comprehensive upper variable. In this study, the variables c1, c2, c3, c4, c5, and c6 were collected under the perception of foods with GI whereas the variables c7, c8, and c9 were collected under the intention of purchasing foods with GI. Because the model had sufficient fit values, it was decided to use all the variables in the model. After the confirmatory factor analysis, the hypotheses were tested by applying the path analysis method with latent variables.

2.1.1. Comparative Fit Indices

Normed Fit Index (NFI)

NFI value obtained by dividing the chi-square value of the tested model by the chi-square value of the independent model was between 0-1 (Bentler and Bonett, 1990). If the NFI value is above 0.90, it is acceptable; if it is above 0.95, it indicates perfect fit (Ullman, 2001).

Incremental Fit Index (IFI)

The difference in this index (Bollen, 1989), which is used to solve problems caused by large variability, is that the degree of freedom is not considered. An IFI value above 0.90 indicates a good fit, and above 0.95 indicates a perfect fit (Meydan and Şeşen, 2011).

Comparative Fit Index (CFI)

These index benches are also known as Comparative Fit Index. CFI compares the fit of the model with the fit of the null hypothesis. Although it is similar to NFI, its distinguishing feature is that it is affected by the sample size. A value above 0.90 for CFI indicates that the model is in harmony, and a value close to 1 indicates that the model is in stronger fit (Bentler, 1990).

Root Mean Square Error of Approximation (RMSEA)

RMSEA value was between 0-1, but a value between 0-0.05 indicates perfect fit (Steiger and Lind, 1980), and a value between 0.5-0.08 indicates acceptable fit. If the value is greater than 0.10, it indicates a weak fit. In models with small samples, the RMSEA value may be misleading. In such cases, it is recommended not to consider this result (Hu and Bentler, 1999; Ulmann, 2011).

Standardized Root Mean Square Residuals (SRMR)

The SRMR index was calculated using covariance residuals, with lower values indicating better fit. The SRMR summarises the differences between the observed data and the model. The SRMR is the absolute mean of all differences between observed and implied correlations in the model. A mean of zero indicates that there is no difference between the observed data and implied correlations of the model; thus, an SRMR of 0.00 indicates perfect fit (Bentler, 1990; Weston and Gore, 2006).

3. Results and discussion

3.1. Socio-demographic characteristics of consumers

The socio-demographic characteristics of the consumers surveyed are presented in Table 1. More than half of the consumers surveyed were women (59.1%), married (59.4%), and had at least an associate degree (50.3%). In terms of age groups, the respondents aged 29 and younger comprise 37.2% of the total, those 30 to 45 years 40.1% and those 46 and older comprised 22.7%. In addition, 50.3% of consumers have at least associate degree. The proportion of those

Table 1 - Socio-demographic characteristics of consumers.

<i>Demographic Features</i>	<i>Frequency</i>	<i>%</i>	<i>Demographic Features</i>	<i>Frequency</i>	<i>%</i>
<i>Gender</i>			<i>Marital Status</i>		
Female	227	59.1	Married	228	59.4
Male	157	40.9	Single	156	40.6
<i>Education</i>			<i>Age</i>		
≤ High school graduate	191	49.7	≤ 29	143	37.2
≥ Associate degree or higher	193	50.3	30-45	154	40.1
<i>Household size</i>			≥ 46	87	22.7
≤ 4	289	75.3	<i>Job</i>		
≥ 5	95	24.7	Housewife	52	13.5
<i>Household income (TL*/month)</i>			Employee in Private sector	90	23.4
≤ 5000	186	48.4	Employee in Public sector	109	28.4
≥ 5001	198	51.6	Self-employment / tradesman	17	4.4
<i>Number of employees</i>			Retired	32	8.3
≤ 1	186	48.4	Student	58	15.1
≥ 2	198	51.6	Unemployed	26	6.8
Total	384	100.0	Total	384	100.0

* TL: Turkish Liras.

with four or fewer people living in the household was 75.3%, and the proportion of those with two or more income earners in the family was 51.6%. Almost half of those surveyed reported earning an income of 5001 TL or more. Almost one-third of the participants (28.4%) worked in the public sector and 23.4% were employed in the private sector.

3.2. Consumption of foods with GIs

Surveyed consumers were asked what the geographically marked product meant, and 62.5% of the consumers had information about the products with GI (Table 2).

The definition of the product with GI was provided in the questionnaire to clearly understand the concept of the product with GI and it was ensured that the definition was read before answering the questions about consumption. After these explanations, it was determined that 58.9% of consumers consume food with GI (Table 2). Contrary to this study, other studies have observed that having information about a geographically indicated product is quite low. For example, Teuber (2011) found that Hessian consumers' GIs awareness and knowledge were very limited. Meral and Şahin (2013) found that 23.7% of consumers living in Kahramanmaraş Province, Turkey had information about the product with GI. In a study conducted in Bang-

kok, 16.2% of consumers had knowledge of geographical indication (Lee *et al.*, 2020).

Participants were asked to respond to nine propositions using a 5-point Likert scale to determine the product with GI perception and to examine the purchase intention of the product with GI. Consumers agree with the proposition that “products with GI contribute to the producer and the economy of the region” (3.95), “products with GI are more reliable” (3.68), “consume products with GI in the future” (3.66) and “products with GI are of higher quality” (3.64), respectively (Table 3). In the studies conducted, consumers found that geographically marked products were superior to others (Van Ittersum *et al.*, 2000; Teuber, 2011; Vecchio and Annunziata, 2011; Verbeke *et al.*, 2012; Likoudis *et al.*, 2016; Kokthi *et al.*, 2016; Ahrendsen and Majewski, 2017; Kos Skubic *et al.*, 2018; Roselli *et al.*, 2018; Dokuzlu *et al.*, 2020; Lee *et al.*, 2020; Lu and Saijiki, 2021).

Table 2 - Having information about product with GI and its consumption.

	Knowing the products with the GI		Consumption status the products with the GI	
	Frequency	%	Frequency	%
Yes	240	62.5	226	58.9
No	144	37.5	158	41.1
Total	384	100.0	384	100.0

Table 3 - Perception and purchase intention on products with GI.

Code	Explanation	Min.	Max.	Mean	Std. Dev.
<i>Food with GI perception</i>					
c1	Foods with GI contribute to the producer and the economy of the region	1	5	3.95	1.052
c2	Foods with GI are more delicious	1	5	3.48	1.163
c3	Foods with GI are of higher quality	1	5	3.64	1.096
c4	Foods with GI are healthier	1	5	3.60	1.131
c5	Foods with GI are more reliable	1	5	3.68	1.097
c6	The production of foods with GI is more troublesome.	1	5	3.47	1.151
<i>Food with GI purchase intention</i>					
c7	I can pay more for the foods with GI	1	5	3.27	1.180
c8	I will consume foods with GI in the future	1	5	3.66	1.101
c9	I will increase the consumption of foods with GI in the future	1	5	3.63	1.098

1: Strongly Disagree, 2: Slightly Agree, 3: Moderately Agree, 4: Quite Agree, 5: Strongly Agree.

3.3. Model results

According to the results of the reliability analysis, nine variables to be used in the structural equation model are quite reliable ($\alpha=0.954$) and it is found that the means of the questions are different from each other (Hotelling's $T^2=201.127$; $p<0.01$). As a result of the confirmatory factor analysis, when the standard coefficients of the data belonging to the latent variable of GI perception and purchase intention were examined, the variables took values between 0.714-0.957 and all observed variables were used in path analysis because the coefficients were greater than 0.70 (Table 4).

The chi-square statistic, which was accepted as the initial fit index, was found to be statistically significant at the 1% significance level ($p<0.01$). If the χ^2/sd value is less than 3, even if the chi-square result is meaningful, the general fit of the model is a good fit ($\chi^2/sd<3$). When ex-

amining other fit values for the model, it can be seen that the model had a good fit (CFI=0.991, NFI=0.985, IFI=0.992, RMSEA= 0.059, RMR= 0.022) (Table 4).

After evaluating the fit criteria for the validity of the model, information on the non-standardized regression coefficients of the variables is given in Table 5. One of the observed variables was defined as 1 to measure the relationship between latent variables and observed variables, and the other variables were calculated according to this variable. "←" shows the direction of influence between variables. The regression coefficients of all observed variables were statistically significant ($p<0.01$).

The latent variable of food with GI perception was expressed with six observed variables, and all variables were found to be statistically significant, and the path coefficients were positive. All variables have a high effect on the perception of GI, but observed variables with the most impact are that "Foods with GI is healthier" (0.940), "Foods with GI is of higher quality" (0.925), and "Foods with GI is more reliable" (0.898), respectively (Table 6). As consumers' level of agreement with these statements increases, the perception of geographical sign increases positively.

The latent variable of intention to purchase food with GI was expressed using three observed variables (Figure 2). Based on the model, it was concluded that all observed variables have positive and statistically significant coefficients. Moreover, all the observed variables are highly influential on purchasing intentions (Table 6).

Table 4 - Model Fit Values.

	<i>Value</i>	<i>Fit criteria</i>
χ^2 (CMIN)	51.421	
P	0.000	
sd	22	
χ^2/sd	2.337	Good Fit
CFI	0.991	Good Fit
NFI	0.985	Good Fit
IFI	0.992	Good Fit
RMSEA	0.059	Good Fit
RMR	0.022	Good Fit

Table 5 - Non-standardized regression coefficients of variables used in the model.

<i>Variables</i>	<i>Effect</i>	<i>Variables</i>	<i>Estimate</i>	<i>S.E.</i>	<i>C.R.</i>	<i>P</i>
GI_purc_inten	←	GI_perception	1.086	0.073	14.950	<0.01
c1	←	GI_perception	1.000			
c2	←	GI_perception	1.251	0.070	17.915	<0.01
c3	←	GI_perception	1.280	0.065	19.843	<0.01
c4	←	GI_perception	1.342	0.066	20.205	<0.01
c5	←	GI_perception	1.244	0.065	19.107	<0.01
c6	←	GI_perception	1.038	0.071	14.540	<0.01
c7	←	GI_purc_inten	1.000			
c8	←	GI_purc_inten	1.053	0.058	18.033	<0.01
c9	←	GI_purc_inten	1.038	0.058	17.916	<0.01

Table 6 - Path coefficients of variables in the model.

Variables	Effect	Variables	Estimate
GI_purc_inten	←	GI_perception	0.859
c1	←	GI_perception	0.753
c2	←	GI_perception	0.852
c3	←	GI_perception	0.925
c4	←	GI_perception	0.940
c5	←	GI_perception	0.898
c6	←	GI_perception	0.714
c7	←	GI_purc_inten	0.848
c8	←	GI_purc_inten	0.957
c9	←	GI_purc_inten	0.946

The relationship between GI food perception and GI food purchase intention is shown in Table 5, 6 and Figure 2. According to the model result, food with GI perception had a statistically significant and positive effect on the intention to purchase food with GI (0.86). In this case, our hypothesis “Foods with GI perception affect the intention to purchase foods with GI” is accepted. Increasing the level of participation in food with GI perception by one unit increased the intention to purchase food with GI by 0.86. Many studies support this result. Due to higher quality perception, consumers are willing to pay more for local products than the others, due to higher quality (Vecchio and Annunziata, 2011; Aprile *et al.*, 2012; Deselnicu *et al.*, 2013; Lefèvre, 2014; Bishop and Barber, 2015; Kokthi *et al.*, 2016; Lu and Sajiki, 2021; Zhang *et al.*, 2022).

The study conducted in Albania determined that consumers who pay attention to taste and origin are willing to pay more (Kokthi *et al.*, 2016). According to Lu and Sajiki (2021), con-

sumers are willing to pay an extra 8.2% for Tagonoura Shirasu compared to products that are not certified under the GI protection system. Zhang *et al.* (2022) find that consumers are more willing to purchase hometown GI products than non-hometown GI products. GI products are frequently in higher demand and sold at higher prices than non-GI products (Vecchio and Annunziata, 2011). Consumers are willing to pay the highest premium price for a product with a PDO label, followed by a product with an organic food label, and finally a product with a PGI label (Aprile *et al.*, 2012).

4. Conclusion

This study was designed to determine the effect of consumers’ perceptions of GI on purchasing intention. Information about foods with GI was obtained from the consumers, while the explanations and definitions of GI given in the questionnaire contribute to the increase in consumers’ knowledge and to raise awareness of products with GI. These findings appear to be significant for all market participants involved in the supply chain of GI with food as they may serve as a guide for developing production and marketing strategies.

It is obvious that awareness of the concept of GI is still not fully formed, but according to the studies carried out in the past years, awareness is increasing progressively. In addition, it is understood from the results of the study that the GI promotion and advertising activities of the Turkish Patent and Trademark Office, commodity exchanges and chambers, municipalities, and other registered institutions and organisations

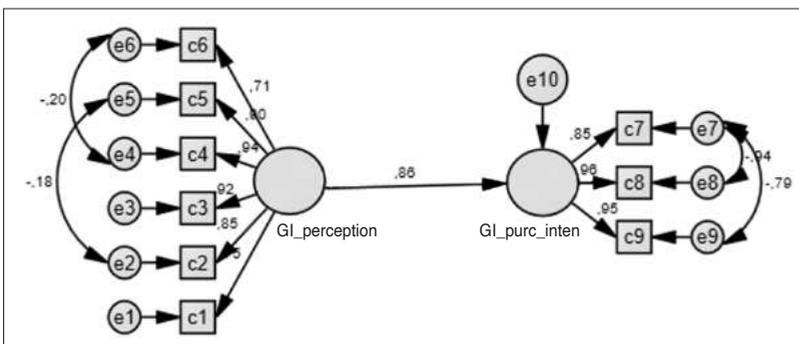


Figure 2 - Path analysis result.

have positive reflections on the product with GI awareness and consumption.

As a result of this research, it has been determined that the contribution of the product with GI to the region and the country's economy, being more delicious, healthy, reliable, and of better quality, will have a positive effect on the intention to purchase foods with GI. Moreover, consumers have positive opinions about foods with GI and are willing to pay more than for other foods. The fact that consumer perception do not change is closely related to the performance of GI foods. Strict monitoring of the production processes of GI foods and ensuring continuity in food production will increase the consumer demand for geographically marked foods. As in this study, in many studies, it has been determined that consumers are willing to pay more for geographically marked foods and are willing to buy. This result can contribute to the income guarantee of farmers and sustainability of production.

Carrying out this research in the provinces located in each region of Turkey and including information about foods with GI makes it important. More information on food with GI would help us to establish a greater degree of accuracy on this matter. Therefore, it is extremely important to focus on other GI product groups in other studies to be carried out, in terms of expanding the subject and guiding researchers and stakeholders working on this subject.

Although this study provides a comprehensive analysis of Turkish consumers' intention to purchase food with geographical indication, given the study's emphasis and scope, some shortcomings deserve further investigation to improve the current study's external validity. We suggest that regionally indicated products be classified into product classes such as milk and dairy products, grains, and handicrafts in future investigations.

In addition, the data for this study were collected in November and December 2020. The fact that the effect of the pandemic was not included in the study is an important shortcoming. Investigating whether the pandemic affects the consumption of geographically marked foods, which are thought to be healthier and of higher quality by consumers, will improve the quality of future studies.

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Factors influencing technological innovation among agribusiness firms: A survey of small agricultural businesses in Ghana

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Abstract

Agricultural research in Ghana has resulted in a number of innovations targeted at increasing the productivity of small agricultural businesses. However, none of these studies has investigated the factors that influence the adoption of technological innovation in Ghanaian agriculture businesses. Hence, this study examines the factors that influence the adoption of technological innovation in Ghanaian agribusinesses. Structural equation modeling was used to examine data collected from 1526 agribusiness employees in Ghana using a convenience sampling technique and a questionnaire survey. The findings indicate that internal, and external factors have an impact on information and communication technology (ICT), and new materials and technology (NM & NT), but no or little impact on biotechnology (BT) respectively. Also, the study reveal that human capital factors have a substantial impact on ICT, BT, and NM & NT. Lastly, the findings show that ICT, BT, and NM & NT have a positive and significant impact on technological innovation. The study underscores the need for agribusinesses to focus on internal and human capital factors since they increase employees' productivity and efficiency.

Keywords: *Agribusiness, Internal factors, External factors, Human capital factors, Technological Innovation, Ghana.*

1. Introduction

Ghana's economy is classified as agrarian in nature. Agriculture contributes significantly to the Ghanaian economy, employing 34% of the working population and contributing significantly to gross domestic product and export profits (Bawa, 2019; Mohammed *et al.*, 2021). Agriculture's growth has been connected to progress in other industries, which invariably helps to alle-

viate poverty (Andrianarimanana and Yongjian, 2021). Poverty is unacceptably high in Ghana, with over 19.2% of the population living in abject poverty (Zereyesus *et al.*, 2017; Dagunga *et al.*, 2020). Over 70% of smallholder farmers farm using rudimentary equipment, and the majority of technical initiatives are outside their financial means (Abokyi *et al.*, 2020). Agriculture is also rain-fed, and most farmers lack the necessary resources, putting smallholder farmers

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in particular at risk, prolonging poverty. When compared to other development sectors of the economy, agricultural growth has a significant influence on poverty because it benefits the bulk of impoverished people. As a result, it is critical that Ghana's agricultural firms stay up with global advances (Banson *et al.*, 2018).

Despite these significant contributions to Ghana's economy, the agricultural sector faces a number of problems that make it difficult for it to integrate technological innovations. For example, according to Daum and Birner (2017), agricultural mechanization has been neglected for decades, which has hindered technological innovation in the agribusiness sector. Ghana's Economic and Agricultural Transformation (2019) states that agriculture in Ghana is predominantly small-scale, traditional, and rain-fed, making it prone to low productivity. In a study of urban agriculture in Ghana, Puppim de Oliveira and Ahmed (2021) discovered that land competition, a lack of urban policy directives, discriminatory land use planning, and land tenure decisions are among the sector's significant issues. According to Abdul-Rahaman *et al.* (2021) who conducted a study on farm production efficiency, small-holder farmers, who face substantial constraints such as restricted access to improved production inputs and technology, financial resources, and extension services, dominate Ghana's agricultural economy. All of these factors lead to low agricultural production, restricting Ghana's ability to meet rising food demand resulting from population increase, urbanization, and shifting consumer dietary habits. Consequently, this study intends to analyze the factors influencing technological innovation among small agricultural firms in Ghana by putting the findings of relevant literature to the test in the context of the agribusiness industry.

According to previous studies, Ghanaian agribusinesses have not completely realized their potential because they have not been able to innovate agricultural technology quickly enough to keep up with improvements in agricultural development knowledge (Abban *et al.*, 2014; Bosompem *et al.*, 2017; Ntiamoah *et al.*, 2019). The research of Vlachopoulou *et al.* (2021) has revealed that agribusinesses should be trained and

equipped with the latest tools and technologies in order to improve their productivity and profitability. Adoption of new technologies, according to Gaffney *et al.* (2019), is influenced by the interaction of several factors. Farmers' adoption of innovation is influenced by the coordinated distribution of inputs and outputs, the provision of technical support, and a steady price and credit for participating farmers. As a result, investigating employee acceptance of innovations inside organizations is crucial, because if employees do not embrace the innovation, the anticipated benefits will not be achieved, and the firm may eventually forsake the innovation. Unless they are satisfied that the change would directly benefit them, people are naturally averse to change (Ali *et al.*, 2021). According to the present literature, we know very little about how agriculture embraces technology innovation and the factors that drive its adoption (Gaffney *et al.*, 2019; Luo *et al.*, 2017; Murray-Prior, 2020). Accordingly, more research into the effects of organizational, external, and other control variables on agribusiness innovation uptake is required. The goal of this study is to close that gap. The study's purpose is to look into the factors that influence agribusiness's acceptance of technological innovation.

This research contributes to the corpus of knowledge by addressing three major issues. Using technological innovation and agribusiness firms' literature, this research contributes to knowledge in a variety of ways. Previous research has concentrated on the factors that influence technological innovation adoption, impact, and organizational performance in the manufacturing and service sectors; thus, concentrating on the factors that influence technological innovation among agribusinesses will benefit the agricultural value chain. Identifying the internal, external, and human capital elements that drive technological innovation might help policymakers make more informed decisions. This study has given agribusinesses policy recommendations that have the potential to boost productivity and innovation effectiveness.

A literature review, data and methods, results and discussion, and conclusion and policy implications are the remaining components of the study. The literature review portion explains the

factors that influence agribusiness technological innovation. The research describes the data and procedures utilized in the research methodology section. The results and discussion section shows the impact of utilizing the dynamic regression model on a data technique. In the section “Conclusion and policy implications,” we present the study’s main findings as well as policy options to aid agribusiness firms in implementing more effective and efficient innovative methods.

2. Literature review

2.1. Adoption of technological innovations

The study’s conceptual framework is the concept of technological innovation adoption. Adoption is described by Rantala *et al.* (2018) as the application of transmitted knowledge concerning a technological advance. Farmers’ opinions of the benefits that would result from the viable and practical reality of the innovation had the greatest impact (Alomia-Hinojosa *et al.*, 2018; Reghunath and Kishore Kumar, 2016). When seen through a broad cross-disciplinary lens, there is widespread agreement that agricultural technology adoption is influenced by a variety of human, social, historical, and economic aspects, as well as the invention’s features (Feyisa, 2020; Ruzzante *et al.*, 2021). According to an analysis undertaken by Khan *et al.* (2021a/b), education level, capital, revenue, farm size, information availability, positive environmental outlook, environmental consciousness, and use of social networks are all linked to the adoption of optimal management techniques. Sinyolo (2020) emphasized that assessing a technology’s adoption potential is multi-faceted, needing knowledge of its farmers’ acceptability, biophysical performance under agricultural conditions, and profitability.

2.2. Adoption of agricultural technology and its determinants

There is a lot of knowledge on the factors that impact the adoption of agricultural technology. According to the authors Gao *et al.* (2020), the dynamic interplay between the technology’s at-

tributes and a variety of events and contexts influences farmers’ judgments about whether and how to accept new technology. Diffusion is the consequence of a series of individual decisions to start using a modern technology, decisions that are typically the result of a trade-off between the unknown benefits of the new innovation and the prospective costs of adoption (Omotilewa *et al.*, 2019). For both economists studying growth determinants and developers and disseminators of such technology, understanding the factors that impact this decision is crucial (Llewellyn and Brown, 2020; Muriithi *et al.*, 2020; Zhang and Wu, 2018).

Personal characteristics and endowments, incomplete knowledge, risk, uncertainty, institutional limits, input availability, and infrastructure have all been used in economic studies of technology adoption in the past (Chibueze and Emmanuel, 2021). Social networks and learning have just been added to the list of variables that influence technology adoption in a new strand of research. Some studies categorize these variables (Ali *et al.*, 2021; Batz *et al.*, 1999; Kuehne *et al.*, 2017; Purnomo *et al.*, 2021). Although technology adoption factors are divided into multiple categories, there is no apparent distinction between variables within each category. This research will examine the factors that influence agricultural technology adoption inside an agribusiness, categorizing them as internal, external, and human capital issues. This will allow a thorough examination of how each aspect affects adoption.

2.3 Agricultural innovations

Agriculture has long been considered as a technology-driven industry, with research and innovation playing a key role in increasing productivity (Berthet *et al.*, 2018). However, studies on innovation and its collaborative networks has primarily concentrated on the manufacturing, high-tech industry, and service sectors, with little emphasis dedicated to agricultural innovations, particularly at the operational, management, and marketing levels (Guo, 2019; Peng *et al.*, 2020; Pozo *et al.*, 2019; Taques *et al.*, 2021). Innovation, according to previous studies Oeij *et al.* (2019), and Hof-

fecker (2021), is the process of experimenting with and developing novel combinations of production variables in economic activities such as production, operation, and management. They go on to say that agricultural innovation is no different than innovation in other industries in terms of recombining existing and adding new production components to optimize resource allocation, increase added value, and overall productivity (Dziallas and Blind, 2019).

As a result, agricultural innovation can be divided into three categories. The first is innovation in a specific agricultural process, such as biotechnology, precision farming, and natural resource pollution management and treatment technologies (Dimitri and Effland, 2020). In addition, product sales innovation, such as e-commerce and online sales, is rising in tandem with the rapid development of information technologies (Warinda *et al.*, 2020). As agricultural growth and the change from production-based to integrated economic, environmental, and social goals progress, it is becoming an emerging need (Sparrow and Traoré, 2018). The second and third categories are both focused on adding value and are often linked, with one on vertical integration and the other on horizontal integration (Klerkx and Begemann, 2020). Vertical integration refers to agricultural enterprises expanding into secondary and service industries, whereas horizontal integration refers to agricultural firms expanding from one site to another using the same brand, production, and management methods. In industrialized countries, agricultural innovations are becoming more common, and much of this knowledge is being exported to developing countries, mainly in Africa (Grovermann *et al.*, 2019; Shi and Pray, 2012).

Product sales innovation is also crucial, especially in developing nations like Ghana, where many farmers are accustomed to direct marketing and selling rather than through intermediaries (Rocchi *et al.*, 2020). Despite the broad acceptance of internet sales, there is still minimal sophistication in the sales and marketing of farm food, as is widely known and with few exceptions (Morel *et al.*, 2020). Consequently, information asymmetry has become a significant issue, with customer demand having minimal bearing on farmer production de-

isions. This is changing, as more sophisticated internet-based technology enables the agricultural sales sector to undergo fast innovation, particularly in response to client demand (Sitaker *et al.*, 2020). New sales and distribution strategies have been created that strengthen the connection between producers and consumers. Contract production and sales, for example, have enabled purchasers meet their individual needs while lowering marketing expenses, reflecting the common interests of both farmers and customers (Fałkowski *et al.*, 2019; Morel *et al.*, 2020).

Much research has been done around the world to support the significant economic contribution of emerging agricultural innovation. As a result, it is commonly considered as a win-win option for agriculture companies. However, little is known about the factors that affect agricultural innovations or how agribusinesses respond to them. The goal of this research is to fill in this knowledge deficit by identifying the factors that influence technological innovation in Ghana's agribusinesses.

2.4. Research model and hypothesis

2.4.1. Internal factors

Previous research has shown that the TAM is applicable to a wide range of agricultural systems (Duong *et al.*, 2019; Mir and Padma, 2020; Molina-Maturano *et al.*, 2020). Farmers and other stakeholders are seen to be more accepting of technological innovation when they have a good understanding of how it will work. Most of the time, an organization's beliefs and ideals reflect its openness to embrace technological advancements. Companies having a long history and strong market performance are more likely to adopt technology than companies lacking those characteristics (Leo *et al.*, 2021). Only a few studies have successfully combined personal qualities with the aim to embrace IT/IS improvements, and even fewer have successfully combined personal characteristics with technological acceptance research. According to Rogers' theory of innovation dissemination Sahin (2006), humans form attitudes toward new technology by synthesizing information from a variety of channels.

When exposed to the same types of media, those with higher personal innovativeness are more likely to produce positive ideas about the target technology. Actors have been practicing new ways of doing things for a long time, so adopting new technology isn't as difficult as it once was. Actors with fewer years of experience, on the other hand, are more likely to oppose new technology. They prefer to address all challenges with the knowledge they have (Kuehne *et al.*, 2017). The compatibility of technology innovation can either encourage or deter agriculture actors from adopting it. Actors believe that the technology they are about to employ will help them improve their performance because of its perceived utility. Agribusiness enterprises believe that any innovation activity that lowers productivity and income is incompatible with their operations (Ntiamoah *et al.*, 2019). In this study, internal factors include PU; perceived usefulness, OC; organizational culture, PI; personal innovation, PE; farmers prior experience, and C; compatibility, as determined by vast literature. Therefore, we posit the following:

H1a: Internal factors have a positive influence on information and communication technology.

H1b: Internal factors have a positive influence on biotechnology.

H1c: Internal factors have a positive influence on new materials and technology.

2.4.2. External factors

People who have access to finance are more likely to accept new technologies, according to studies (Chandio *et al.*, 2021). Access to credit is likely to stimulate the adoption of high-risk technologies by alleviating liquidity constraints and enhancing households' risk-bearing capacity (Twumasi *et al.*, 2020). Enterprises with sufficient funding and other resources can effectively respond to innovations, whereas businesses with inadequate resources are rarely able to withstand industry-wide technical innovation pressures. According to Budzianowski, (2016), organizations in more volatile external environments have a larger potential for innovation because turbulent circumstances compel them to incorporate innovation into their business strategy in order to stay competitive and, eventually, sur-

vive (Rossi, 2017). Technology, market data, and government policy measures can all help to underline the importance of innovation and its potential advantages (Ionescu *et al.*, 2020). Governments, research institutions, and commercial institutions in developed economies provide resources to the agriculture industry to help it operate better. On the other hand, the agribusiness concept is gaining traction in most emerging economies, including Ghana, and obtaining the necessary support from all stakeholders is a major issue for the industry, despite the fact that there are several prospects. IP; industry pressure, GI; government influence, AC; access to credit, and HC; high cost of agribusiness technology were also derived as external factors for this study. It is, thus, hypothesized that:

H2a: External factors have a positive influence on information and communication technology.

H2b: External factors have a positive influence on biotechnology.

H2c: External factors have a positive influence on new materials and technology.

2.4.3. Human capital factors

Human capital is thought to have an important part in agribusiness' decision to adopt new technologies. In order to quantify human capital, most adoption studies looked at the farmer's educational level, age, gender, and household size (Ankrah Twumasi *et al.*, 2021a; Twumasi *et al.*, 2021). Farmers' education is thought to influence their decision to adopt new technology in a positive way. A farmer's ability to learn, comprehend, and apply knowledge crucial to the adoption of a new technology improves with his education (Marescotti *et al.*, 2021). Age is known to have an impact on how quickly people accept new technology. Farmers that are older are said to have accumulated more knowledge and experience over time and are more prepared to evaluate technical data than younger farmers (Marescotti *et al.*, 2021; Molina-Maturano *et al.*, 2021).

Gender issues in agricultural technology adoption have long been researched, and the plurality of studies have revealed inconsistent data on the distinct roles men and women play in technology adoption (Yovo and Ganiyou, 2021). A household's size is simply a measure of labor availability

ty. In a larger family, the work constraints imposed during the introduction of new technology can be reduced, which has an impact on the adoption process (Worku, 2019). Off-farm money has been shown to have a favorable impact on technology adoption. This is because, in many developing nations, rural households rely primarily on non-farm income to overcome credit limits (Twumasi *et al.*, 2021). Several scholars have shown a strong link between extension services and technology adoption. Human capital factors were identified as a viable independent influence on technological innovation. A; age, AR; access to resource, HS; household size, FI; farm income, and FE; level of formal education were the resulting factors for human capital elements. Thus, we propose that:

H3a: Human capital factors have a positive influence on information and communication technology.

H3b: Human capital factors have a positive influence on biotechnology.

H3c: Human capital factors have a positive influence on new materials and technology.

2.4.4. The mediating factors

According to the research of Hwang (2020), Kijek and Kijek (2019), and Yunis *et al.* (2018), ICT-based innovations and applications have become key drivers of enhanced organizational performance, economic growth, and social change, and ICT use increases technical creativity, according to

a study that looked into the relationship between ICT and technological innovation. Jafari-Sadeghi *et al.* (2021) investigated the impact of digital transformation on technological market expansion and discovered that ICT has a key role in market expansion technological innovations. Again, in order to better understand how biotechnology contributes to technological innovations within the food value chain, Foltz *et al.* (2003), Spielman *et al.* (2014), and Goeschl and Swanson (2003) found that biotechnology innovations have enhanced crop yields in recent years, but real policy reforms are needed to foster additional innovation, eliminate regulatory uncertainty, and encourage firm- and industry-level growth, as well as sustained public funding on agricultural research. The study Scarpato and Ardeleanu (2014) looked at the role of biotechnological innovations in food and sustainability, and found that today’s major challenge for the agriculture sector is feeding a growing population, and that biotechnology for plant variety improvement is one of the most promising sectors that requires immediate attention.

Furthermore, research has shown the role of novel materials and technologies in the transformation of sustainable food systems. According to a review study on the potential role of technology innovation in the transformation of sustainable food systems Bedeau *et al.* (2021), and Khan *et al.* (2021a), modern technology and innovation are crucial for developing sustainable food systems

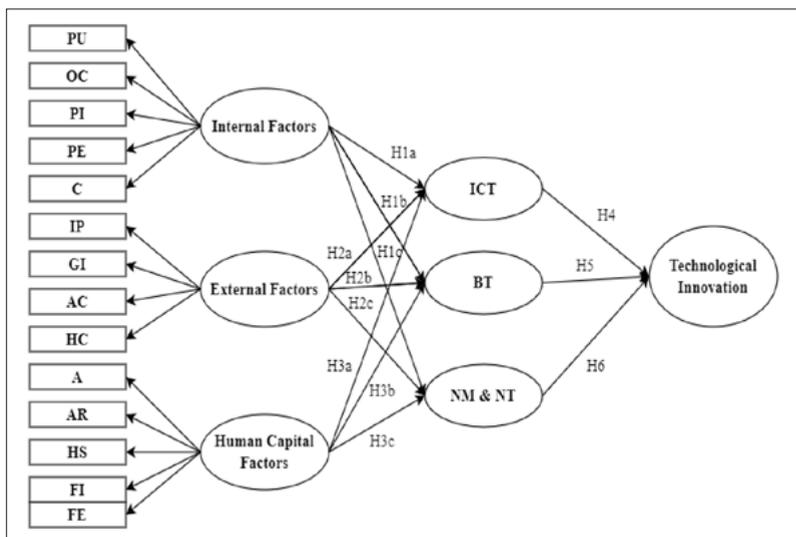


Figure 1 - Conceptual model.

(SFSs) because they can be utilized to answer some of the key questions that will help us better comprehend global food security and nutrition. New materials and agricultural technology breakthroughs are critical for enhancing productivity, sustainability, and resilience in food production and agriculture, according to studies by (Cheng *et al.*, 2021; Liu *et al.*, 2021; Spielman *et al.*, 2009; Zaitsev *et al.*, 2020). They also found that new digital agriculture technologies such as the Internet of Things (IoT), artificial intelligence and machine learning, drones, advanced robotics, autonomous vehicles, advanced materials, and gene technology like biofortified crops, genome-wide selection, and genome editing have the potential to transform sustainable food systems. As a result, we propose the following hypotheses:

H4: Information and communication technology (ICT) has a positive influence on TI.

H5: Biotechnology (BT) has a positive influence on technological innovation.

H6: New materials and technologies have a positive influence on technological innovation.

3. Research methodology

3.1. Data collection and sampling selection

A pre-testing with ten experts from non-sampled agribusinesses was undertaken prior to data collection to determine the questionnaire's applicability. First, because all of the agribusiness enterprises in the study are members of the Chamber of Agribusiness (CAG), we obtained permission from the CAG and explained the purpose of the study to the respondents before handing out the questionnaires. Following that, we conducted a pilot test with 100 agribusiness practitioners from the research area to analyze the questionnaire's phrasing, clarity, relevance, and time spent (Ebrahimi Sarcheshmeh *et al.*, 2018). In terms of phrasing, clarity, and relevancy, the pilot test found no major issues. The questionnaire was deemed simple to understand and fill out, and just a few minor revisions were required, which we dutifully made. Furthermore, Cronbach's alpha was calculated for all of the questionnaire items, and the findings revealed values higher than .70, as predicted by the formula (Ahmadi Dehrashid *et*

al., 2021; Hayran *et al.*, 2018; Rajabi *et al.*, 2012). The questionnaire was divided into two parts. The participants' demographic characteristics were examined in section one, and the respondents' perceptions of the study model's constructs were measured in section two.

Finally, a convenience sample of 2500 self-administered questionnaires were delivered to agribusiness employees in 10 cities: Accra, Cape Coast, Kumasi, Takoradi, Koforidua, Ho, Sunyani, Tamale, Bolgatanga, and Wa. The study's participants came from all of Ghana's regions. Because most agribusiness enterprises are located in urban regions, where labor and markets are readily available, these locations were chosen. Due to resource and time restrictions, a convenient sample was used. This method, on the other hand, is similar to that used by (Piñeiro *et al.*, 2021). Four researchers collected data over the course of seven weeks. Due to inaccurate responses and missing data, 974 of the 2500 questionnaires given were discarded. As a result, 1526 valid questionnaires were determined to be analyzable and employed in the research. Males made up 54.6 percent of the responses, while females made up 45.4 percent, according to descriptive statistics. In terms of age, the majority of respondents (37%) are between the ages of 36 and 45, while 25.8% are between the ages of 26 and 35. Furthermore, 64.8 percent of the respondents had earned at least a higher national diploma. In addition, the data revealed that 69.9% of respondents have worked in the agribusiness industry for four years or more, and that 87.5 percent of respondents consider their agribusiness activities to be very innovative. Table 1 shows the complete descriptive statistics for the demographic characteristics of the respondents.

3.2. Measures

All of the items were derived from previous literature and modified to fit the study's context in order to ensure and maintain content validity. Our conceptual model consists of 15 constructs, each of which was assessed using a variety of criteria. Internal factors such as perceived usefulness (PU), organizational culture (OC), personal innovation (PI), prior ex-

Table 1 - Demographic data of respondents.

Variable	Category	Frequency	%
Gender	Male	834	54.6
	Female	692	45.4
Age (in years)	18-25 years	112	7.3
	26-35 years	394	25.8
	36-45 years	564	37
	46-55 years	365	24
	56 and above	91	5.9
Level of education	Basic level	189	12.3
	High school level	349	22.9
	Higher national diploma	395	25.9
	Bachelor Degree	413	27.1
	Postgraduate degree	180	11.8
Agribusiness experience (years)	Less than 1 year	103	6.7
	1-3 years	362	23.7
	4-6 years	589	38.6
	7-9 years	336	22
	10 years and above	136	9
Agribusiness firm innovativeness	Excellent	315	20.6
	Very good	412	27
	Good	609	39.9
	Poor	126	8.3
	Very good	64	4.2

perience (PE), and compatibility were assessed using Kuehne *et al.* (2017), and Ntiamoah *et al.* (2019) scales. External factors such as industrial pressure (IP), government influence (GI), access to credit (AC), and high cost of agriculture technology (HC) were assessed using scales developed by Chandio *et al.* (2021), and Twumasi *et al.* (2020) respectively. Human capital factors including age (A), access to resources (AR), household size (HS), farm income (FI), and level of formal education (FE) were all measured using scales developed by Ankrah Twumasi *et al.* (2021), and Twumasi *et al.* (2021). Finally, items derived from Kijek and Kijek (2019), and Yunis *et al.* (2018) were used to assess technological innovation. The questionnaires contained biographical information as well as five-point Likert scale questions ranging from fully agree to completely disagree, with neutral values in the middle. 1, 2, 3, 4, and 5 denote fully disagree, disagree, neutral, agree, and absolutely agree, respectively.

4. Results and analysis

Two steps were involved in the statistical data analysis. The validity of the proposed research paradigm was first determined. The reliability of model components was determined using Cronbach's coefficient. Convergent and discriminant validity, as well as composite reliability, were explored more thoroughly using confirmatory factor analysis (CFA). Structural equation modeling was used to assess the stated study hypotheses (SEM). The data was analyzed using SPSS and AMOS. The reliability study revealed that all coefficients were significantly over the cut-off criterion of 0.700, indicating that each construct had a high level of internal consistency (Table 2) (Mba *et al.*, 2021). Cronbach's coefficient values ranged from 0.786 to 0.923 in this study. In addition, all constructs' composite reliability (CR) values were within the range of 0.700, as recommended by Benson *et al.* (2020), ranging from 0.788 to 0.929 (Table 2), indicating appropriate construct internal consistency.

Table 2 - Reliability and validity of the constructs.

<i>Construct</i>	<i>Indicators</i>	<i>Factor Loadings</i>	<i>Cronbach's alpha</i>	<i>Composite reliability</i>	<i>AVE</i>
Perceive usefulness	PU1	0.733	0.786	0.794	0.698
	PU2	0.818			
	PU3	0.721			
Organizational culture	OC1	0.824	0.810	0.833	0.734
	OC2	0.732			
	OC3	0.801			
Personal innovation	PI1	0.778	0.842	0.854	0.763
	PI2	0.852			
	PI3	0.836			
Farmers' experience	PE1	0.785	0.788	0.797	0.699
	PE2	0.762			
	PE3	0.812			
Compatibility	C1	0.910	0.923	0.929	0.752
	C2	0.894			
	C3	0.811			
Industry pressure	IP1	0.741	0.786	0.788	0.681
	IP2	0.782			
	IP3	0.733			
Government influences	GI1	0.792	0.801	0.825	0.717
	GI2	0.728			
	GI3	0.798			
Access to credit	AC1	0.791	0.814	0.836	0.720
	AC2	0.823			
	AC3	0.754			
High cost of agribusiness technology	HC1	0.811	0.823	0.841	0.734
	HC2	0.737			
	HC3	0.722			
Age	A1	0.877	0.893	0.893	0.767
	A2	0.798			
	A3	0.757			
Access to resource	AR1	0.814	0.820	0.846	0.739
	AR2	0.737			
	AR3	0.721			
Household size	HS1	0.771	0.822	0.839	0.737
	HS2	0.768			
	HS3	0.813			
Farm income	FI1	0.755	0.857	0.864	0.771
	FI2	0.843			
	FI3	0.733			
Farmers' education	FE1	0.889	0.902	0.908	0.758
	FE2	0.832			
	FE3	0.741			
Technological innovation	TI1	0.853	0.881	0.889	0.724
	TI2	0.823			
	TI3	0.791			
	TI4	0.861			
	TI5	0.798			

Note: AVE = average variance extracted.

Table 3 - Means, standard deviation, and discriminant validity.

	M	SD	PU	OC	PI	PE	C	IP	GI	AC	HC	A	AR	HS	FI	FE	TI
PU	3.745	0.725	.826														
OC	3.986	0.698	.089	.835													
PI	4.231	0.823	.229	.289	.717												
PE	4.004	0.753	.269	.376	.211	.822											
C	3.244	0.676	.348	.282	.370	.359	.837										
IP	3.986	0.719	.290	.438	.260	.214	.489	.741									
GI	4.084	0.746	.225	.310	.405	.348	.367	.420	.818								
AC	4.032	0.731	.247	.303	.309	.471	.458	.389	.516	.805							
HC	3.902	0.712	.238	.370	.271	.237	.203	.378	.418	.519	.733						
A	4.186	0.823	.248	.223	.243	.385	.349	.293	.471	.487	.671	.854					
AR	4.007	0.737	.343	.337	.329	.262	.336	.120	.460	.499	.534	.648	.861				
HS	4.121	0.667	.228	.322	.431	.380	.479	.231	.325	.541	.424	.486	.639	.819			
FI	4.408	0.781	.386	.336	.358	.298	.221	.308	.290	.514	.588	.498	.534	.748	.727		
FE	4.021	0.729	.243	.420	.338	.373	.491	.489	.145	.466	.515	.548	.557	.535	.635	.811	
TI	4.231	0.739	.353	.395	.310	.388	.485	.437	.326	.542	.523	.612	.641	.645	.654	0.546	.868

Note: PU = perceived usefulness; OC = organizational culture; PI = personal innovation; PE = prior experience; C = compatibility; IP = industrial pressure; GI = government influence; AC = access to credit; HC = high cost of agriculture technology; A = age; AR = access to resources; HS = household size; FI = farm income; FE = level of formal education; and TI = technological innovation.

The validity analysis took into account both convergent and discriminant validity. Table 3 demonstrates that the average variance extracted (AVE) for each construct was greater than the squared correlation coefficient for associated inter-constructs, implying discriminant validity (Benson *et al.*, 2020; Rönkkö and Cho, 2022). Furthermore, the fact that all AVEs (see Table 2) were greater than 0.500, ranging from 0.681 to 0.771, confirmed convergent validity. Furthermore, the CFA results in Table 2 give additional evidence for the convergent validity of measures, as all of the calculated loadings were significant at $p < .001$ (Swami *et al.*, 2017). The goodness-of-fit test was used to evaluate for sampling correspondence and sampling adequacy. The value of 1.811 for the $\lambda^2/\text{degree of freedom}$ corresponded to the general rule of $1 < \lambda^2/\text{df} < 5$, showing evidence of a good match. With values > 0.9 , the CFI (comparative fit index) of 0.955, the NFI (normed fit index) of 0.939, the RFI (relative fit index) of 0.901, the IFI (incremental fit index) of 0.956, and the TLI (Tucker-Lewis fit index) of 0.964 all revealed a very good fit. Finally, the RMSEA value of $0.0025 < 0.08$ indicated that the model was well-fit.

Furthermore, taking into account the validity of self-report questionnaires, this study used Harman's single-factor test to assess for the likelihood of common method variance (CMV) (Fuller *et al.*, 2016; Tehseen *et al.*, 2017). All of the study items are generally subjected to exploratory factor analysis (EFA) in a single-factor test. CFA can be used instead of EFA when doing Harman's single-factor test. All of the displayed components can be modelled as indicators of a single factor that exhibits technique effects using the CFA approach (Sureshchandar, 2021). In CFA fitness indices, the single-factor model (CMIN/DF = 3.762, GFI = 0.689, AGFI = 0.659, CFI = 0.523, NFI = 0.541, IFI = 0.558, TLI = 0.518, RMR = 0.061, RMSEA = 0.083) does not yield a better outcome than the current model, indicating that CMV is not a problem in this data set.

4.1. The structural model analysis

The assumed correlations among latent variables were tested using the structural model SEM with maximum likelihood estimation. The results are shown in Table 4 and Figure 2. The structural model fits the data well (CMIN/DF =

Table 4 - Standardized path coefficients.

Hypothesis	Path	Estimate	SE	Composite reliability	P value
H1a	ICT ← IF	0.433	0.053	7.940	.000
H1b	BT ← IF	0.088	0.042	5.657	.073
H1c	NM & NT ← IF	0.221	0.086	3.120	.000
H2a	ICT ← EF	0.324	0.060	5.234	.000
H2b	BT ← EF	0.095	0.051	1.437	.109
H2c	NM & NT ← EF	0.411	0.047	1.983	.000
H3a	ICT ← HCF	0.678	0.068	7.852	.000
H3b	BT ← HCF	0.252	0.038	6.589	.000
H3c	NM & NT ← HCF	0.336	0.062	3.323	.000
H4	TI ← ICT	0.585	0.056	8.788	.000
H5	TI ← BT	0.462	0.030	9.563	.000
H6	TI ← NM & NT	0.512	0.070	7.899	.000

Note: ICT = information and communication technology; IF = internal factors; BT = biotechnology; NM & NT = new materials and new technology; EF = external factors; HCF = human capital factors; and IT = technological innovation.

2.804, GFI = 0.902, AGFI = 0.867, NFI = 0.889, IFI = 0.906, TLI = 0.901, CFI = 0.913, RMR = 0.036, RMSEA = 0.067), according to the goodness of fit indices. The p value of a path is used to determine its significance in path analysis. The standardized path coefficients (β) and p values are listed in Table 4, and Figure 2 depicts the variance explained by the research model (R^2). The findings revealed that significant factors that affect technological innovations can explain 66.2 %, 48.7%, and 58.6% of the variances in ICT, BT, and NM & NT, respectively, whereas ICT, BT, and NM & NT can explain 74.5 percent of the variance in technical ways to adopt

innovations.

The predicted path coefficients of the structural model were then investigated to evaluate the hypotheses after the model was found to be a good fit to the data. The path and significance of causal links between latent variables should be investigated using the structural model Ntiamoah *et al.* (2019). Internal factors (H1a: $\beta = .433$, $t = 7.940$, $p = .000$), external variables (H2a: $\beta = .324$, $t = 5.234$, $p = .000$), and human capital factors (H3a: $\beta = .678$, $t = 7.852$, $p = .000$) all had a substantial impact on ICT, according to the structural model results shown in Table 4 and Figure 2. As a result, H1a, H2a, and H3a were supported. Human cap-

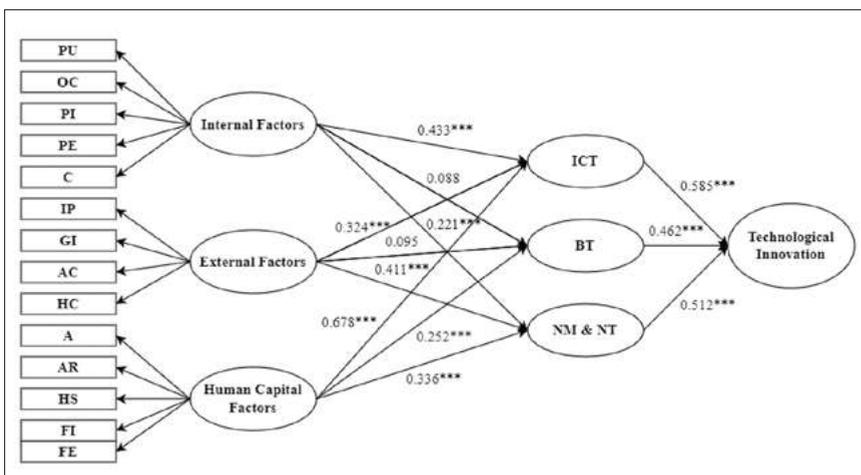


Figure 2 - Results of the model.

ital factors had a substantial impact on BT (H3b: $\beta = .252$, $t = 6.589$, $p = .000$). Internal (H1b: $\beta = .088$, $t = 6.589$, $p = .073$) and external (H2b: $\beta = .095$, $t = 1.437$, $p = .109$) factors, on the other hand, were insignificant. As a result, H3b was supported, but H1b and H2b were not. Internal factors (H1c: $\beta = .221$, $t = 3.120$, $p = .000$), external factors (H2c: $\beta = .441$, $t = 1.983$, $p = .000$), and human capital factors (H3c: $\beta = .336$, $t = 3.323$, $p = .000$) all had a substantial impact on NM and NT, demonstrating that H1c, H2c, and H3c are all supported. Furthermore, the findings reveal that ICT (H4: $\beta = .585$, $t = 8.788$, $p = .000$), BT (H5: $\beta = .462$, $t = 9.563$, $p = .000$), and NM & NT (H6: $\beta = .512$, $t = 7.899$, $p = .000$) have a considerable impact on technical methods to adopting innovation, hence supporting H4, H5, and H6.

5. Discussion

The use of technological innovation by agriculture is seen as a critical component in countering domestic and international rivalry competition among agricultural enterprises. Agribusiness enterprises in Ghana, in particular, are trying to place themselves on par with multinational agribusiness firms in terms of offering excellent services via branding, marketing, and other means. The zeal with which these companies pursued technological innovation has influenced us to study the factors that stimulate the adoption of technological innovation by agriculture companies in Ghana. The impact of internal, external, and human capital determinants on the adoption of technological innovation was investigated in this study. Three (3) mediating factors were used to examine these variables (ICTs, Biotechnology, New materials and technology). The goal of the study was to look at the factors that can influence technological innovation in small agricultural businesses. Based on the findings, our proposed research model was able to achieve a sufficient degree of predictive power for the dependent variables: ICT (66.2%), BT (48.7%), NM & NT (58.6%), and technological innovation (TI) (74.5%). Furthermore, the R^2 value accounted for in technological innovation was within extremely acceptable bounds and exceeded several researchers' proposed val-

ues (Durowoju, 2017). In addition, the value of variance is higher than in other similar research studies that looked at organizational technological innovations. For example, Hwang (2020), Niehaves and Plattfaut (2014), Kijek and Kijek (2019), and Yunis *et al.* (2018) explored the correlation between ICT and technological innovation and discovered that ICT-based innovations and applications have become primary factors of improved organizational performance, economic growth, and social change, and that ICT use enhances technological innovation.

Table 4 shows the path coefficient analyses, which show that the research assumptions are generally confirmed. The findings show that all internal factors, such as perceived usefulness, organizational culture, personal innovation, prior experience, and compatibility, have an impact on information and communication technology (H1a) and new materials and technology (NM & NT) (H1c), but not on biotechnology (BT) (H1b). Perceived usefulness, personal innovation, and organizational culture have all been shown to have a strong beneficial impact on behavioral intention to embrace an innovation (Ankrah Twumasi *et al.*, 2021b; Haji *et al.*, 2020). Surprisingly, respondents' responses to the compatibility questions revealed that prior knowledge of the use of new materials and technology did not always impact technology adoption (Saurabh and Dey, 2021). Internal factors have a greater impact on ICT than BT, NM, and NT, according to the findings (Li *et al.*, 2020; Prause, 2019; Takahashi *et al.*, 2020). Although biotechnology and new materials and technology are important in increasing productivity and efficiency, most agribusinesses in Ghana think that ICT activities improve yields and efficiency. Our findings are consistent with those of other investigations (Bersani *et al.*, 2020; Steinke *et al.*, 2022).

External variables such as industry pressure, government influence, financial availability, and the high cost of agricultural technology have a considerable impact on ICT (H2a) and NM&NT (H2c), but have a little impact on BT (H2b). However, respondents claimed that adopting high-cost ICT agriculture technology has a negative impact on a company's profitability and long-term viability, making it less likely

to accept technological innovation (Rabadán *et al.*, 2019). Within the agro industry, the results demonstrate that external forces have a greater influence on new materials and technologies than information and communication technology and biotechnology (Blichfeldt and Faullant, 2021; Conidi *et al.*, 2020; Jambrak *et al.*, 2021; Smajlović *et al.*, 2019; Zhang *et al.*, 2018). Asadi *et al.* (2020) looked at the factors that drive innovation adoption and its prospective effects on performance, and discovered that industry pressure and government influence illustrate the importance and potential of innovation in supporting long-term performance. Furthermore, Wang (2018) found that government is one of the most important determinants of innovation capability, and that government intervention is necessary in innovation because the market alone cannot provide appropriate incentives for knowledge development. Government intervention, according to the study, increases the technological relevance and scope of innovation.

Human capital factors like age, access to resources, household size, farm income, and level of formal education all have a substantial impact on ICT (H3a), BT (H3b), and NM & NT (H3c). Although all of the contributions are favorable, the findings show that human capital considerations contribute much more to ICT than BT, NM, and NT. This finding lends credence to the study of Gao *et al.* (2020). Furthermore, the findings show that ICT has a considerable impact on technological innovation (H4), BT has a big impact on TI (H5), and NM and NT have a favorable impact on TI (H6). These findings corroborate previous research (Bedeau *et al.*, 2021; Foltz *et al.*, 2003; Goeschl and Swanson, 2003; Hwang, 2020; Jafari-Sadeghi *et al.*, 2021; Khan *et al.*, 2021a; Kijek and Kijek, 2019; Spielman *et al.*, 2014). Moohammad *et al.* (2014) discovered a relationship between company size, age, and organizational innovation in their study. According to the findings, the size and age of a company have a substantial impact on organizational creativity. In addition, Mazzarol *et al.* (2010) looked at the impact of firm size and age on growth in 143 companies in Australia, France, and Switzerland. According to the study, the size of a company, its age, and the rate at which it

grows are all crucial factors in determining how quickly it adopts innovation.

We also discovered that information and communication technology (ICT) aids technical advancement. In comparison to biotechnology and new materials and technology, agribusinesses in Ghana are more familiar with the use of ICT in implementing technological innovation, according to the survey. According to the analysis, biotechnology adds to technical innovation. Seedlings, pesticides, feed, and food firms have all been found to have biotechnology components in recent years, according to the study. However, we noticed that a lot of agribusiness managers are concerned about the consumption of genetically modified (GM) foods and oppose GM crop production. Also, the high cost of biotechnology, predictably, has a negative impact on the firm's overall profitability as well as its day-to-day operations. These findings add to previous study conducted by the author Kim *et al.* (2011). Finally, the study discovered that new technologies and innovation are vital for enhancing production of food because they can be used to answer some of the critical questions that must be addressed in order to reform the global food system and better understand global food security and nutrition. New materials and agricultural technology advances are crucial for increasing food production and agriculture productivity, sustainability, and resilience.

6. Conclusion and policy implications

Agriculture technology innovation is critical for developing countries to achieve broad-based social and economic progress. The sector gives employment to more people than any other in Ghana and the wider region. It is, however, much more than a source of employment and economic stability. Ghana's agriculture sector has contributed significantly to the country's food security. In order to be self-sufficient and able to feed itself despite challenges such as population growth, climate change, and variability, Ghana requires rapid new agricultural innovations that can help agribusinesses build profitable companies that are workable and able to contribute to the global value chain. According to studies in

Ghana, a combination of innovations and operational support services is required to improve agricultural productivity, boost smallholder farmer incomes, and alleviate poverty. Also, the concept of agribusiness and technical innovation has not reached the majority of agrarian companies in developing countries like Ghana.

As a result, it was crucial to shed light on the factors influencing the adoption of agricultural technology innovation in Ghana as a whole using a survey data of 1526 respondents from the ten regions of Ghana. The impact of internal, external, and human capital determinants on the adoption of technological innovation was investigated in this study. Three (3) mediating factors such as information and communication technology, biotechnology, and new materials and technology were used to examine these variables. The findings indicate that internal factors have an impact on information and communication technology (H1a) and new materials and technology (NM & NT) (H1c), but not on biotechnology (BT) (H1b). The results show that external variables have a considerable impact on ICT (H2a) and NM & NT (H2c), but have a little impact on BT (H2b). Also, the study reveal that human capital factors have a substantial impact on ICT (H3a), BT (H3b), and NM & NT (H3c). Lastly, the findings show that ICT has a considerable impact on technological innovation (H4), BT has a big impact on TI (H5), and NM and NT have a favorable impact on TI (H6).

Theoretically, by examining internal, external, and human capital factors, this study has been able to advance the literature relating to the factors that impact technological innovations among small agribusinesses. Previous research has looked at the relationship between agricultural enterprises and technological innovation (Anang, 2018; Danso-Abbeam *et al.*, 2019; Martey *et al.*, 2014; Tsinigo and Behrman, 2017). No study, however, has looked into the factors that influence agribusiness's willingness to adopt technological innovation. The internal, external, and human capital components investigated had a significant and positive impact on the mediating factors, as well as a favorable effect on the dependent variables, according to the findings.

As a result, the proposed and tested model in this study could be used as a reference for any future studies looking at agricultural innovation adoptions. The research is also one of the first to look into the factors that influence technological innovation in the agricultural sector. As previously noted, there is a paucity of empirical research on the factors that influence technical innovation in agribusinesses. This study tried to address that gap, and the findings reveal some major discoveries on the impact of internal, external, and human capital determinants on agricultural innovation in developing countries, greatly expanding and improving the existing literature.

From a managerial perspective, the various impacts of internal, external, and human capital factors on technological innovation via ICT, BT, NM&NT suggest that agribusiness managers should pay close attention to internal and human capital factors because they have a significant impact on employee productivity and efficiency. Employees with past expertise, who are highly innovative, and who have a positive attitude toward new ideas and innovations, for example, are more likely to see innovations as more valuable and impactful to organizational performance. Employees' age, level of formal education, and the company's ability to provide the resources needed to engage in innovative activities can all help to boost organizational productivity and efficiency. Furthermore, the government should develop practical innovation measures to encourage small agribusiness enterprises to incorporate technology innovation into their daily operations, as well as to ensure that recent innovations are extremely profitable, superior, and easy to understand, as well as compatible with existing values, norms, prior experience, and agribusiness demands. In the future, future research could expand on this study by addressing the following constraints. This model can be used in future study to look at the adoption of innovation in various sectors of the economy. Because our research is limited to Ghana, it would be intriguing to see if the findings hold true in other developing nations such as Nigeria, Uganda, Kenya, and Ethiopia, where food security is a concern and novel techniques to feeding a growing population are required.

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Consumers' food safety perceptions in three Mediterranean countries

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Abstract

The purpose of the study is to investigate and compare consumers' food safety perceptions in three Mediterranean countries (Greece, Italy, and Spain). A survey was carried out based on a structured questionnaire focusing on food safety-related issues concerning food characteristics, the labeling of systems implemented by food companies such as the Quality Management System and the Food Safety Management System, consumer trust in the food supply chain, and consumer illusion of food control. Information was collected from individuals located in those three countries (2,664 respondents), which share common characteristics. The results indicate that there is a significant heterogeneity in consumers' food safety perceptions in the three countries. The Spanish sample has the greatest level of trust in the supply chain in terms of food safety and the highest level of illusion of food control. The Italians evaluate the food characteristics and the QMS-FSMS's labeling higher than the Spanish and the Greeks. This multinational study brings to light the different types of food safety concerns of consumers from three Mediterranean countries.

Keywords: Food safety, Food characteristics, QMS-FSMS's labeling, Trust, Illusion of control.

1. Introduction

Consumers, food companies, and governments often face foodborne illnesses and virus outbreaks, which are a worldwide concern rather than merely nationally or regionally specific (Popova *et al.*, 2010). Consumers' concerns over food safety have escalated, making them more precise about their food choices and more demanding in terms of healthy and safe food (Liu and Ma, 2016; Gracia and de Magistris, 2016). In other words, nowadays,

the consciousness of consumers with regard to the risks of foodborne diseases has been increased (Göbel *et al.*, 2022). According to the European Food Safety Authority (2019), one of the most important factors for Europeans when purchasing food is food safety, since 41% of them declare that they are personally interested in this topic. Thus, over the last few years, food quality and safety has been a concern that has attracted a great amount of public, political, industrial, and research attention (Psomas and Kafetzopoulos, 2015).

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As an emerging field, there are few previous academic empirical studies concerning how food safety is understood and what food safety means to individuals. These topics still remain underdeveloped in the literature (Elliott and Ellison, 2018, p. 2748). Ortega and Tschirley (2017) also state that the knowledge about consumer demands for food safety is limited. Similarly, Bozoglu *et al.* (2019, p. 2380) point out that food safety has not been a common research topic in developed countries from the consumer perspective. Most of the previous studies are related to specific product categories (e.g., meat, fish, fruits, and vegetables) or they focus on a narrow range of food safety attributes (e.g., country of origin, amount of preservatives and pesticides, organic food products) (Bouranta *et al.*, 2019).

It is worth noting that consumer attitudes with regard to food safety appear to vary considerably across different countries, making it difficult for policymakers to create a single and general strategy for multinational export food companies (Mazzocchi *et al.*, 2008; Poinhos *et al.*, 2014). An examination of spatial differences in consumer perception of food safety is important, as it will support the development of effective food safety communication strategies (Ha *et al.*, 2019). According to Brečić *et al.* (2017, p. 857), the differences among consumers are often neglected by marketing strategies that assume that “one size fits all”. Market segmentation based on consumers’ food safety perceptions should help food supply chains to tailor their communication strategies to different groups of international consumers (Chen, 2012).

The literature gap identified above as well as the differentiation of consumers’ food safety perceptions across countries, stimulated the authors of the present study to conduct a multinational study. More specifically, this study was conducted in three Mediterranean countries: Greece, Italy, and Spain, aiming at eliciting consumers’ perceptions with regard to food characteristics and the labeling of systems implemented by food companies such as the Quality Management System (QMS) and the Food Safety Management System (FSMS), trust in the food supply chain, and illusion of food control. These developed Mediterranean countries share some common characteristics, which was the reason for their selection.

Specifically, in these countries, agriculture is supported by similar climatic conditions and is considered an important sector for their domestic economies (Eurostat, 2012). Moreover, the Mediterranean crops require high levels of seasonal labor, small and medium-sized family businesses dominate the markets of these Mediterranean countries, and newly-arrived migrants/refugees are recruited in their rural areas helping to reduce labor costs (Corrado, 2018). Moreover, the three countries share a common retail structure, which is characterized by having few European food retailers and many small independent retailers (Grunert *et al.*, 2012). The data also shows that the amount consumers spend on food per capita for Greece (2,510.6 US dollars), Italy (2,986.9 US dollars), and Spain (2,217.9 US dollars) is almost equal (Knoema, 2018). Additionally, the consumers of these countries share similar preferences for the freshness and quality of their food since they follow the same nutritional model based on the Mediterranean diet.

Thus, by asking Greek, Italian, and Spanish consumers about food safety-related issues, this study attempts to find out and justify any significant differences in their perceptions regarding food safety. It should be noted that their perceptions with regard to food safety-related issues might vary due to their cross-cultural differences, historical differences in governance practices, and the occurrence in their countries of food safety incidents (Popova *et al.*, 2010).

The following section of the paper briefly describes the food safety-related issues in the context of the food characteristics, the labeling of systems implemented by food companies such as the QMS and the FSMS, consumer trust in the food supply chain, and consumer illusion of food control. The methodological analysis and results are presented in the two subsequent sections. In the final section of the paper, the results are discussed and the main conclusions and limitations of the study are presented.

2. Literature review

Based on the food quality model formulated by Brunsø *et al.* (2005), three main types of food safety can be distinguished: product-oriented

safety, safety control, and user-oriented safety. Product-oriented safety covers the aspects of the physical product characteristics, that are mainly extrinsic attributes that give a basic description of the food product. The notion of food safety control covers the way the food product has been portrayed following quality or food safety management systems or legislation to ensure that it is safe for consumption. User-oriented safety is a subjective perception from the consumer's point of view (Brunso *et al.*, 2005). In the absence of sufficient knowledge, consumers' decisions are guided by their trust and illusion of food control. To cover these main types of food safety, this empirical research focuses on food characteristics, the QMS-FSMS's labeling, and consumer trust in and illusion of food control.

2.1. Food characteristics

The reporting of fraud in the food supply makes consumers more aware of food safety issues. They realize that food safety is not a given for every food product placed on the market, but it should be considered as a food quality characteristic (Lau *et al.*, 2018). Consumers, mainly in developed societies, have become more discriminating in their food product choices, since they want not only safe but also fresh and healthy food that contributes to their welfare and a balanced diet (Misra and Singh, 2016; Hamam *et al.*, 2022). Thus, the concept of food safety includes an assurance that the food will not harm the consumer and that it has essential nutritional ingredients (Grunert, 2005).

Consumers evaluate different food product characteristics and try to guess how they may influence the safety of food. Their evaluation of food is based on both intrinsic and extrinsic attributes (Wu *et al.*, 2011; Brečić *et al.*, 2017). In most cases, consumers cannot evaluate the intrinsic attributes of food during the retail phase. Before the purchase, they cannot check it directly, except in the case of a food product being available for tasting in the shop (Bouranta *et al.*, 2019).

Djekic and Smigic (2016) point out that food product labels are one of the most important communication channels between food producers and consumers. Hence, consumers' expectations and decisions are mainly influenced by the

level and quality of the information provided on the product package (Akpyomare *et al.*, 2012; Miroso *et al.*, 2021). These labeling cues help consumers to make a conscious choice while purchasing their foodstuff. The use of labels to ascertain information is different among international consumers. For example, Annunziata *et al.* (2016) found that U.S. consumers on average tended to pay more attention to nutritional labels when buying wine when compared to Italian, French, and Spanish consumers.

Bearing in mind the above discussion, the following research questions are formulated in order to be answered based on samples of Greek, Italian and Spanish consumers:

RQ1a: *What are the perceptions of the consumers from the three Mediterranean countries with regard to food characteristics?*

RQ1b: *Are there significant differences among the consumers from the three Mediterranean countries with regard to their perceptions concerning food characteristics?*

2.2. QMS-FSMS's labeling

The food industry uses the food product quality and safety label on the package to add value and provide food quality and safety assurance. Consumers perceive food quality and safety labels as a guarantee that the labeled products are safer than others. The quality labels confirm that the food manufacturers had tested the product at every production stage before it was put on the market. They are used as part of a strategy to certify the safety characteristics of the labeled food, which transforms food safety into a searchable attribute that affects the acceptability of the labeled food (Wu *et al.*, 2011). For this reason, food companies strive to ensure their food's safety in order to gain external and internal benefits (Rampl *et al.*, 2012). So, they simply implement the hazard analysis of critical control points (HACCP) or adopt private food standards or establish a food safety management system which can be certified according to standards such as, for example, the ISO 22000 international standard and the BRC standard (Psomas and Kafetzopoulos, 2015). In so doing, they follow their country's legislation to ensure and promote

that their food products are safe for consumption. Non-compliance may affect the quality and safety of the food or worse, be a reason for outbreaks of food poisoning that can lead to significant damage to the brand's identity, financial losses, or bankruptcy (Griffith *et al.*, 2010). Thus, food companies should establish a proactive food safety and quality culture in order to ensure food safety, continuous quality improvement as well as good hygiene attitudes among employees (Psomas and Kafetzopoulos, 2015).

The products that have special quality assurance seem to increase consumers' trust, which in turn, positively influences their purchasing behavior (Sadílek, 2019). Britwum and Yiannaka (2019) found that consumers were willing to pay a higher price for a product with a food safety label. They also suggested that the most preferred type of food safety label was one that did not provide information about the intervention and its role in enhancing food safety. However, some studies suggest that not all consumers fully understand what these quality assurance labels mean (Xu and Wu, 2010; Wu *et al.*, 2011). It is still not clear what determines consumers' food safety perceptions with regard to quality labeling and if the importance given to these labels varies between the populations of different countries.

Bearing in mind the above discussion, the following research questions are formulated in order to be answered based on samples of Greek, Italian and Spanish consumers:

RQ2a: What are the perceptions of the consumers from the three Mediterranean countries with regard to the QMS-FSMS's labeling?

RQ2b: Are there significant differences among the consumers from the three Mediterranean countries with regard to their perceptions concerning the QMS-FSMS's labeling?

2.3. Trust in the supply chain

Consumers usually cannot rely on their personal experience or knowledge in order to evaluate food safety attributes. Thus, food safety in essence has a strong credence component (Chen, 2012; Bearth *et al.*, 2014). In the absence of sufficient knowledge, consumers' decisions are guided by their trust in the supply chain. Trust

is defined as an individual's general tendency to be willing to depend on others (Love *et al.*, 2013). The fact that consumers trust the long and complex food supply chain (involving farmers, manufacturers, importers, retailers, regulators, etc.) allows them to fully access and highly evaluate the information they have in order to make decisions (Love *et al.*, 2013). Consumers' trust makes them simplify their decision-making process, since their trust reduces the complexity they face regarding whether or not they feel safe while purchasing a certain food. People differ in the extent to which they trust those involved in the food supply chain -from farms to retailers- due to their personal or environmental characteristics. Consumers usually rely on government and industry integrity (Wu *et al.*, 2011). Public intervention is based on the need to guarantee the protection of minimal requirements in terms of consumer health, market information and commercial loyalty along the supply chain (Camanzi *et al.*, 2019). In countries with reliable government agencies, consumers are less likely to have concerns about food quality and safety (Kolodinsky *et al.*, 2003). In some other cases, the government's information had no significant effect on the consumers' perceptions of the risks and benefits, maybe due to the fact that some government agencies are distrusted and their information is ignored by the public. For example, Albanian consumers lack trust in the regulatory system's ability to monitor and guarantee food safety (Kokthi *et al.*, 2015). Based on empirical evidence in three countries (the U.S., the U.K., and France), Yee *et al.* (2008) found that the level of trust in the information provided by food industry affects consumers' perceptions of the risks and benefits of genetically modified foods. Chinese consumers' trust and confidence in the dairy product supply chain were at a moderate and low level with the magnitude of trust being placed in the actors of the supply chain in the decreasing order of government regulators, enterprises, farmers and retailers (Zhang *et al.*, 2022).

Bearing in mind the above discussion, the following research questions are formulated in order to be answered based on samples of Greek, Italian and Spanish consumers:

RQ3a: What is the level of trust in the food sup-

ply chain of the consumers from the three Mediterranean countries?

RQ3b: Are there significant differences among the consumers from the three Mediterranean countries with regard to their trust in the food supply chain?

2.4. Illusion of food control

Consumers' perceptions of food safety can be influenced by having an illusion of food control (Frewer *et al.*, 1994; Kennedy *et al.*, 2008). In this case, they subconsciously believe that they can control food product safety and consequently they can purchase products at a desirable level of quality and safety. A frequent bias occurs when consumers use their knowledge, information, experience, and abilities to evaluate food safety and quality effectively (Koc *et al.*, 2019). The consumers' desire for control is associated with their desire to reduce losses and increase their earnings (Koc *et al.*, 2019) when they purchase healthy and safe food. However, most of the consumers do not have specialized food safety knowledge, and consequently, the quality or risks associated with certain food are not fully identified by them. Thus, their evaluation of food is conditioned by their common sense.

Bearing in mind the above discussion, the following research questions are formulated in order to be answered based on samples of Greek, Italian and Spanish consumers:

RQ4a: What is the level of illusion of food control of the consumers from the three Mediterranean countries?

RQ4b: Are there significant differences among the consumers from the three Mediterranean countries with regard to their illusion of food control?

3. Methodology

3.1. Developing the constructs

A structured questionnaire was designed to collect the primary data concerning the following latent constructs: food characteristics, QMS-FSMS's labeling, consumer trust in the food supply chain and consumer illusion of food

control. The questionnaire items reflecting these latent constructs were developed with reference to the relevant literature. More specifically, the following five items representing the food characteristics that influence consumers' purchasing decisions were drawn from the studies of Bonnet and Simioni (2001) and Grunert (2005): the type of packaging (glass, plastic, paper, etc.), whether or not the food products are available loose or are packaged, the ingredients of the food, the food's appearance and the information included in the food product label. The QMS-FSMS's labeling was evaluated through a two-item construct which was based on the instruments used in the studies of Krystallis and Ness (2005), Grunert (2005) and Yaya *et al.* (2011). Consumers were invited to express their opinion as to whether quality labels (HACCP-ISO 22000, ISO 9001) are used by companies to provide evidence of their capability to supply food according to legislative and consumer requirements or whether they are used for the purpose of continuous process improvement. The four items with regard to consumer trust in the food supply chain were drawn from the studies of Grunert (2002) and Yaya *et al.* (2011). An example is as follows: "the consumer trusts the food supply chain including farmers, manufacturers, retailers as well as the local authorities in issues related to food safety". Finally, the latent construct of the illusion of food control was operationalized through two items which were drawn from the studies of Panisello and Quantick (2001) and Musa *et al.* (2010). An example of an item is as follows: "food products which are placed on the market are safe to be consumed".

The original questionnaire was in the English language, so it was necessary for it to be translated into the three relevant languages (Greek, Italian, and Spanish). Forward and backward translation procedures were used to verify the translated questionnaires' adherence to the original document and ensure that each question had the same meaning in each language (Brislin, 1970). This method is commonly used in cross-cultural research (Dept *et al.*, 2017). First, the researchers translated the questionnaire items into their native language and then the translated texts were retranslated back into the English language by a translator who did not have access to the original

source. This method helped to identify discrepancies, which led to changes in order that the questionnaire be linguistically and culturally appropriate. Then, the questionnaire was pre-tested within a small sample of consumers (about 50 from each country) to guarantee its readability and to reduce the probability that the questionnaire items could be misunderstood. Based on this feedback, slight modifications were made and some questions were eliminated or modified.

The items took the form of a 7-point psychometric Likert scale (anchored by 1 = “strongly disagree” and 7 = “strongly agree”). The self-administered questionnaire also included a series of questions related to the demographic characteristics of the respondents, such as gender, age, education level, etc., which were drawn from the studies of Krystallis and Ness (2005) and Musa *et al.* (2010).

3.2. Sampling process

The structured questionnaire was administered to the general public. The respondents were approached by well-trained interviewers during selected times of the day during one month-long period (January, 2020). The empirical survey was conducted in the same period in three Mediterranean countries (Greece, Italy, and Spain). Research teams of postgraduate business students from each country were stationed outside the entrances of food stores or supermarkets in order to collect quantitative data. The sampling method was similar to that of a mall intercept interview (Malhotra, 2004). By conducting the interview right on the spot, the participants’ memory of the experience was fresh given that they were just leaving the food store. Pelletier *et al.* (2016) points out that consumer intercept interviews can be successfully used to recruit a diverse sample of consumers at food retailers. To avoid a time sampling bias, since the characteristics of persons visiting the food stores may vary according to the time of day, the interviews were conducted at different times (Bruwer *et al.*, 1996).

The respondents were selected randomly, using systematic sampling. This sampling method produces results that represent the general pop-

ulation (Sekaran and Bougie, 2016). The only condition for the inclusion of respondents was their being an adult (over 18 years of age) at the time the survey was conducted. A verbal filtering question of selected participants ensured that they met this criterion.

About 7,000 consumers were approached and 2,878 gave their consent to participate in the research study. The purpose of this research was clearly explained to the respondents, and they were assured of total confidentiality and anonymity. They were also informed that the survey would take up to five minutes. The completed questionnaires were checked to exclude obvious incompleteness or extreme answers. In this phase of the survey, 214 questionnaires were rejected. Hence, the total usable sample for data analysis consisted of 2,664 questionnaires, representing a response rate of 38.1%. The final sample consisted of consumers from the three Mediterranean countries: 1,072 from Greece, 1,040 from Italy, and 552 from Spain. The demographic profile of the respondents is presented in Table 1.

The sample includes more women (64.3%) than men (35.7%), given that women are often the key decision makers in family food and nutrition choices (Daivadanam *et al.*, 2015). A total of 1,841 respondents held a university degree or higher, while the rest of the respondents (823) were high school graduates. As far as their occupations are concerned, most of them worked for the private sector (26.9%), about 20.0% of the respondents were students, and 15.2% were self-employed. The unemployed participants made up about 13.3% of those surveyed, a percentage that is close to the national rates of unemployment (ranging from 9.8% in Italy to 16.5% in Greece) (Eurostat, 2020). In terms of income, 37.4% earned family monthly incomes of 600 Euros or less. Finally, the age groups of the respondents were almost equal.

4. Data analysis and results

4.1. Testing measurement instruments

The SPSS software (version 26) was used for data analysis. An exploratory factor analysis (EFA) was applied in order to support the

Table 1 - Demographic profile of the respondents (N = 2,664).

<i>Type of Classification</i>	<i>Category</i>	<i>Number of respondents</i>	<i>Percentage %</i>
<i>Nationality</i>	Greek	1,072	40.3
	Italian	1,040	39.0
	Spanish	552	20.7
<i>Gender</i>	Male	952	35.7
	Female	1,712	64.3
<i>Education Background</i>	MSc - PhD	649	24.4
	University graduate	1,192	44.7
	High School	823	30.9
<i>Job occupation</i>	Freelancer	405	15.2
	Employee private sector	717	26.9
	Employee public sector	288	10.8
	Housewife	151	5.7
	Unemployed	355	13.3
	Retired	235	8.8
	Undergraduate student	513	19.3
<i>Family monthly income group</i>	≤ 600€	996	37.4
	601 – 1000€	533	20.0
	1001 – 2000€	803	30.1
	> 2001€	332	12.5
<i>Age group</i>	18-24 years	532	20.0
	25-34 years	566	21.2
	35-44 years	564	21.1
	45-54 years	457	17.2
	55-64 years	545	20.5
<i>Place of residence</i>	City	1,839	69.0
	Village	825	31.0

latent constructs' convergent and discriminant validity. It was employed using the Principal Component factor extraction method with the Orthogonal Varimax rotation method. The data were also tested using the Kaiser-Meyer-Olkin index and the Bartlett Test of Sphericity, both of which were considered satisfactory. The extraction criterion was set as eigenvalue above one. Loadings of ± 0.45 are considered statistically significant for sample sizes of more than 150 as in the present research study (Hair *et al.*, 2010). The factor analysis revealed a one-dimensional factor for each latent construct (Table 2).

The internal consistency of the latent constructs range from 0.60 to 0.80 which exceeds the minimum threshold of 0.60, suggesting that

these constructs have high internal consistency (Griethuijsen *et al.*, 2014). The analysis verified that the factor loadings of the items exceeded the 0.40 threshold on its parent latent construct with low cross-loading, and moreover that the Average Variance Extracted (AVE) of the latent constructs exceeded the 0.50 threshold, which ensures the convergent validity of the latent constructs (Hair *et al.*, 2010). Discriminant validity was also supported by the AVE for each latent construct being greater than the squared correlation between the construct of interest and the remaining constructs. Thus, studying the evidence of reliability and validity (Table 2), the latent constructs used can be considered generally reliable and valid.

Table 2 - Measurements' accuracy.

<i>Research constructs</i>	<i>Mean</i>	<i>Std Dev</i>	<i>Cronbach alpha (α)</i>	<i>AVE</i>	<i>Factor loading</i>
Food Characteristics	4.94	1.14	0.77	0.53	0.784
					0.780
					0.746
					0.700
					0.621
QMS-FSMS's labeling	5.15	1.13	0.71	0.77	0.880
					0.880
Trust in the food supply chain	4.04	1.02	0.80	0.63	0.841
					0.820
					0.783
					0.728
Illusion of food control	4.28	1.18	0.60	0.67	0.821
					0.821

4.2. Consumers' perceptions of food safety issues across countries

Descriptive statistics were applied in order to determine consumers' perceptions with regard to food characteristics and the QMS-FSMS's labeling, trust in the food supply chain and illusion of food control. The mean values and standard deviations of these latent constructs were calculated for the samples of the respondents of the three Mediterranean countries (Greece, Italy, and Spain) (Table 3). In so doing, consumers demonstrating high and low scores for all the latent constructs were identified. More specifically, as far as the food characteristics and the QMS-FSMS's labeling are concerned, the Italians gave the highest scores, followed by the Greeks and finally the Spanish. In terms of consumer trust in the food supply chain and consumer illusion of food control, the Spanish gave the highest scores, followed by the Italians and finally the Greeks.

In order to determine whether there are statistically significant differences among consumers from the three Mediterranean countries with regard to their perceptions concerning food characteristics and the QMS-FSMS's labeling, trust in the food supply chain and illusion of food control, the analysis of variance (ANOVA) was applied. The sample of 2,664 respondents was

divided into three sub-samples based on the respondents' nationalities (Greek, Italian, or Spanish). The ANOVA was applied using nationality (the nominal variable) as a factor (independent variable) and the food characteristics, the QMS-FSMS's labeling, consumer trust in the food supply chain, and consumer illusion of food control as the dependent variables. First, ANOVA assumptions with regard to missing values, outliers, data normality, and the homogeneity of variances were tested (Hair *et al.*, 2010). Since it was verified that the results of these tests were satisfactory, the least significant difference (LSD) method was used to explore the differences among consumers' perceptions. The results of this statistical analysis are presented in Table 3, demonstrating that the F-values were significant at the $p = 0.01$ level in all cases. This means that there are significant differences among consumers from the three Mediterranean countries with regard to their perceptions concerning food characteristics and the QMS-FSMS's labeling, trust in the food supply chain and illusion of food control. In other words, there are no similarities in consumers' perceptions; they display different perceptions for all the issues examined.

The ANOVA analysis was followed by Tukey post hoc comparison tests (Table 3). The results revealed that when comparing the Greeks and the Italians, there are significant differences in terms

Table 3 - ANOVA comparison and results of Tukey post hoc comparison tests based on respondents' nationality.

<i>Attributes</i>	<i>Country</i>	<i>Mean - S.D.</i>	<i>Sig. diff. in means</i>	<i>F-value</i>	<i>Tukey post hoc comparison tests</i>
Food Characteristics	Greece	4.88 – 1.12	0.000	13.781	Greece - Italy Italy - Spain
	Italy	5.08 – 1.02			
	Spain	4.79 – 1.34			
QMS-FSMS's labeling	Greece	5.09 – 1.07	0.000	125.626	Greece - Italy Italy - Spain
	Italy	5.27 – 1.03			
	Spain	5.02 – 1.39			
Trust in the food supply chain	Greece	3.89 – 0.92	0.000	110.987	Greece - Spain Italy - Spain
	Italy	3.90 – 0.88			
	Spain	4.60 – 1.24			
Illusion of food control	Greece	4.08 – 1.01	0.000	31.440	Greece - Italy Greece - Spain Italy - Spain
	Italy	4.36 – 1.21			
	Spain	4.53 – 1.38			

of their perceptions concerning food characteristics and QMS-FSMS's labeling and consumer illusion of food control. However, the Greek and Italian consumers seemed to trust the food supply chain almost equally. It was also observed that the Greek and Spanish consumers have differences in terms of their trust in the food supply chain and illusion of food control, while there were no significant differences in terms of their perceptions regarding food characteristics and QMS-FSMS's labeling. When comparing the Italians and the Spanish, the Tukey tests demonstrated significant differences in the consumers' perceptions concerning food characteristics and the QMS-FSMS's labeling, trust in the food supply chain and illusion of food control.

5. Discussion and conclusions

The absence in the literature of research studies investigating consumers' perceptions with regard to food safety issues as well as the fact these perceptions differ considerably across countries, stimulated the authors of the present study to conduct a multinational study investigating consumers' food safety perceptions. So, the present study focuses on three Mediterranean countries (Greece, Italy, and Spain), consumers of which have not been previously studied in terms of their perceptions concerning food

safety issues. The contribution of the present study refers to determining consumers' perceptions with regard to food characteristics and the QMS-FSMS's labeling, trust in the food supply chain and illusion of food control. Determining the differences among consumers from the three Mediterranean countries with regard to their perceptions concerning the above mentioned food safety-related issues, enhances the contribution of the present study both from an academic and a practical perspective. This means that academics, through identifying consumers' food safety perceptions in the context of a specific country, can formulate country-specific theoretical models. On the other hand, practitioners can take into consideration consumers' food safety perceptions to improve company management and production systems and also develop appropriate marketing strategies.

For the purpose of the present study, a sample of 2,664 consumers from the three Mediterranean countries (Greece, Italy, and Spain) was approached. It is worth taking into account that across the selected countries there are similarities in terms of the production and retailing structure, and the population characteristics (for example, their expenditure on food per capita is almost equal and they have the same nutrition model), which justifies the focus of the present study on this specific geographic area.

Based on the present study's findings, Italians can be characterized as more food safety-sensitive than the Spanish and the Greek consumers, since they appreciate more highly the food product's characteristics and the QMS-FSMS's labeling. However, while the Spanish and the Greek consumers do not follow this trend to the same extent as the Italians, both Spanish and Greek consumers have almost the same perceptions with regard to food products' characteristics and the QMS-FSMS's labeling albeit at a lower level than that of the Italians. The fact that all the samples of consumers seem to highly appreciate the food product's characteristics and the QMS-FSMS's labeling, may be justified given that during the last few years, consumers have started reading packaged food labels more, and they have become better informed by the media (television, newspapers, cook books, and the internet) and authorized organizations in a way that has made them more thoughtful in their food choices (Viola *et al.*, 2016). As has already been mentioned, reading food labels helps consumers make healthier food choices. However, sometimes these labels can be misleading, confusing or difficult to understand. Often consumers don't have the time to devote or the knowledge to understand what the different types of information provided on a label mean. A recent survey reveals that while the majority of the Nigerian consumers (70.6%) read the nutritional information, only 64.9% understand the information presented on food labels (Adesina *et al.*, 2022). Thus, the implementation of training programs would increase consumer label-reading skills and boost their confidence in food product quality (Miller *et al.*, 2017). In addition, improvements concerning label design enhance consumer trust (Moreira *et al.*, 2021). The labels have to include the compulsory information in a clear way.

A significant heterogeneity was revealed with regard to consumers' trust in the food supply chain across the three participating countries, which is in line with Bearth *et al.* (2014). More specifically, Spanish consumers have a high degree of trust in the various players that make up the food supply chain. In other words, they do not seem to worry a lot about food safety since

they do trust farmers, importers, manufacturers, retailers, and regulators. The level of trust of these consumers in the food supply system in terms of food safety is significantly higher than the level of trust of Italians and Greeks. This means that the Spanish consumers had the characteristics of being trustful (Kennedy *et al.*, 2008), which is in agreement with a similar survey that showed that the Spanish had a high degree of trust in food manufacturers (GfK Global Trust Report, 2017). On the other hand, the level of trust of the Italians and the Greeks in the food supply chain is deemed medium to high. These consumers may believe that the laws and regulations related to food safety are not being fully applied, and this belief may lead to a lack of trust in the processes followed by farmers, manufacturers or retailers, and finally to a lack of trust in the safety of the food they purchase (Popova *et al.*, 2010). This, in turn, may lead to pressure being applied not only to policy makers to step up regulations of the food supply chain, but also to food companies, which must continually review their own production and marketing strategies if they wish to assure food safety and gain the consumers' trust (Scarpato *et al.*, 2017). From the above it can be concluded that consumers' trust in the food supply chain has an effect on their approval of the supply chain itself. However, the consumers' trust in the food supply chain in terms of food safety issues may change over time if severe or extensive safety incidents occur. In such cases, consumers' trust decreases and they become more conscious of their food choices. Moreover, publications in the media about food product recalls or possible outbreaks of foodborne illnesses make consumers more suspicious and cautious, influencing, thus, their trust (Sanlier and Konaklioglu, 2012). Consumers need to play an active role in food safety. They have to act as health-promoting agents, giving feedback on food quality. They should inform supply chain actors when something suspicious is perceived. A customer complaint about a food product may stimulate the mechanisms and thus a foodborne illness is prevented.

Spanish consumers seem also to have the highest level of illusion of food control, since they think that they do have adequate control

over food safety. Italians seem also to believe that food safety is their responsibility and that it is controllable by themselves, however, their illusion of control is somewhat lower than that of the Spanish. The Greeks seem to have the least illusion of food control compared with the Italians and the Spanish. The high level of illusion of food control demonstrated by all the samples of consumers is justified, taking into consideration that their high level of education may help them to be engaged in self-protective behaviors (Milton and Mullan, 2012). However, there are significant differences with regard to the illusion of food control among consumers from the three Mediterranean countries. In a similar survey, it was also found that the perceived efficacy of control and regulations was somewhat lower in Greece than in other European countries including Norway, Germany, Spain, Poland, the U.K., Ireland, the Netherlands, and Portugal (Poinhos *et al.*, 2014), which provides support for the findings of the present study concerning the different levels of illusion of food control among consumers from different countries. Nowadays, new channels such as online shopping websites have been created and many consumers purchase food via the internet (Lang and Hooker, 2013). This method of purchasing requires having a greater level of trust and illusion of food control, since consumers don't have the ability to physically inspect and closely examine the food that they purchase. Moreover, purchasing through internet websites creates concerns about the food quality and safety, which make it more important for food companies to develop suitable marketing strategies for boosting consumers' trust and illusion of food control.

The present study suffers from some limitations. This study deals with factors that are relevant to food safety issues. However, they are not the only ones that are related to consumers' food safety perceptions and influence their food purchasing behavior. Thus, a significant over-estimation of the factors that affect consumers' food safety perceptions is possible. Moreover, the findings are based on self-administered questionnaires completed by consumers of only three Mediterranean countries. Based on these limitations, future research studies can be designed.

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Farmers' opinion about Syrian workers in agricultural sector in Turkey: Case study of Gaziantep

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Abstract

Due to the Syrian Civil War, many Syrians have had to flee their country and seek refuge in neighbouring countries, and they face a great deal of financial and social problems in their new countries of residence. Problems such as language barriers and hostility from the host community make it difficult for refugees to integrate into the countries which took them in, and the fact that they must become a part of the work force as a matter of priority to meet their daily needs means that they often work unskilled jobs for low wages and are not registered in any official systems. The structural properties of the agricultural sector means that it is one of the most popular work areas for Syrian migrants. This study aims to evaluate the circumstances of Syrian individuals under temporary protection status in Turkey in the agricultural sector from the perspective of farmers. To this end, a survey was conducted with 395 farmers working in the agricultural sector in the province of Gaziantep. According to the findings of the research, 61.5% of agricultural businesses in Gaziantep employ Syrian refugees. The main reason for farmers opting to employ Syrian workers under temporary protection order is low wages (78.8%). 82.9% of Syrian refugees work only during harvesting season. 92.4% work both harvesting and hoeing, while 79.2% of business owners state that employing refugees allows them to decreased their production costs. Despite the presence of legal regulations in Turkey outlining how refugees can become a part of the labour force, these haven't prevented the prevalence of off-the-books employment. Making the necessary amendments to legal regulations regarding seasonal workers in the agricultural sector would benefit both local workers and Syrian refugees. Additionally, legislation regarding salaries would improve the living standards of refugee workers and increase their motivation to work, thus improve productivity in agricultural products.

Keywords: *Syrian refugees, Agriculture, Seasonal workers, External migration.*

1. Introduction

Migration is the act of individuals or communities abandoning their places of residence for other regions or countries due to political, social, or economic reasons (Saltık, 2001). Voluntary migration refers to individuals leaving their place

of residence and choosing to move to another place for a better life due to financial, social, or similar circumstances, while involuntary migration refers to leaving one's place of residence for a safer location due to compulsory circumstances such as natural disasters or war (Gürel Üçer *et al.*, 2018). However, migration is a multifaceted

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phenomenon with social, financial, political, and cultural implications both on the migrant and the receiving country, and must not be reduced to mere geographical mobility (Aktaş and Gülçür, 2017). It is thought that the lack of food security has an impact on both internal and external migration. The connection between food security and migration is increasingly discussed by both international agencies and academic literature (Mulazzani *et al.*, 2020). Đokić *et al.* (2021) states that countries with high levels of food security and political stability have the highest influx of immigrants. Individuals who migrate leave behind the life they are accustomed to and the safety of their home to try and establish a new life within an unfamiliar culture speaking a language they don't understand (Harunoğulları and Cengiz, 2014). This attempt at establishing a new life pushes immigrants into difficult circumstances financially and socially. Migration has always been a factor in life on earth and has brought problems with it, and many countries actively work towards solving these problems and unearthing their underlying reasons. There are many international organisations which are tasked with tackling the issue.

After the Syrian Civil War broke out in March 2011, those overwhelmed by the hunger and poverty created by the war were forced to leave their country and become temporary refugees in other countries. Since 2012, when the civil war intensified, Turkey has been home to one of the largest Syrian refugee populations in the world, followed by other countries in the region such as Lebanon, Jordan, and Iraq (Erol *et al.*, 2017). Turkey's humanitarian approach and its "open door" policy since the start of the crisis made it the leading country by the number of refugees it hosts in 2015, a title it still holds today (Ministry for Development, 2018). As of May 2021, 3.672.646 Syrians live under temporary protection in Turkey. Currently, more than 98% of Syrian refugees live in towns, cities, and rural areas across 81 Turkish provinces, and less than 2% live in the seven Temporary Accommodation Centres (TAC) that were established (3RP, 2021). Provinces with the largest number of Syrian refugees in order of refugee population size are Istanbul, Gaziantep, Hatay, and Şanlıurfa. 449.667 Syrian

residents live in Gaziantep, constituting 21.56% of the population (Presidency of Migration Management, 2021). The significant role played by refugees in the daily life of the province will be made clearer when the number of resident refugees is compared to the size of the general population. In this regard, it can be said that Gaziantep has been transformed in terms of both financial and socio-cultural aspects.

Migration also creates an employment-related effect when migrants become jobseekers in order to provide for their families (Güder, 2016). Since March 2011, when high numbers of majority Syrian refugees began to arrive in Turkey in increasing numbers, the employment rights of refugees and migrants and their integration into the local economy have become one of the most oft-discussed issues (İşcan and Çakır, 2019). Many legal and administrative regulations have been put in place in order to facilitate the Syrian population's integration into the workforce and to increase their participation in registered employment, such as a 60% reduction in the work permit fee employers are liable to pay in the event of employing Syrian refugees under temporary protection in 2018. The regulations have also made those working in seasonal agricultural or husbandry jobs as being exempt from requiring work permits (3RP, 2019). This might appear to be a positive influence on the agricultural sector, however, those with no prior agricultural experience joining the sector also brings various problems along with it. Regardless of what profession they might have held in their home countries, the obligation for these individuals to quickly integrate into the workforce to ensure their survival in their new home country pushes them to work for low wages and without social security. Due to a lack of knowledge, skills, and experience, they generally work in sectors in which off-the-books employment is easy. The potential for unofficial employment due to the structural properties of the agricultural sector and its lack of auditing and organisation often allow potential refugee-migrant labourers to find employment with ease (Bozdemir *et al.*, 2019). The agriculture and food industries are among the main sources of income and employment not just for the host community but also for the migrant and refugee communities in southeastern Turk-

ish cities such as Gaziantep, Kilis, and Şanlıurfa (3RP, 2021). In terms of businesses, the employment of unskilled/cheap labour lowers costs and increases profitability (Kutlu, 2019). Due to these reasons, Syrians living under temporary protection in Turkey work mainly in the agricultural sector, particularly at seasonal jobs such as sowing, planting, hoeing, and harvesting.

In national and international research literature on the subject, studies focusing on migrants and refugees are mainly based on interviews to evaluate their circumstances in their host country and their integration process (Martin, 2002; Franz, 2003; Cannizzaro and Corinto, 2012; Harunoğulları and Cengiz, 2014; Özkarslı, 2015; Açikel, 2016; Ertürk, 2016; Collins *et al.*, 2016; Çetin, 2016; Duruel, 2017; Erol *et al.*, 2017; Gürel Üçer *et al.*, 2018; Güneş-Aslan and Güngör, 2019; İşcan and Çakır, 2019; İlgazi, 2019; Kutlu, 2019; Schneider *et al.*, 2020; Turkmani and Hamade, 2020). There are limited studies exploring employers' approach to migrants and refugees. This study aims to evaluate the circumstances of Syrian agricultural workers under temporary protection in Turkey from the perspective of farmers. The attitudes of farmers towards refugees and migrants working in the agricultural sector will be examined, and the resulting data is expected to contribute to the creation of policies to mitigate disadvantages for both sides, as well as provide a resource for policy makers.

2. Materials and method

The main material of this study were provided from questionnaires conducted by face to face and telephone interviews with farmers working in the agricultural sector in the province of Gaziantep. Earlier national and international research on the subject, information obtained from public and private institutions about agricultural enterprises and refugees were also included in this study. According to data obtained from the Provincial Directorate for Agriculture and Forestry in Gaziantep, there are 31.609 agricultural businesses located in central Gaziantep and surrounding towns (Şahinbey, Şehitkamil, Nizip, İslahiye, Araban, Oğuzeli, Yavuzeli, Karkamış, Nurdağı). The survey questions for the study

were developed with awareness of the study's aims, the contents of the subject, and the features of the group whom the survey was intended for.

The Simple Random Sample method was used to calculate sample sizes. The formula used to calculate sample size according to this method is as follows (Yamane, 2001):

$$n = \frac{Nz^2s^2}{Nd^2 + z^2s^2}$$

n: Sample size

N: Accessible population (31609)

z: z value on the standard normal distribution table based on error ratio (z: 1,96)

d: Accepted error tolerance level (d:±5)

s: Sample standard deviation (s: 50.95).

The sample size has been calculated as 394 with a standard deviation value of (s: 50.95) calculated from the pilot sample, with a confidence level of 95% (z: 1.96) and an area width median within the boundary of ±5. When considering the sample size distribution across towns, a proportional distribution has been made based on the number of businesses. The survey began in December 2019, and was conducted through face-to-face and telephone interviews with farmers. The findings of the study have been presented as frequency and percentage distribution, and averages.

3. Study findings and discussion

Farmer characteristics and enterprise information are given in Table 1. Almost eighty percent (79.2%) of farmers were male and 20.8% were female. Most were between the ages of 20-60. Twenty one percent of farmers received no formal education at all, only 12.7% had a university graduates degree. The percentage of farmers who graduated from primary, secondary, or high school is 67.3% and distributed evenly across the three educational level. Majority of farmers (66.3%) main income is solely agriculture, while the rest conduct agricultural activities as a secondary source of income. The latter are generally small business owners or public servants, and practice agriculture as an additional job. Only 6.1% of farmers have less than 5 years of experience in agriculture, while 6.8% have been farm-

Table 1 - Farmer characteristics and business information.

<i>Gender</i>			<i>Age</i>		
	<i>F</i>	<i>%</i>		<i>F</i>	<i>%</i>
Female	82	20,8	18-25	26	6,6
Male	313	79,2	26-40	181	45,8
<i>Number of Individuals in the Family</i>			41-60	149	37,7
	<i>F</i>	<i>%</i>	61+	39	9,9
1-5	181	45,8	<i>Land Size</i>		
6-10	202	51,1		<i>F</i>	<i>%</i>
11+	12	3,0	1-10	146	37,0
<i>Job</i>			11-20	99	25,1
	<i>F</i>	<i>%</i>	21-50	98	24,8
Small business	54	13,7	51-80	24	6,1
Officer	40	10,1	81-100	10	2,5
Private sector	26	6,6	100+	18	4,6
Student	8	2,0	<i>District where the land is located</i>		
Self-employment	6	1,5		<i>F</i>	<i>%</i>
Farmer	261	66,1	Nizip	80	20,3
<i>Land Ownership Status</i>			Oğuzeli	100	25,3
	<i>F</i>	<i>%</i>	Şahinbey	62	15,7
Property	208	52,7	Şehitkamil	60	15,2
Partner	126	31,9	Araban	34	8,6
Hirer	61	15,4	Yavuzeli	29	7,3
			İslahiye	30	7,6

ers for more than 40 years. It was observed that the majority of farmers in the research region have been practicing agriculture for more than 10 years. Almost fifty percent of farmers cultivate only plant produce, while 37% has plant and animal production. The number of farmers who only practice husbandry is very low. 52.7% of farming land is privately owned, while 31.9% are shared and 15.4% are rented. In Gaziantep, there are nearly as many shared and rented farm lands as privately owned ones, however, shared ownership is more common than renting. About 37% of farmers surveyed cultivate land smaller than 10 decares, while 13.2% cultivate land larger than 50 decares. It was observed that farmers in the province of Gaziantep do not generally own large areas of land. 51.9% of farmers state that they cannot easily make a living from agriculture. About 50% percent are satisfied with being in the agricultural sector, while the rest are

dissatisfied. The reasons for their dissatisfaction is insufficient income, high costs of materials, not being able to create any savings, being unable to work in a different sector due to lack of education and being forced to remain in the agriculture industry, and the inadequacy of support funds and grants.

Data shows that in agricultural businesses, family and relatives are the most often employed individuals with 90%, due to the majority of agricultural businesses being small or family businesses. About 60% of businesses employ permanent staff for tasks such as guarding and animal care. About 34% of businesses employ between 1-5 temporary staff members, while 24.6% employ between 6-10, 14.2% employ between 11-20, and 13.8% employ more than 21 temporary workers. Since pistachios are highly economically valuable and a speciality of the Gaziantep region, it is generally a common occurrence for lands with pistachio trees

grown on them to have guards. The vast majority of producers (67.1%) state that they haven't had any problems recruiting workers recently due to increased migration and an influx of refugees, while 32.9% state that they have encountered problems finding workers.

About 57% of farmers chose workers' clubs and coffeehouses to seek out prospective employees, while 28.4% found staff through their social circle and 12.7% opted for employment agencies. Farmers also used more than one source of employees when needed. An interesting finding is that the internet was also cited as a resource to recruit possible workers, though its prevalence was low (2.3%). Fifty one percent (51%) of business owners concurred that the salaries paid for agricultural workers were sufficient, while 49% disagreed with the statement.

The most important criteria when recruiting agricultural labourers were the resilience of the worker (66.3%), the daily fee requested (66.1%), and work performance (58.8%). Age (36.2%), the worker's ethnic background (22.5%), and gender (17%) were also cited as being important criteria (Table 2). Landowners place a high importance on the workers' physical makeup and resilience, due to concerns about health issues which might arise after working intensively in very warm weather at tasks such as harvesting, hoeing, and irrigation. Age is an important criteria because elderly or very young people are regarded as not being capable of physical toughness or a high level of performance. Only 32.7% were undecided regarding the importance of the ethnicity of the worker, while 31.3% stated it was unimportant. Only 3.3% farmers do not think that the performance of labourers were im-

portant, which is due to the fact that workers are paid based on the amount of land they tend to, not based on how they perform at their work. Some landowners opt to pay workers at the end of the task rather than on a daily basis, calculating their wages by acre.

About 62% of farmers interviewed had refugee and migrant workers on their payroll, while 38.5% did not. 62% of farmers who employ refugee and migrant workers employ between 1-5 workers, while About 22% employ between 6-15, and 16.2% employ between 16-40 workers. Many refugees in Gaziantep work in labour-intensive sectors such as agriculture. Views of employers in the agricultural sector and other sectors state that Syrians are able to fill the deficit in the supply of labour. Al-Turk (2016) states that Syrians, who work skilled jobs for lower wages compared to Jordanians, dominate the labour market for this reason. Ilgazi (2019) states that according to employers, the refugee workforce fills in the gaps in sectors with a worker deficit. Similar conclusions are drawn from interviews conducted in other sectors. Interviewing employers in the textile manufacturing sector for their study, Erol *et al.* (2017) state that after the Syrians joined the labour force they began to work jobs in the textile sector that locals in Turkey preferred not to work, and were influential in keeping the sector afloat through a time of difficulty.

About 52% of agriculture business owners in Gaziantep state that the migrant workers they employ have work permits, while 48.3% state they don't. The most cited reason for the preference for refugee workers is low wages (78.8%), while low wages and undiscerning acceptance of work were cited by 96.3%, and low wages, undiscerning ac-

Table 2 - Qualities sought in prospective employees.

Qualities	Very important		Important		Undecided		Unimportant		Very unimportant	
	f	%	f	%	f	%	f	%	f	%
Age	143	36,2	84	21,3	79	20,0	28	7,1	61	15,4
Gender	67	17,0	66	16,7	106	26,8	58	14,7	98	24,8
Ethicity	89	22,5	53	13,4	129	32,7	40	10,1	84	21,3
Performance	232	58,7	141	35,7	9	2,3	7	1,8	6	1,5
Resilience	262	66,3	123	31,1	10	2,5	0	0	0	0

ceptance of work and flexible schedules were influential for 79.1%. Research studies also support these findings. In a study conducted in Mardin, Özkarslı (2015) states that jobs in the construction and agriculture sectors are preferred by Syrian workers due to there not being a requirement for a high level of education or skill, their widespread availability, their seasonal nature, and the ease of finding work in these sectors. Lordoğlu and Aslan (2016) claim that due to not having a sufficient amount of rights and securities, Syrian migrants generally become labourers for low wages in the agriculture and construction sectors, regardless of what their previous status or experience might have been. Duruel (2017) says that in Hatay, Syrian refugees work in the industrial, construction, or service sector, and like in other cities in the region, they generally work low-skilled jobs that aren't preferred by local workers. Franz (2003) states that Bosnian refugee women in Vienna and New York often work low-skilled and low-wage jobs regardless of whether they had a successful career in their homeland, due to not being able to afford participating in cultural programs in their host countries such as language schools.

About 83% of Syrian refugees employed by agricultural businesses surveyed by the study work only during harvesting, while 92.4% work during harvesting and hoeing (182 businesses). Hundred thirty (130) businesses employ Syrian refugees for harvesting, hoeing, and watering. Syrian workers also work in guarding (2.1%) and animal care (3.8%) jobs, though with much fewer frequency. According to the FAO and AKCAM, many Syrian women under temporary protection status work in the agriculture-food sector, particularly in planting, sowing, weeding, harvesting, and post-harvesting tasks such as packaging (3RP, 2021). In a study focusing on Mexican workers in the US agricultural sector, Martin (2002) states that agriculture is an important starting point for migrants from rural and agricultural communities, and that migrants in the US mainly work in fields and agriculture-adjacent sectors such as cattle and poultry processing.

Almost all of the enterprises (99.6%) were provided with food to the workers, while 44.4% of businesses provided both food and shelter, and 50.4% provided food, shelter, and transport.

About 79% of businesses state that employing refugees lowers costs, while 98 business owners state that an increase in productivity is seen as well as a decrease in costs. Cannizzaro and Corinto (2012) state that local communities and local authorities mainly prefer a migrant workforce in order to lower production costs. Açikel (2016) states that the active role played by Syrians in the business world is regarded as a positive development by industrialists and small business owners, the main reason for which is the economic advantages created by lower wages due to an expansion of the labour market. Ertürk (2016) states that Syrian refugees working in olive groves in Altınözü have filled the existing labour gap in the olive growing sector, and that they play an important part in ensuring the sustainability of olive growing. In their study, Collins *et al.* (2016) state that migrants in Australia contribute greatly to the workforce in the agricultural sector, and an increase in agricultural productivity was anticipated following the opening up of agricultural jobs to migrant populations.

Adverse outcomes of employing refugee workers were cited as a lack of information and knowledge (39.8%), security concerns (33.6%), and language problems (26.6%). After arriving in Turkey due to force of circumstance, refugees require a job in order to meet their personal needs, and they accept any job they are offered without having the right to choose. Due to many refugees not speaking the local language at all or having a limited understanding of it, they struggle to clearly comprehend the work they are expected to complete or the tasks they are given, which can lead to conflict.

About 45% of farmers state that refugee workers encountered problems with other workers, while 8.3% state that such problems were encountered occasionally. About 47% stated that there were no problems. Out of those who confirmed encountering problems, 27.3% stated the problems arose due to insults and name calling, and 25% were petty disagreements. Language problems were behind 25% of issues, while political reasons accounted for 22.7%.

Table 3 lays out farmers' views regarding the effects of the arrival of Syrian refugees into the country. The majority of farmers interviewed

Table 3 - Farmers' opinions regarding the effects of the arrival of Syrians under temporary protection in Turkey.

Opinions	Disagree		Undecided		Agree		Mean
	f	%	f	%	f	%	
Syrian workers work for lower wages	27	6,8	69	17,5	299	75,7	2,69
They create off-the-books employment and unregulated production	58	14,7	100	25,3	237	60	2,45
They cause unfair competition in employment and when opening businesses	76	19,2	124	31,1	195	49,4	2,35
Syrian workers have more flexible work schedules	82	20,8	117	29,6	196	49,6	2,29
Syrian workers are more productive in labour intensive jobs	85	21,5	117	29,6	193	48,9	2,27
Migration has had a positive influence on the country's economy in terms of the agricultural sector	100	25,3	112	28,4	183	46,3	2,21
The local labour market suffers as a result	93	23,5	143	36,2	159	40,3	2,17
The increased requirement for agricultural production due to refugees, and their influence on agricultural production cancel each other out	94	23,8	159	40,3	142	35,9	2,12
Migrants' contribution to agricultural production lowers product standards	108	27,3	148	37,5	139	35,2	2,08
Refugees and the local population work under the same conditions	163	41,3	134	33,9	98	24,8	1,84
I have no difficulty finding agricultural employees thanks to Syrian workers	203	51,4	116	29,4	76	19,2	1,68
I would prefer to recruit Syrian workers for my agricultural business	211	53,4	132	33,4	52	13,2	1,60
Syrian workers working in agricultural production possesses a high level of knowledge	238	60,3	116	29,4	41	10,4	1,50

state that Syrian workers work for lower wages, while the opinion that they create an unregulated labour and production market and cause unfair competition in employment and the opening of businesses is also prevalent. Despite employing Syrian workers in their businesses, 61.5% of farmers state that they do not prefer to employ Syrian individuals when recruiting workers, and that they hold the view that Syrian workers have a low level of knowledge. Various studies in the area review the effects of refugees and migrants, regarded as a cheap labour force, on the labour market, and their work circumstances. Bayramoğlu and Bozdemir (2019) claimed that despite migrants employed in seasonal agricultural jobs in Turkey having proficiency and expertise

working in other areas in their home country, the fact that they do not have sufficient knowledge regarding agricultural produce grown in Turkey and lack of skills to operate agricultural machinery leads to a decrease in the quality of agricultural produce and the productivity of the workforce, as well as produce yield. Their study states that due to an increasing refugee population and the workforce potential they create, the prevalence of refugees as agricultural workers will also bring about social changes in rural communities. Bozdemir *et al.* (2019) state that migrant-refugee workers becoming a source of cheap labour will not only have a detrimental effect on the wage policies in the labour market in the agricultural sector, but also create an en-

Table 4 - Opinions regarding the training of Syrians under temporary protection status in the agricultural sector.

<i>Opinion</i>	<i>f</i>	<i>%</i>
No comment	121	30,6
I view the idea negatively	33	8,4
I view the idea positively	53	13,4
It is permissible if it lowers production costs	11	2,8
It is a good move to solve the labour shortage	31	7,8
I would support the idea if the state didn't pay for it	7	1,8
It's a good idea if those who deserve to be a part of it are chosen	13	3,3
It could be beneficial if the training is thorough	8	2,0
I do not support the idea because Turkish workers should be given priority	40	10,1
The state must not be involved in such matters	16	4,1
I think it is an unnecessary idea	28	7,1
We wouldn't want it because we don't employ Syrian people	11	2,8
There are benefits and drawbacks, I am undecided	10	2,5
They must not be involved in an important sector like agriculture	4	1,0
It would cause many problems. I don't support the idea	6	1,5
It would place an unnecessary burden on the state	3	0,8
Total	395	100,0

vironment of conflict in rural areas. In a study by Schneider *et al.* (2020), it is revealed that migrant workers in Germany, the Netherlands, and Sweden encounter sub-standard and exploitative working conditions in the agricultural food production sector. In their study, Turkmani and Hamade (2020) state that refugee agricultural workers in Lebanon feel trapped in insecure and non-contracted jobs, and that they encounter problems due to working for minimum wage for long hours, having no social security, being exposed to many health risks and dangerous working environments, and cyclical poverty.

As for the effects on agricultural production of certain precautions taken by the government due to the Syrian civil war, it was found that restrictions on the import of raw materials affected producers adversely, causing a rise in raw material prices and causing problems for low-cost input supply.

In 2017, the United Nations Food and Agriculture Organisation (FAO) launched an agricultural vocational training project for Syrian refugees and host communities in Turkey. The aim of the project was to provide sustainable job opportunities for 900 individuals who would receive voca-

tional training in five provinces – Adana, Mersin, Şanlıurfa, Gaziantep, and Isparta. The project was financed by the UN's High Commissioner for Refugees (UNCHR) and cost 1.7 million USD. The Turkish Ministry for Food, Agriculture, and Husbandry was the primary executive stakeholder, while the FAO was the administrative organisation. The project aimed to create employment opportunities for Syrian refugees and host communities, increasing household income, productivity, and the quality of agricultural production, therefore improving social cohesion between these groups. The vocational training comprised the following subject: cattle farming and herding; apple, grape, olive, pistachio, and cotton planting and harvesting; bell pepper, citrus fruit, pomegranate harvesting and post-harvest processing; greenhouse vegetable growing; irrigation management; farm management; and food hygiene (TOB, 2017). The "Developing Resilience Through Increasing Economic Opportunities for Syrian Refugees and Host Communities" project trained 900 people, 70% of whom were Syrian guests and 30% of whom were from the host community (TOB, 2018).

Table 4 details the views of farmers on training Syrians under temporary protection status in the agricultural sector and directing them towards regions where there is a lack of agricultural labourers in order for them to work. About 31% of farmers declined to comment on the subject, while 13.3% viewed it as a positive idea. Issues such as solving labour shortages and a decrease in costs were regarded positively, while some farmers did not support the idea due to reasons outlined below.

4. Conclusion and recommendations

Syrians who've had to flee their country due to the Syrian civil war have had to seek refuge in neighbouring countries such as Turkey, Lebanon, Jordan, and Iraq. Due to its humanitarian approach and open door policy, Turkey has accepted the largest number of refugees worldwide. Individuals who are forced to migrate are required to join the labour force so as to create a life for themselves in their host countries. Regardless of what profession they might have held in their own country, due to their need to integrate into the labour force as quickly as possible in their new country, they often end up working unregistered and undocumented jobs in various sectors. Problems, such as not speaking the language of migrated country and lack of knowledge and experience push refugees to work for low wages at unskilled jobs, and without social security. The agriculture sector has a vast number of seasonal jobs due to its inherent nature, and it is one of the sectors with the largest number of refugee and migrant workers. It is an important employment field not just for Syrian refugees but migrants from different countries. Refugees and migrants work extensively in seasonal tasks such as sowing, planting, hoeing, irrigation, and harvesting. This study was conducted in the province of Gaziantep to provide an overview of farmers' attitudes to the circumstances of Syrian agricultural workers under temporary protection in Turkey, and 61.5% of farmers were found to employ refugees. The primary factors for the preference towards refugee workers are low wages, indiscriminate acceptance of jobs, and flexible work schedules. It was stated that refu-

gee workers contribute to lower the costs due to working for lower wages, however, problems between migrant workers and other workers were also encountered. Despite working extensively in the agricultural sector, Syrians under temporary protection status are rejected by a not insignificant portion of farmers in the sector. Syrian refugees were trained as part of an agricultural vocational training program implemented by FAO in Turkey in 2017, and many farmers found this an objectionable idea due to various reasons.

Refugee and migrant workers in the agricultural sector have become a fact of life in Turkey, and despite their employment being profitable for farmers due to low costs and increased profitability, they are certain adverse socio-cultural effects. Additionally, factors viewed favourably by farmers such as low wages and employment without social security have a negative effect on the living conditions of refugees. Despite the presence of legal regulations in Turkey outlining how refugees might participate in the work force, these aren't enough to curtail off-the-books employment. However, this is not only limited to refugees working seasonal jobs in the agricultural sector. Due to the structural properties of the agriculture sector, nearly all workers who work seasonal jobs are devoid of social security. For this reason, implementing the necessary changes to improve the social rights of labourers working seasonal agricultural jobs in Turkey would be a significant benefit to both local workers and Syrian refugees. Additionally, putting regulations in place regarding wages would improve the living standards of migrant workers, thus increasing employee motivation and therefore productivity. Syrian refugees provide an important labour supply in sectors where recruiting local workers is difficult, such as agriculture, and improving their work and living conditions would solve the labour shortage in the agriculture sector. Considering the importance of agriculture when it comes to providing food to communities and its' contributions to the food industry, its' problems are worth solving and labour conditions are worth improving. Without ignoring the support of Syrian refugees as part of the workforce in the agriculture sector in Turkey, and keeping in

mind their continued presence here, the government must take the necessary precautions to ensure they play a more productive role when it comes to production.

One of the limitations of the study is its taking place in the Southeastern Anatolian region, and additional studies are required to discern problems which might be encountered in other regions and cities. The findings of this study are expected to provide a valuable resource for future studies in the field.

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Consumers' perceptions and policy implications towards the future of the Organic Food Sector in Italy

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Abstract

Research on organic consumers' preferences has been given a lot of attention in the past, analysing in detail the motives of organic food consumption across the World. However, less attention has been paid to the expectations of consumers change in the context of growing complexities of sustainable agriculture and competing discourses of numerous food movements. The main goal of this study is to explore how the ongoing changes of the organic sector are reflected in consumers' perspectives of organic agriculture and their preferences for organic food quality. The study was conducted in Italy with the use of the Q-methodology with a Q-set of 44 statements and a P-set of 20 participants. Three main groups of consumers were identified for the purposes of the study: "Mainstreaming for the better good", "Critical supporters looking for more", "Organic intensification supporters". Despite each ideal-typical group showing different perceptions of the future of the organic movement, they all shared similar policy implications. Three main topics of discussion emerged from the results of this study which are: the expectations of the consumers towards the future of the organic movement, the role of trust in purchasing behaviors and the importance of supporting rural development.

Keywords: *Organic 3.0, Q-methodology, Organic movement, Local food, Policy implication.*

1. Introduction

The global organic movement is currently looking for its new strategic course. An important contribution to this debate has been provided by the framework Organic 3.0 (Arbenz *et al.*, 2017), created by IFOAM - Organics International as the new development of the organic sector. As Arbenz *et al.* (2017) show, the pioneer movement (Organic 1.0) is in continuing development: from the standard and certification

phase (Organic 2.0) which created trust among consumers and policymakers (Huber *et al.*, 2015), guaranteeing the growth of the organic practices and consumption, the organic 3.0 aims for a paradigm shift. The new model proposed by IFOAM follow seven features that rotate around the idea of cultural innovation, transparency and integrity, wider sustainability interests, empowerments of the actors of the food system and true value cost accounting (Arbenz *et al.*,

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2017). One of the keys, and often neglected, questions in this debate, is how are changes in the course of the organic movement reflected by consumers themselves?

Research on organic consumers' preferences has been given a lot of attention in the past. Those studies explored and tested in detail the motives of organic food consumption across the World (Vindigni *et al.*, 2002; Aertsens *et al.*, 2009; Thøgersen, 2010; Feldmann and Hamm, 2015; Azzurra *et al.*, 2019). The relevance of the subject has been proven by Hemmerling *et al.* (2015) which showed a strong rise in studies regarding organic consumption from 2000 till now. However, less attention has been paid to the expectations of consumers change in the context of growing complexities of sustainable agriculture and competing discourses of numerous food movements, which are also referred to in the Organic 3.0 concept.

The aim of this study is to explore how consumers modify their approaches to organic food with respect to the changing strategy of the organic movement. But more specifically, we want to find out how organic consumers view successes and insufficiencies of the current organic movement model, and how they expect organic agriculture to change, in order to improve sustainability of food production. To achieve this goal, the authors selected Italy as their context of the study.

2. Literature review

The Italian organic movement started to spread in the 1970s as an alternative network that wanted to reconnect farmers with consumers under greener, cleaner and more fair agricultural methods (Brunori *et al.*, 2013). The growth of this movement had to cope with strong regional disparities caused by the politics of decentralization that the national government implemented throughout the years, which transferred the agricultural policy competences to local governments. Thus, financial support, growth of organic farmers associations and organic farms, have always depended on uneven promotion of this sector from the regional authorities (Darnhofer *et al.*, 2019; Compagnoni *et al.*, 2000; Defrancesco and Rossetto, 2007). These disparities are also reflected in con-

sumption which mostly occurs in the wealthier northern regions even though production is mainly located in the south of the country (Gracia and De Magistris, 2008; Compagnoni *et al.*, 2000; Defrancesco and Rossetto, 2007).

Despite these reactive rather than proactive governmental measures (Darnhofer *et al.*, 2019), today Italy is one of the largest producers of organic food worldwide. The growth in supply and demand, along with the strong support of mainstream farmers' associations (such as Coldiretti), lead the spread of organic products in supermarkets and GDO (Darnhofer *et al.*, 2019; Defrancesco and Rossetto, 2007). In fact, the Italian organic food sector no longer remains a niche market but shifted into the mainstream, becoming available to a larger group of consumers (Defrancesco and Rossetto, 2007; Darnhofer *et al.*, 2019). This shift was endorsed by a general narrative of the Italian food politics which focuses on local, traditional, artisanal as safer, fresher and cleaner: the so called "quality turn" (Brunori *et al.*, 2013). For these reasons, the majority of Italians buy organic products in combination with conventional ones and only a few percentages buy organic food solely (Pellegrini and Farinello, 2009; Rete Rurale Nazionale, 2018; Compagnoni *et al.*, 2000).

Just like organic consumers in other countries, Italians' have a good awareness and knowledge of the link between food consumption and personal health (Annunziata and Pascale, 2009; Annunziata and Vecchio, 2016; Annunziata *et al.*, 2011; Pellegrini and Farinello, 2009; Chinnici *et al.*, 2002; Defrancesco and Rossetto, 2007; Hemmerling *et al.*, 2015). This approach is not only related to the absence of specific substances, such as pesticides or additives, but also in the perception of freshness and natural production methods (Annunziata and Pascale, 2009). Additionally, caring about the environment and the ethical aspects of food production is part of the consumers' drivers to buy organic food (Pellegrini and Farinello, 2009; Cicia *et al.*, 2002; Chinnici *et al.*, 2002; Zanolini *et al.*, 2013; Hemmerling *et al.*, 2015; Karelakis *et al.*, 2018). As demonstrated also by Karelakis *et al.* (2018), personal values are often an important component of the organic choice. Although Italian or-

ganic consumers trust labelling as an important feature to distinguish production systems, as confirmed by Troiano *et al.* (2016) study, consumers ask for more detailed information, especially related to the environment, ethics and health (Annunziata *et al.*, 2011; De Magistris and Gracia Royo, 2012; Rete Rurale Nazionale, 2018; Canavari, 2007). However, scepticism towards labelling can be attributed to the general mistrust of institutions, typical of Italians' mindset or to a low level of communication regarding new policies and strategies adopted by governments (Canavari, 2007).

The strong link between organic and health/sustainable considerations are, however, overruled by taste and pleasure which are always considered very important food characteristics (Annunziata and Pascale, 2009; Annunziata and Vecchio, 2016; Pellegrini and Farinello, 2009). "Although consumers often claim to purchase organic food out of altruistic motives that have a public utility, such as environmental protection, in practice, attributes representing an individual utility (e.g. health, taste and quality) are the stronger driving forces for organic food consumption" (Hemmerling *et al.*, 2015, p. 25). Because of the "quality turn" (Goodman, 2004; Brunori *et al.*, 2013) earlier mentioned, those characteristics (e.g. taste, pleasure, health etc.) are strongly related to local and traditional products in Italy (Hemmerling *et al.*, 2013). In fact, the origin of production is the first proxy for quality, in particular when talking about local and regional production (Annunziata and Vecchio, 2016; Cicia *et al.*, 2002; Hemmerling *et al.*, 2013; Rete Rurale Nazionale, 2018; Darnhofer *et al.*, 2019; Jorge *et al.*, 2020). In Troiano *et al.* study (2016), for instance, local claims prevail on organic labelling when it comes to purchasing influence of wine: "quality is more linked to the local claims and therefore organic labels seem to be a not sufficient condition to guarantee the perceived quality of a certain wine" (p. 19). In fact, as confirmed by Hemmerling *et al.* (2015) tradition or origin is often more important than an organic certification. In particular, often the term local has been associated with natural attributes in food, as confirmed by Jorge *et al.* (2020) which states that "local" has a

strong influence in the intention of eating healthier among millennials.

3. Materials and methods

The empirical study is based on the application of the Q-method. This method – which combines an interpretative approach with a statistical rigour – is intended for social discourse analysis (Stephenson, 1936; Stephenson, 1953). The method has been recently applied in various contexts including agriculture (Previte *et al.*, 2007; Hall, 2008; Zagata, 2010; Nicholas *et al.*, 2014; Mandolesi *et al.*, 2015; Iofrida *et al.*, 2018; Zanolini *et al.*, 2018) and consumers studies (e.g. Kraak *et al.*, 2014; Zhang and Beyounecef, 2016; Yazar and Orth, 2018).

The application of the Q-method is concisely presented in the points below that inform in detail about our steps and also about the specific parameters of our empirical study. The design of our study follows guidelines provided in seminal literature for Q-methodology (Brown, 1980; Brown, 1993; Barry and Proops, 2000).

3.1. Mapping of the social discourse

Our empirical inquiry started with the exploration of the communication concourse of the organic sector in Europe. Based on the study of documents, there were approximately 300 arguments and statements identified, which reflected the ongoing debate on organic agriculture in Europe. The main attention was given to strategic documents, discussion papers, policy documents, research reports which represented different viewpoints of stakeholders active in the organic sector. We have systematically explored public documents on the EU level and particularly within the national context of Italy. Additionally, we have explored communication concourse related to the situation in Great Britain, Portugal, Austria and Czech Republic. Such a sample of countries enabled us to look at diverse realities of organic sectors in Europe – with respect to the main goal of the q-methodology – to identify inner structures represented by latent discourses within a communication concourse (Addams, 2000).

3.2. Selection of the stimuli (Q-set)

In order to systematically organise a large number of quotes from the documents, the pool of the statements was categorized into four thematic groups related to (1) agriculture, (2) food production, (3) organic movement and (4) organic policy. The first step was to exclude any duplicate and unclear statements from the pool. In the second step, we looked for statements that explicitly addressed current challenges of the organic sector and possible changes in strategic course. At the same time, we aimed to create a balanced sample that would proportionally cover the four basic themes. The final sample (Q-set) consists of 44 statements (see the Table 4).

3.3. Sorting grid

A standard scale with quasi-normal distribution was selected, reaching from +5 to -5. The scale was printed out on a large paper to allow respondents to place the statements directly on the sorting grid (Figure 1).

3.4. Sample (P-set)

Sample of the respondents was created with the use of the strategic sampling (Watts and Stenner, 2005) and counted 20 participants, who represented different groups of organic consumers with a different level of experience and knowledge about organic agriculture. The Q-methodology has been selected as it allows the use of small number of respondents (Previte *et al.*, 2007), which was the case of this study. In fact, as confirmed by many studies (Brown, 1996; Watts and Stenner, 2005; Previte *et al.*, 2007), Q studies can be carried out

Table 1 - Demographics of the participants.

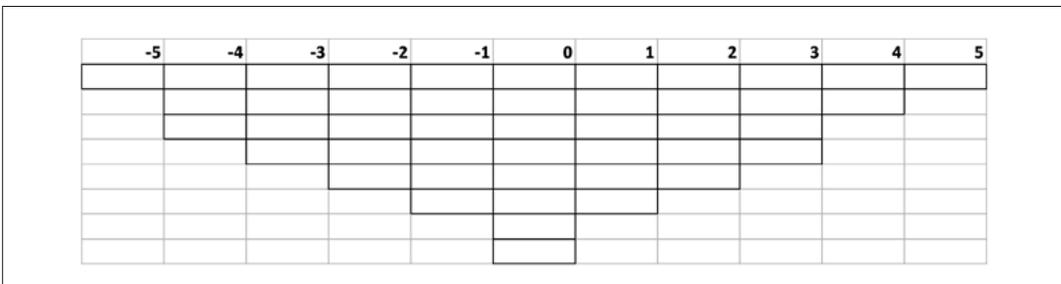
<i>Participants</i>	20
Woman	15
Men	5
Less than 30 years old	10
More than 30 years old	10

with very few participants and still be considered highly effective. Hence, the participants were recruited via social networks with respect to two conditions: participants had to be responsible for food purchases in their household and buy at least two types of organic products (available options: dairy products, meat, vegetables/fruit, bakery) on a frequent basis (monthly or more). These conditions have been checked with filter questions prior to sorting of the statements. The selected participants resulted in 75% women and an equal number of participants under and over 30 years old, as described in Table 1.

3.5. Data collection

Participants were asked to place the statements on the evaluation scale based on their subjective opinion. The condition of instruction was framed by the question (written above the sorting grid): “Can you value on a scale from -5 to +5 your agreement or disagreement on the following statements?”. Right after the sorting, an in-depth interview to elucidate the participants chosen sorting of the statements. The interviews validated the sorting grids results and added some important details for better understanding those results, for instance, the personal motives and habits of purchasing choices.

Figure 1 - Sorting grid prototype.



3.6. Analysis

We have calculated a basic descriptive statistic and, after a preliminary check for errors, we processed the data with the application *qmethod package for R* (Zabala, 2020). Although original studies in Q-methodology used for extracting factors centroid factor analysis (Brown, 1980), other extraction methods, such as factor analysis or PCA, are also accepted in Q-methodology studies, since both methods of extraction generate very similar results (Watts and Stenner, 2005). For pragmatic reasons the *qmethod package* relies on the PCA method only (Zabala, 2020, p. 41) and therefore this extraction method was used also in our analysis. Table 2 shows the factor loadings of the extracted factors.

Factors were extracted through the PCA method with the following varimax rotation method. Decision about the number of factors was based on substantial and statistical criteria, i.e. interpretability of factors, eigen values of factors and their coefficients of reliability (see the Table 2 for details). We have opted for a 3-factor solution that has matched the above-mentioned combination of criteria.

4. Results

From the Q-analysis three main factors were extracted, which cumulatively explain 53.48% of the total variance within the data. Following the Q-methodology, each factor aims to represent a group ideal-type viewpoint of organic consumers and their distinct views on the organic sector (Table 2). The interpretation of the data, which will be explained in this section, focuses on statements with the highest dis/agreement, as those are the statements that reflect the viewpoints of the consumers, and the viewpoints that discern differences between the groups (Table 3). After a brief description of the three main factors extracted, an analysis of consensus statements is presented. Confounded statements, which are those that load significantly on more than one factor, are mostly treated in section of consensus statements, or simply ignored if their score was low, as they risk making the factors array less distinct (Armatas *et*

Table 2 - General factor characteristics.

	F1	F2	F3
Number of loadings	6	7	4
Eigenvalues	4.24	3.65	2.81
Explained variance (%)	21.22	18.23	14.04
Reliability	0.96	0.97	0.94
Standard error f-scores	0.20	0.19	0.24

Table 3 - Factor loadings of the extracted factors.

	F1	F2	F3
X2	0.518	0.272	0.433
X9	0.631	0.378	0.385
X12	0.638	0.416	0.140
X13	0.769	0.231	0.263
X14	0.787	0.097	0.263
X15	0.765	0.044	0.182
X1	0.040	0.730	0.425
X3	0.364	0.596	-0.430
X6	0.264	0.640	0.152
X8	0.318	0.565	0.228
X10	0.310	0.509	-0.073
X17	-0.073	0.772	0.119
X20	0.456	0.487	0.142
X4	0.439	-0.168	0.526
X5	-0.169	0.466	0.657
X11	0.296	0.032	0.419
X16	0.164	0.099	0.776
X18	0.433	0.370	0.241
X19	0.473	0.285	0.541
X7	0.112	0.084	0.180

al., 2014). The appendix attached to the article better explains the statistical significance of the statements by showing the consensus and distinguishing ones for each factor.

Factor 1: Mainstreaming for the better good

The first discourse is characterised by a strong support for organic production which should be more prioritized by institutions as a healthier and more sustainable method that should consequently be widely available for all. Communication towards the consumer is one of the main concerns (1, +3; 4, +5¹) as the label is intended

¹ In this section, the statement number is cited with the respective factor score.

to inform about absence of fertilizers, pesticides and GMO, which strongly differentiates organic from conventional (38, -4). Indeed, this group of consumers believes in organic production as a healthier option (26, -3; 35, -3) that not only helps farmers in rural areas (34, -5) but also could provide a safety net to food security issues on a global scale (16, +4; 3, -4). For this reason, the need to mainstream organic products into all public facilities such as school canteens, hospitals etc. is one of the statements with the most agreement (16, +4). It is interesting to notice that this discourse in our analysis is mainly shared by mothers between 26 and 64 years old. For instance, during one of the post-sorting interviews, a participant included in this factor talked at length about the importance of organic foods in school public procurements and the role that teachers have in educating students about sustainable diets and healthy nutrition. The fact that this perspective is supported by women with children strongly influences the answers which are all directed to what can be called *the better good*. In this view, organic and conventional systems should overcome their differences (8, +3) in order to build a more ecological (33, +3) and healthier world for future generations. As all types of agricultural production are subject to climate change and market variability (30, -3; 40, -3), institutions and agricultural subsidies should focus on organic as a more environmentally friendly, economically fair and healthier method (24, +3; 33, +3; 2, +4).

Factor 2: Critical supporters looking for more

The second factor is composed by a mixed group of young men and women between 23 and 33 years old, mainly single and without children. This viewpoint believes in the need of a strong political intervention regarding sustainability policies, refusing the idea that consumers should lead the sector (2, +5; 42, -5). The focus here is less on organic specifically but more generally on the impact that massive food production has on human health and the environment, as its “true cost” is not integrated in the price of products (14, +4; 2, +5). According to this discourse, the production method strongly influences the environment and human health (39, +4; 2, +5;

14, +4) and therefore a better communication towards consumers should be pursued (1, +3; 4, +3; 37, +3). However, in opposition to this first factor, this view strongly disagrees on the mainstreaming of organic agriculture as it will not provide food security to the European population (20, -4; 6, -3). There is, in fact, the implicit idea that by becoming more mainstream organic will impact as much as conventional agriculture. Organic is viewed as questionable as many other types of food production (40, -4), which is *not enough* to make the sustainable transition. While not denying the qualities, this factor critically supports organic production, implicitly suggesting that more could be done. This argument was mentioned during the interviews. One of the consumers said he “expects more” from organic agriculture. During the post-sorting interviews, these consumers showed the propensity to distinguish organic from local, regional from local, products bought in local markets – either organic or not – from the ones from supermarkets. Many participants shared the viewpoint that organic was being overtaken by the alternative food movement initiatives flourishing in their local areas, which are often considered to be more sustainable because they are less related to the dynamics of conventional production. In this perspective, trust in producers and local products was a big part of the consumption pattern. Hence, organic does not have to learn from conventional (44, -3), does not have to become more productive (20, -4) although new voices and other sustainable initiatives, should be part of the political decisions (27, +3).

Factor 3: Organic intensification supporters

The last viewpoint is very heterogeneous: it includes mainly women but also men, mainly born in the 1960 as well as few younger consumers with or without children. According to this discourse, organic production should be mainstreamed on a global scale (19, +4), become a priority for institutions (24, +4) and intensify its production in order to change the conventional system (10, +3) as organic products are more healthy and environmentally friendly (39, +5; 35, -5; 32 -3). By intensifying the production, organic could solve global food system issues (10, +3),

Table 4 - Statements and factor array for each perspective.

<i>Nr.</i>	<i>Statement</i>	<i>F1</i>	<i>F2</i>	<i>F3</i>
1	Organic farming and food sector needs to improve communication towards consumers	3	3	2
2	The future policy needs to take into account the true cost of industrial farming	4	5	0
3	Food security cannot be achieved with organic agriculture	-4	-1	1
4	Food products that have been produced using artificial fertilizers, chemical treatments or GMO should be clearly labelled	5	3	0
5	A more sustainable lifestyle is more costly for the consumer	1	-1	-3
6	Organic agriculture can provide more than enough nutrition for the entire European population	0	-3	1
7	The dependency on subsidies has a very negative effect on autonomy and stability of farms	1	1	-1
8	Ideological barriers between supporters and opponents of organic agriculture need to be overcome to pave the way for reaching higher sustainability	3	1	-1
9	Consumers have more trust in local production, as opposed to organic products, which are globally traded and whose origins and production is not always clear	2	1	-1
10	Organic production must continue to grow to change conventional systems, contributing to solving global problems	1	0	3
11	The controls on organic farms should be strengthened, eliminating any derogations	-1	1	-3
12	Regulations for organic farmers and producers must be simplified	1	0	1
13	Organic farming and the organic food sector are currently competing with other sustainability initiatives	-1	-3	-4
14	If ecological costs would be fully integrated into the price of the products, industrially produced food would be much more expensive	2	4	1
15	Higher prices for food could perhaps contribute to a higher appreciation of their value and resulting in less food waste	-2	2	1
16	Organic products should be widely available in hospital catering, schools canteens, green management and public areas	4	1	2
17	More people would choose seasonal, regional and organic food products if they had the financial option	1	-1	0
18	The organic movement should be more inclusive of other issues, such as social justice and food sovereignty	0	0	2
19	Organic farming needs to be adopted on a global scale	1	-1	4
20	Organic agriculture needs to be more productive	0	-4	0
21	Lack of information is a major factor which limits the uptake of organic methods in modern agriculture	0	0	0
22	Smart combinations of organic and conventional methods could contribute toward increases of sustainable farming in global agriculture	-1	-2	2
23	Financial subsidies provided by the EU are not available for small farms and this should be addressed directly	2	1	-1
24	Organic agriculture should become a priority within national and EU agricultural policies	3	0	4
25	Local food production is more important than organic-based food production	-2	2	-1
26	Organically produced food are not more nutritious	-3	2	-3
27	Small-scale producers and consumers should have a significant voice in the political decisions concerning food and agriculture	2	3	3
28	Organic farmers should be given more room to autonomously develop sustainable solutions	0	0	3
29	Agro-industry and mass animal production must be restricted and subsidies withdrawn	1	2	-2

Nr.	Statement	F1	F2	F3
30	Organic farms can better tolerate periods of drought and other extreme weather fluctuations	-3	-1	-3
31	One of organic agriculture's strengths is improved livestock welfare	0	-2	-1
32	Organic production requires too much land usage for minimal yield	-2	-2	-3
33	All subsidies for agriculture should be oriented much more towards protection of the environment and climate	3	2	2
34	Organic agriculture does not contribute to employment in rural areas	-5	-3	-4
35	There is no scientific proof to verify that organic food products are more healthy and environmentally friendly than conventionally produced food	-3	-2	-5
36	The increasingly present term of "regional" in opposition to "organic" creates confusion for consumers	-1	-2	0
37	Consumers need to have a greater understanding of the work involved in food production	-1	3	2
38	At present the gap between "conventional" and "organic" production has become smaller and the differences blurred	-4	-1	-2
39	The way we produce and consume our food has a big impact on our health	0	4	5
40	Organic farms can better adapt to volatile fluctuating market prices and climate change	-3	-4	0
41	Precision farming and digital technologies are necessary innovations that should be implemented in organic agriculture	-1	0	3
42	The support for organic agriculture should be provided mainly from the consumers' side	-2	-5	-2
43	Organic products are often imported and therefore are not necessarily environmentally friendly	0	0	-1
44	Organic farms can learn from conventional farms	-2	-3	0

giving consumers and farmers a louder voice in policy making (27, +3; 28, +3) and guaranteeing a fair sustainable lifestyle to all (5, -3). This idea of sustainable intensification is also supported by the role of technology, which was not highlighted in the other two factors. Indeed, members of this group believe in the need to apply modern agricultural technology to organic production (41, +3), along with a lighter control system and higher autonomy of organic farmers (11, -3; 28, +3). While the first factor supports organic as strongly different to conventional, here this distinction is blurred, and the support is focused on adapting organic agriculture to the conventional system. During one of the interviews, the participant declared "the more organic we have, the better it is".

Consensus statements

Some consensus statements have been highlighted, as those statements that gained similar

or equal scores in all three factors. Indeed, most participants stated to have more trust in local production than organic products (9: +2, +1, -1²). This characteristic has been highlighted in the post-sorting interviews as well, where many participants, especially in Factor 2, confirmed that one of their main purchasing motives was trust in their local market or local shop, regardless of buying organic. Also, another consensual aspect regards the role of small producers and consumers in the political decision making (27: +2, +3, +3) which can still be related to the trust in local production and the affinity to farmers that Italians might have as a rural country. Again, environmental protection seems to be a very important pattern among all participants of the study, as all three factors support the protection of the environment and climate change as a focus of agricultural subsidies (33: +3, +2, +2). On the other hand, they showed a negative consensus regard-

² In this section, all three factor scores are showed for each statements cited. The sequence is F1, F2, F3.

ing land usage requirements for organic products (32: -2, -2, -3), showing an interesting insight on consumers' knowledge. Finally, there is a neutral consensus regarding simplification of regulations (12: +1, 0, +1), lack of information as a limit to modern agricultural growth (21: 0, 0, 0) and the role of imported organic food as less environmentally friendly (43: 0, 0, -1), which all show a good understanding of the trust in organic methods and certification. It is important to highlight that the trust in certification system shown by the results often do not constitute a real understanding of what the organic certification is. This was confirmed by the interviews with participants where the trust mentioned was often related to trust in a certification rather than on the organic certification itself. Same regarding the use of terms such as "local", "natural", "plant-based", "sustainable". The study recognized that these terms are often used as interchangeable without understanding the nuanced differences.

5 Discussion

This study aimed at understanding the impact of the evolvments of the organic movement on organic food purchasing behaviours. Other studies already showed that personal health (Annunziata and Pascale, 2009; Annunziata and Vecchio, 2016; Annunziata *et al.*, 2011; Pellegrini and Farinello, 2009; Chinnici *et al.*, 2002; Defrancesco and Rossetto, 2007; Hemmerling *et al.*, 2015) along with environmental and ethical aspects of food production (Pellegrini and Farinello, 2009; Cicia *et al.*, 2002; Chinnici *et al.*, 2002; Zanolli *et al.*, 2013; Hemmerling *et al.*, 2015; Karelakis *et al.*, 2018) are important purchasing drivers. This research adds on this field of study by commenting on the perceptions of how the organic movement has been changing and how does this impact on purchasing choices. Hence the study aimed to answer to the following question: how are changes in the course of the organic movement reflected by consumers themselves?

To answer this question, three main topics of discussion emerged from the results of this study:

- Expectations of the consumers towards the future of the organic movement.

- The role of trust in purchasing behaviors.
- The importance of supporting rural development.

Expectations of the consumers towards the future of the organic movement

The interpretation of the ideal-typical views shared by the consumers point out different expectations towards the Italian organic movement. Indeed, the first and the third factor believe in the need for increased institutional support for organic production since they view organic food as a sustainable and healthy product that should be available to all consumers. However, these two factors differ in the role that organic should play towards conventional. While the third factor believes that organic should take control of the current agricultural system, by maintaining its properties but using conventional features such as mass production, consumers and farmers sovereignty and advanced technology, the first factor places organic in opposition to the conventional sector. Therefore, both discourses accentuate the need to create a higher availability of organic products, but each of them proposes a different means to reach such a goal. The second factor, on the other hand, brings to the analysis a more critical perspective that seeks a more radical innovation to achieve sustainability. This is based on the argument that the production system that becomes mainstream and intensifies its production and is no longer sustainable and calling for a shifting focus from organic to non-industrial food, as the strong agreement on statement 4 shows (Table 3).

Regarding the role of the sector, the first factor is inclined towards maintaining the status quo. By making organic available to more consumers, organic production could help solve European food insecurity. This vision has direct policy implications which are: the need for a better labelling system and communication towards consumers; policies that would consider the true cost of industrial farming; the spread of organic products into all public facilities; more subsidies oriented towards environmental protection. As previously mentioned, the third factor has a similar vision but seeks production intensification for the future of the movement, raising the possi-

bility of organic to increase its share in the agri-food sector. Policy implications, in this case, are all based around the idea of giving farmers more space in the production and policy making systems. Therefore, consumers in the third factor suggest the inclusion of small farmers and consumers into policy making, more autonomy in sustainable production methods for farmers, facilitate controls on organic and the introduction of tech solutions in organic agriculture. Finally, the third perspective would enhance the main principles of organic production, trying to reach new peaks of sustainability, with the help of other similar movements. Therefore, policy implications would involve: the consideration of the true cost of farming; better communication and labelling, starting from more consumers' education on food production systems; the introduction of small-scale farmers into the policy making process; and a stronger role of each State in the sector.

The role of trust in purchasing behaviors

Based on the consensus statements, we argue that all consumers in our sample follow similar discourse streams that nuances according to the factor they belong to. The first stream of consensus relates to consumers' trust in organic certification and methods for which all factors seem to agree (21: 0, 0, 0; 32: -2, -2, -3; 43: 0, 0, -1). Also, regarding trust, similar scores appear for local production whether organic or not, for which all factors have a similar score (9: +2, +1, -1). Although the topic of trust into certifications and local production seems prominent in all three factors, the study highlights how participants tend to have a very general understanding of what a certification really is and the actual differences between the terms "local", "sustainable", "organic" and similar. Finally, many statements share a consensus on the idea that policies and the State should play a stronger role on agricultural and environmental issues while including other stakeholders in the policymaking (33: +3, +2, +2; 27: +2, +3, +3; 12: +1, 0, +1). These similarities in all three discourses can be seen as a request from organic consumers to generally have more policies addressing the environment and supporting organic and local pro-

ductions. Moreover, despite the differences of future worldviews, all viewpoints state the need to have a policy system that would better inform consumers not only on organic production but on the food production system in general. This expectation of the consumers was also explicitly stated during the sorting exercise.

As other previous studies also mention (Canavari, 2007; Annunziata *et al.*, 2011; De Magistris and Gracia Royo, 2012; Rete Rurale Nazionale, 2018), consumers perceive the labelling of organic products to be a quality signal, and very important in recognizing the differences between organic and non-organic. At the same time, they feel the need to have more information, especially related to the ethical/sustainable characteristics, that seems to be a valuable aspect to take into consideration (Zanoli *et al.*, 2012). However, previous studies on the expectations of consumers (Cicia *et al.*, 2002; Chinnici *et al.*, 2002; Defrancesco and Rossetto, 2007; Annunziata and Pascale, 2009; Pellegrini and Farinello, 2009; Annunziata *et al.*, 2011; Zanoli *et al.*, 2013; Annunziata and Vecchio, 2016; Rete Rurale Nazionale, 2018) tend to look at purchase preferences and motivations without deepening the sustainability and climate change issue. Nevertheless, our study underlined that such issues seriously concern organic consumers. All three factors agree that climate change and environmental issues go beyond organic agriculture which results in being powerless in the face of similar challenges. Hence, the need that all perspectives expressed have policies which deal with sustainability issues. These policies should take into consideration price and market volatility, production methods and climate change resilience.

The importance of supporting rural development

Finally, besides consensus statements, it is interesting to notice that all factors disagreed with the opinion that undermines the positive impact of organic agriculture on employment in rural areas, scoring statement 34 in the following way: F1 -5; F2 -3 and F3 -4. Such evaluation verifies the course of the rural development policy that is currently implemented. As Martindale *et al.*

(2018) underlines, most alternative food movements strongly relate to rural development and support local farmers' initiatives, and consumers seem to perceive the effort in dealing with those issues. Indeed, this strong awareness towards the positive impact that organic farming has on Italian employment is a consequence of the role of mainstream unions and established farmers associations in the organic movement growth, and the support of the State (Darnhofer *et al.*, 2019). In fact, even though the Italian government has always been passive in agricultural matters by leaving most of the decisions to regional governments, it has always supported the promotion of organic farming. The government facilitated the implementation of the organic meals at schools and launched the first National Plan for Organic Agriculture in 2005 (Darnhofer *et al.*, 2019).

6. Conclusions

Some authors argue that the organic movement will undergo a significant "metamorphosis" (Gould, 2015), in a sector which is known to be consumer driven, what path this metamorphosis will take can depend on consumers' expectations regarding the future of this movement. This study discovered three factors of organic consumers, differentiated by their discourse on the organic movement and its future: "mainstreaming for the better good", "critical supporters looking for more" and "organic intensification supporters". Despite their differences, all discourses showed the environment, local production, and more support from the state, to be the most pressing issues in our sample, regardless of the factor our participants matched.

Moreover, the study also highlighted a general discontent about policy intervention regarding the environment and consumers' education on food, whilst a general satisfaction regarding the link between organic production and employment in rural areas. The idea is that EU and State policies should have a greater part in contributing to the flourishing of the organic sector and of a more sustainable system. If we look at our results within the framework of the Organic 3.0, considered the strategic course of the movement, it is interesting to note that most of the consumers'

expectations match the key ideas of the Organic 3.0 vision. However, it seems that mainstream consumers are hardly aware of the Organic 3.0 strategy and goals, confirming the need to improve communication with consumers. Based on our findings we argue that policymakers and organic movement proponents should not only inform consumers on the qualities of organic food, but also on their movement's policies and strategies. This would address the broader issue of sustainability in a way that would enable a wider acceptance of the organic principles. This approach seems to be a precondition for the new strategy, which counts on "integration of organic into the development of the planet and societies rather than concentration on the perfection of the niche" (Arbenz *et al.*, 2017, p. 207). Future studies within this context should aim on practices and perspectives of other stakeholders' groups for a better understanding of their expectations and eventual refinement of policy strategies.

Main limitations of the study are related to subject, object, and time. The identified perspectives represent ideal-type discourses that reflect subjective viewpoints of Italian organic consumers on selected aspects of the organic sector. Despite the extensive exploration of the existing discourse, the statements presented to the interviewed consumers do not cover *all* aspects of organic food consumption reflected by consumers themselves. At the same time, the results of the Q-method study cannot be generalized to the entire population of consumers in Italy. However, the purposive (non-probability) sample of 20 participants provides sufficient empirical data for extraction of factors, which meet the statistical criteria for reliability, and which can be meaningfully interpreted to understand perspectives of consumers in the given context.

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Appendix

Figure 1A - Distinguishing and consensus statements.

	dist.and.cons	f1_f2	sig_f1_f2	f1_f3	sig_f1_f3	f2_f3	sig_f2_f3
1		-0.344		0.299		0.642	*
2	Distinguishes all	-0.907	***	1.529	****	2.436	****
3	Distinguishes all	-1.403	****	-2.270	****	-0.867	**
4	Distinguishes all	0.807	**	1.664	****	0.857	**
5	Distinguishes all	0.960	***	1.722	****	0.761	*
6	Distinguishes f2 only	1.203	***	-0.148		-1.350	***
7	Distinguishes f3 only	0.289		0.972	**	0.683	*
8	Distinguishes all	1.069	***	1.878	****	0.809	**
9	Consensus	0.272		0.546		0.274	
10	Distinguishes f2 only	0.839	**	-0.356		-1.195	***
11	Distinguishes all	-0.769	**	0.788	*	1.558	****
12	Consensus	0.511		0.534		0.023	
13	Distinguishes f1 only	0.710	**	0.851	**	0.141	
14	Distinguishes f2 only	-1.053	***	0.233		1.286	***
15	Distinguishes f1 only	-1.783	****	-1.518	****	0.265	
16		1.037	***	0.517		-0.520	
17	Distinguishes f1 only	1.160	***	1.131	***	-0.029	
18	Distinguishes f3 only	-0.093		1.008	**	1.102	***
19	Distinguishes all	0.994	***	-0.793	*	-1.787	****
20	Distinguishes f2 only	1.656	****	0.135		-1.521	****
21	Consensus	0.360		0.247		-0.113	
22	Distinguishes f3 only	0.268		-1.475	***	-1.742	****
23	Distinguishes f3 only	0.342		1.513	****	1.171	***
24	Distinguishes all	1.480	****	-0.683	*	-2.162	****
25	Distinguishes f2 only	-1.507	****	-0.378		1.129	***
26	Distinguishes all	-2.228	****	-0.775	*	1.453	****
27	Consensus	-0.145		-0.532		-0.387	
28	Distinguishes f3 only	0.202		-1.078	***	-1.280	***
29	Distinguishes f3 only	-0.110		1.505	****	1.615	****
30	Distinguishes f2 only	-1.097	***	-0.369		0.728	*
31		0.770	**	0.598		-0.172	
32	Consensus	-0.365		0.078		0.443	
33	Consensus	0.207		0.232		0.024	
34	Distinguishes f2 only	-0.916	***	-0.279		0.637	*
35	Distinguishes f3 only	-0.442		0.814	**	1.256	***
36		-0.299		-0.843	**	-0.544	
37	Distinguishes f1 only	-1.171	***	-0.739	*	0.431	
38	Distinguishes f1 only	-1.313	****	-0.787	*	0.527	
39	Distinguishes all	-1.504	****	-2.124	****	-0.621	*
40	Distinguishes f3 only	0.318		-1.111	***	-1.429	***
41	Distinguishes f3 only	-0.421		-2.019	****	-1.598	****
42	Distinguishes f2 only	2.044	****	-0.096		-2.140	****
43	Consensus	0.218		0.495		0.276	
44	Distinguishes f3 only	0.157		-0.914	**	-1.071	***

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