



PRIMA
PARTNERSHIP FOR RESEARCH AND INNOVATION
IN THE MEDITERRANEAN AREA



TECHONEY

Development of a **blockchain-based ecosystem** that allows an **improved positioning of small producers of honey** on local and international markets

WP1: HONEY INNOVATION AND LEARNING COMMUNITY LAB
(HILE)

Task 1.4: Sustainability analysis of the current honey supply chains
(R) (PU) (CREDA)

CHARTER

PROJECT	PROJECT FULL TITLE	DEVELOPMENT OF A BLOCKCHAIN-BASED ECOSYSTEM THAT ALLOWS AN IMPROVED POSITIONING OF SMALL PRODUCERS OF HONEY ON LOCAL AND INTERNATIONAL MARKETS		 TECHONEY
	PROJECT ACRONYM	TECHONEY		
	EC PROGRAMME	GRANT AGREEMENT	National Founding Prima Sec. 2	
		PROGRAMME	Partnership on Research and Innovation in the Mediterranean Area (PRIMA)	
		SECTION 2	Multitopic 2021	
		THEMATIC AREA 3	Agro-food chain	
		TOPIC	Increasing the resilience of small-scale farms to global challenges and COVID-like crisis by using adapted technologies, smart agri-food supply chain and crisis management tools	
		FUNDING SCHEME	Collaborative Project	
		TYPE OF ACTION	Research and Innovation Actions (RIA)	
	COORDINATOR	Tiziana de Magistris · Principal Investigator Centro de Investigaciones Técnicas Agrolimentarias (CITA) · Zaragoza (Spain)		
START DATE	01.May.2022	DURATION	42 months	
PROJECT URL	http://www.techoney.org			
DELIVERABLE	DELIVERABLE	D1.4. Report on the sustainability assessment of the current honey supply chain		
	WORK PACKAGE	WP1: Honey Innovation and Learning Community Lab		
	DATE OF DELIVERY	26/09/2025		
	NATURE	R (Report)	DISSEMINATION LEVEL	PU (Public)
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	FILENAME	TECHONEY-D1.4. Sustainability assessment of the honey current supply chain		
	VERSION	I.)		
ABSTRACT OF THE DELIVERABLE	The four pillars of sustainability were evaluated by Delphi expert panel for the different supply chain identified in the Living Labs in Spain, Turkey and Tunisia. The relative importance of each indicator (economic, social, environmental and governance) was estimated using the Analytical Hierarchy Process (AHP). A sustainability index was estimated for the eight main distribution channels identified.			

VERSION TRACKER

VERSION	REVIEWER	PARTNER	DATE	STATUS
0.1	DR. SELENE I.ORNELAS	CREDA	25 th September	First Draft
0.2	DR. ZEIN KALLAS	CREDA	26 th September	Final Draft



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EXECUTIVE SUMMARY

- This report presents a comprehensive sustainability assessment of distribution channels in the honey value chain across three case study countries: Spain, Tunisia, and Turkey. The evaluation is based on a multidimensional framework adapted from the SAFA methodology (FAO, 2014), integrating economic, environmental, social, and governance indicators.
- A participatory methodology was applied, combining the Delphi method with the Analytic Hierarchy Process (AHP) to gather expert insights and quantify the relative importance of sustainability indicators. Experts included beekeepers, cooperative representatives, retailers, processors, distributors, and academic researchers from each country.
- The results reveal that **short supply chains**, particularly **direct sales and cooperatives**, are consistently perceived as the most sustainable distribution channels across all three countries. These channels align closely with key sustainability indicators, especially those related to environmental and economic performance.
- In **Spain**, environmental indicators were prioritized, with “Water Conservation Practices” (ENV4) being the most valued. Direct sales, cooperatives, and small retailers were identified as the most sustainable channels.
- In **Tunisia**, economic indicators gained prominence in the second round of expert evaluation, with “Cost of Production” (ECO1), “Net Income” (ECO2), and “Energy Consumption” (ENV3) ranked highest. Direct sales and cooperatives were again the preferred channels.
- In **Turkey**, environmental indicators were dominant, particularly “Locally Adapted Varieties and Breeds” (ENV1). Cooperatives were identified as the most sustainable channel, followed by direct sales, with economic and environmental factors driving their relevance.
- Governance indicators were consistently rated as the least important across all countries, suggesting a limited perceived impact of institutional mechanisms on sustainability in the honey sector.
- The comparative analysis highlights the importance of **contextualizing sustainability assessments** and the value of participatory approaches in capturing stakeholder perspectives. The findings support the promotion of short supply chains as a strategic pathway toward sustainability in apiculture.
- These insights are essential for guiding future policy development, stakeholder engagement, and innovation strategies within the Techoney project and similar initiatives focused on sustainable agrifood systems.



1. INTRODUCTION

Task 1.4 of the Techoney project focused on **analyzing the sustainability of the honey supply chain**, with the aim of identifying the most optimal and sustainable distribution channels for small producers in the beekeeping sector. This task was led by the CREDA team, in collaboration with the case study leaders in each participating region. The need to establish a common framework for assessing the sustainability of agri-food chains motivated the development of a robust, multidimensional methodology adapted to the specific context of honey production.

To address this task, the SAFA (Sustainability Assessment of Food and Agriculture Systems) methodological approach proposed by the Food and Agriculture Organization of the United Nations (FAO, 2014) was adopted.



Figure 1. SAFA presentation.

This framework provides guidelines for assessing sustainability through four fundamental pillars: economic resilience, social well-being, good governance, and environmental integrity. SAFA includes a total of 118 indicators, organized into themes and subthemes that reflect universal sustainability goals applicable to agri-food supply chains. However, given the specific nature of the beekeeping sector and the regional diversity of the project, it was deemed necessary to adapt and select the most relevant indicators.

Within the framework of the Techoney project, 20 indicators were selected from the SAFA set, prioritizing those that demonstrated the greatest applicability to the analysis of the honey value chain and that had data available in the different regions (see Table 1). This selection was based on the methodological approach proposed by Kouchner et al. (2018), which allows the indicators to be contextualized based on the productive and commercial reality of each territory.

Table 1. Selected Indicators

Indicators		Description
C Economic resilience		
C 1.4.2 Cost of Production	ECO1	Economic or accounting indicator that refers to the costs related to the distribution channel: Energy, water, labor costs, packaging.
C 1.4.1 Net income	ECO2	Total revenue earned in the last five years associated with production
C2.2.2 Stability of supplier relationships	ECO3	This indicator measures the share of supplier contracts/business relationship that has remained ongoing over the last 5 years, or since the enterprise is in business for a period of less than five years.
C4.2.1 Local Procurement	ECO4	This indicator measures whether the enterprise has purchased its inputs/ingredients/products from local suppliers when equal or similar conditions exist, in comparison to non-local suppliers.
C 1.4.3 Price determination	ECO5	The amplitude of the mark-up (i.e. the difference between the selling price and the cost per unit of production)
E Environmental Integrity		
E4.3.3 Locally adapted varieties and breeds	ENV1	Determine the share of production (by area, animal number of live weight) accounted for by: locally adapted plant varieties or animal breeds; rare; and traditional (heirloom) crop varieties and livestock breeds.
E5.1.4 Intensity of material use	ENV2	The replacement of virgin non-renewable materials by recycled and renewable materials and the reduction of the material intensity of production (i.e. increased eco-efficiency) are two central pillars of a green economy.
E5.2.3 Energy consumption	ENV3	This indicator measures how has the enterprise' direct energy consumption per unit of produce changed during the past five years.
E2.1.2 Water conservation Practices	ENV4	Practices that aim at saving water in agriculture chains
E5.3.4 Food loss and waste reduction	ENV5	The topic of this indicator relates to food losses that occur during production, post-harvest and processing operations, as well as food waste that occurs at different distribution channels
S Social Well-being		
S3.1.1 Employment relations	SOC1	Well-paid employment, working conditions
S4.2.1 Gender equality	SOC2	Female workers presence
S 2.2.1 Rights of Suppliers	SOC3	Suppliers, particularly primary producers, rights to freedom of association and collective bargaining are basic freedoms that form the necessary basis and prerequisite conditions for fair trading with buyers. This indicator refers to buyers treating the primary producers who supply them with farm products with respect, as well as other suppliers such as processors and other businesses.
S2.1.1 Fair pricing and transparent contracts	SOC4	For sustained trading relationships to exist, buyers must pay primary producers' prices for their products that reflect the real cost of the entire process of sustaining a regenerative ecological system. This includes supporting a decent livelihood for primary producers, their families and workers by providing living wages that cover producer's costs



S5.1.2 Safety of workplace operations and facilities	SOC5	This qualitative indicator measures whether the enterprise has been ensuring a safe, clean and healthy workplace for employees by determining if facilities and structures, equipment, practices, and food offered are safe and meet employee needs for healthy lifestyles.
G Good governance		
G2.3.1 Transparency	GOV1	Real transparency involves understanding the information needs of stakeholders and making accurate, timely and relevant information available in an accessible way.
G3.1.2 Stakeholder engagement	GOV2	The enterprise is able to effectively engage with stakeholders. Excellent performance in this indicator will be evidenced by engagement activities customized for stakeholder type, resulting in comprehensive and mutually satisfactory engagement which is sustained over time
G3.1.3 Engagement barriers	GOV3	The enterprise understands how asymmetries of power can prevent the engagement of vulnerable stakeholders. It has a commitment to identifying barriers to engagement for all stakeholder groups and working with those groups to overcome barriers. Barriers can include but are not limited to knowledge/information, financial, physical, geographic, cultural, religious, linguistic/communication and status barrier
G3.1.4 Effective participation	GOV4	Any enterprise which has genuinely engaged its stakeholders should be able to show the effect of this engagement on the enterprise's decisions and actions
G4.3.1 Civic responsibility	GOV5	This is achieved when all parts of the supply chain are free from exploitation of individuals, communities and the environment across all four dimensions of sustainability.

Once the indicators were defined, they were evaluated using the Delphi methodology, recognized for its ability to systematically gather informed judgments and foster the exchange of perspectives among experts. This technique is especially useful in contexts where objective information is limited and consensus building is required based on the experience and knowledge of key stakeholders (Turoff, 1970:149). In this case, a panel of experts was formed, comprising researchers, producers, wholesalers, industry representatives, retailers, and academics linked to the beekeeping sector in each case of study.

The Delphi process was carried out in several rounds, ensuring the anonymity of responses and providing feedback among participants to refine consensus. The indicators were evaluated using the Analytic Hierarchy Process (AHP) tool (Saaty, 2001), which allows for assigning differentiated weights to each indicator based on its perceived relevance. The AHP is a multi-criteria decision method based on simple pairwise comparisons, which makes it easier for the respondent to discern the preferences of the compared items (Kallas et al., 2011). The indicators weighting was essential, as not all indicators carry the same weight in determining sustainability, and their assessment depends on subjective criteria derived from the local context and the experts' experience (Goepel, 2013; Sipahi and Timor, 2010).



To facilitate the consistent implementation of this task across regions, CREDA designed a specific tool and provided all project partners with a detailed protocol (Annex 1), accompanied by an online training session. The effort done (on the **Delphi tool**, the protocol to guide for Delphi tool application and the webinar - see video "[Meeting Delphi Techoney \(2024-06-12 12 10 GMT+2\)](#)") ensured methodological consistency and comparability of the results obtained.

In summary, Task 1.4 has enabled significant progress in building a common framework for assessing sustainability in the honey supply chain. The combination of the SAFA approach with the Delphi methodology has provided a robust tool for identifying the most sustainable distribution channels, considering economic, social, environmental, and governance dimensions. The results obtained lay the groundwork for future actions aimed at strengthening the resilience and sustainability of the beekeeping sector, especially for the benefit of small producers.

2. METHODOLOGY

To evaluate the sustainability of distribution channels for small-scale agrifood producers, a multidimensional index was developed based on the SAFA framework (FAO, 2014), encompassing economic, social, environmental, and governance dimensions.

The assessment was conducted using a combination of the **Delphi method** and the **Analytic Hierarchy Process (AHP)**. The Delphi method, known for its iterative and anonymous nature, was chosen to gather and refine expert opinions, minimizing bias and promoting consensus. The AHP technique was applied to quantify the relative importance of sustainability indicators, using the *Super Decisions* software to process pairwise comparisons and generate weighted scores.

The methodological process consisted of the following steps:

1. **Identification of Sustainability Indicators** Based on the SAFA framework, a comprehensive list of indicators was compiled across four dimensions.
2. **Selection of Relevant Indicators.** Indicators were filtered according to their relevance to the agrifood distribution context, with input from preliminary expert consultations.
3. **Expert Panel Formation.** Experts were selected based on their experience in agrifood production, distribution, and sustainability research. The panel included producers, cooperative representatives, retailers, and academic researchers.



4. **First Round of Delphi Survey.** Experts evaluated the importance of each indicator. Their responses were analyzed using AHP to determine initial weightings.
5. **Feedback and Preliminary Results.** Experts received a summary of the initial findings, including aggregated indicator weights and distribution channel evaluations.
6. **Second Round of Delphi Survey.** Experts re-evaluated their responses in light of the preliminary results, allowing for refinement of opinions.
7. **Final Analysis and Results Generation.** AHP was applied again to the second-round data, and final indicator weights and sustainability assessments of distribution channels were produced.

Case-study leaders of Algeria, Luxembourg, Morocco, Spain, Tunisia and Turkey are responsible for the sustainability Indicators study coordination with the platform (HILE). They should contact and apply the Delphi tool in their respective country, according to the protocol shared with all case leaders' partners.



3. RESULTS

In the following section, expert opinions gathered through the Delphi methodology for each case study will be presented. First, the analysis of results from the initial round of the Delphi method will be discussed, followed by the evaluation of the second round. Lastly, each section will conclude with an assessment of the sustainability level of the respective distribution channels, offering a comprehensive perspective on their performance within the scope of the study.

3.1 SPAIN HONEY SUPPLY CHAIN

The case study conducted in Spain for the analysis of sustainability in the honey value chain was Integrated by a group of 4 experts (2 of them corresponded to farmers (beekeepers), one corresponded to a representant of a honey cooperative, and 1 retailer), and additionally 2 researchers from the CREDA research group.

3.2.1 FIRST ROUND

Results obtained in the first round after the Delphi tool application to identify the experts' opinions showed that the environment is the most important indicator on the honey value chain. Experts give it the highest evaluation (34.04%) in comparison with the other components of sustainability. The importance of the economic indicators was positioned in second place (27.64 %) and was followed by the social indicators with a similar value (27.15 %) collocating the governance indicator in the last place (11.18 %).

In the local level, the most important indicator, from each component of sustainability, corresponded to the “ECO3 - Stability of Supplier Relationships”, from the economic group with a level of importance of 29.15% from the total of this group. The environmental indicator with the highest importance was “ENV4- Water conservation Practices” with (35.33%) of the level of the importance. The social indicator considered most important was the “SOC5-Safety of Workplace, operations and facilities” (31.29%) and from group of governance indicators “GOV1-**Transparency**” were identified as the most important indicators on sustainability with a value of (36.45%). All these results can be observed in Figure 2.



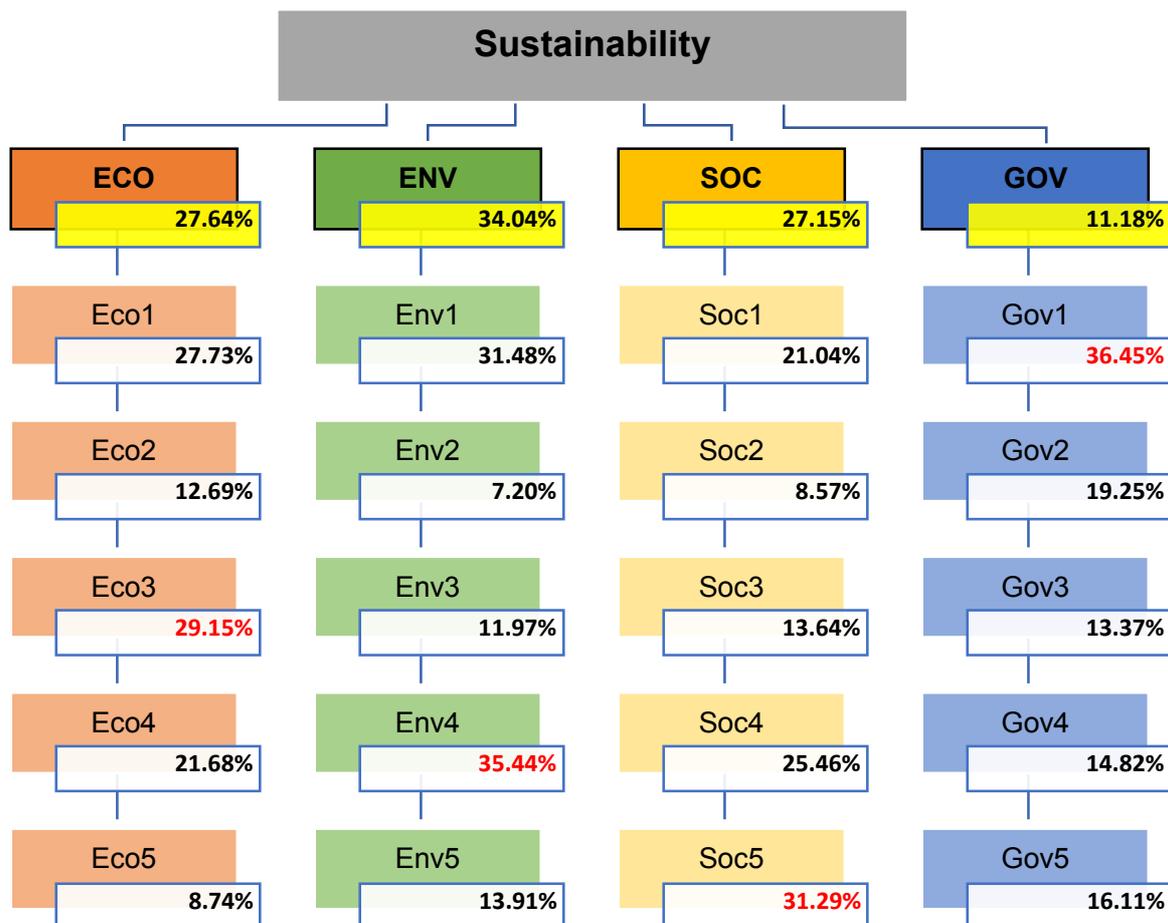


Figure 2. Spain Honey supply chain experts' ponderations of sustainability indicators

The **researchers'** evaluation positioned the environmental indicators group in first place, with more than half of the importance within the group (54%) as can be observed on Table 2. While the group of governance indicators was considered as the less important indicator within the honey value chain, with only 5% of importance.

Results from both **experts and researchers** generated a **general** point of view where the group of environment indicators were identified as the most important (44,84 %) for sustainability on the honey value chain (Table 3), the economic indicators group obtained (26.97%) of the importance, the social indicators group (20%) and finally the group of indicators related to the governance obtained only the (8.1%) of the importance.

The three most Important Indicators of sustainability in the honey value chain since global level were assigned to "ENV4- Water conservation practices", "ENV5- Food loss and waste reduction" and "ECO4- Local Procurement" with ponderations of (14,6%, 12.5% and 9.9% respectively).



The evaluation of the distribution channels according to the experts and researchers' point of view (Table 4) allowed us to identify that **Direct Sales (17.42%)**, **cooperatives (16.03%)** and **small retailers (14.27%)** are the three most Important distribution channels for a sustainable honey value chain.



RESULTS FIRST ROUND (SPAIN)

Table 2: Spanish researchers' ponderations

ECO		ENV					SOC					GOV							
26,31%		55,64%					13,02%					5,0%							
4,5%	11,5%	28,9%	51,7%	3,4%	3,7%	8,7%	16,1%	29,8%	41,6%	15,8%	10,3%	9,5%	8,5%	56,0%	55,0%	22,9%	7,4%	12,1%	2,7%
1,19%	3,02%	7,61%	13,60%	0,90%	2,08%	4,86%	8,96%	16,57%	23,16%	2,05%	1,34%	1,23%	1,10%	7,29%	2,76%	1,15%	0,37%	0,61%	0,13%

Table 3. Spanish general (experts and researchers) ponderations of sustainability indicators

ECO		ENV					SOC					GOV							
26,97%		44,84%					20,08%					8,1%							
16,1%	12,1%	29,0%	36,7%	6,1%	17,6%	8,0%	14,0%	32,6%	27,8%	18,4%	9,4%	11,6%	17,0%	43,6%	45,7%	21,1%	10,4%	13,4%	9,4%
ECO1	ECO2	ECO3	ECO4	ECO5	ENV1	ENV2	ENV3	ENV4	ENV5	SOC1	SOC2	SOC3	SOC4	SOC5	GOV1	GOV2	GOV3	GOV4	GOV5
4,3%	3,3%	7,8%	9,9%	1,6%	7,9%	3,6%	6,3%	14,6%	12,5%	3,7%	1,9%	2,3%	3,4%	8,8%	3,7%	1,7%	0,8%	1,1%	0,8%

Table 4. Spanish General Sustainability of Honey Distribution Channels

Aggregation	ECO	ENV	SOC	GOV	CHANNEL	
ALT1	Wholesaler	3.71%	4.24%	1.53%	0.69%	10,17%
ALT2	Direct Sales	4.19%	8.59%	2.96%	1.68%	17,42%
ALT3	e-commerce	2.36%	6.76%	2.31%	0.80%	12,23%
ALT4	Small retailer	3.27%	7.41%	2.38%	1.21%	14,27%
ALT5	Supermarkets	3.08%	3.97%	1.78%	0.63%	9,46%
ALT6	Industry	3.77%	3.85%	2.03%	0.60%	10,25%
ALT7	Restaurants	2.69%	4.33%	2.34%	0.83%	10,19%
ALT8	Cooperatives	3.91%	5.70%	4.76%	1.66%	16,03%



3.2.2 SECOND ROUND

After the second round, results in Spain according to **experts' opinions** reflected a small change (**Figure 3**) respect to the first round. The importance of the economic indicators group increased a little bit, reducing principally the importance of environmental and governance indicators. The global weights allowed see that "ENV4 - Water conservation Practices", "ENV1- Locally adapted varieties and breeds" and "SOC5 - Safety of workplace operations and facilities", rated with an importance of (11.51%, 10.25%, and 8.64% respectively) positioned in the three first places of importance compared to all other indicators analyzed. In this second round CREDA **researchers** maintained the values assigned to the indicators during the par comparison made for sustainable indicators evaluation with the Delphi tool.

The combined opinions from **experts and researchers** were used to generate the last results. These results maintained the same structure as in the first round but with a small variation. In the first place of importance for sustainability was allocated the environment indicators group with a weight of (44.35%), the group of economic indicators were ranked in the second place with (27.39%) of the importance. Social and governance indicators groups were positioned in third and fourth place with (20.3 %) and (7.9 %) of importance respectively (see Figure 4). From all the three most important Indicator were the same that in first round "ENV4- Water conservation practices", "ENV5- Food loss and waste reduction" and "ECO4- Local Procurement" with a really few variations in their ponderation regarding the first round. Results for the three mentioned indicators were (14.3%, 12.4% and 9.9 %) respectively.

On **distribution channels' analysis**, results shown in Figure 5, clearly highlight that Direct sales channel was considered the most important distribution channel for the sustainability of the honey value chain (17.39%). The Importance of this distribution channel was highly defined principally by the important effects of environmental indicators on it and in second place by the influence of the economic indicators' relevance. Cooperatives were also considered as one of the most important distribution channels with a rank of (16.04%). In the Spain case of study small retailers were positioned as the third distribution channel most important for a sustainable honey value chain. All these results allowed us to know that short value chains are more aligned with the sustainability of the honey sector.



RESULTS SECOND ROUND (SPAIN)

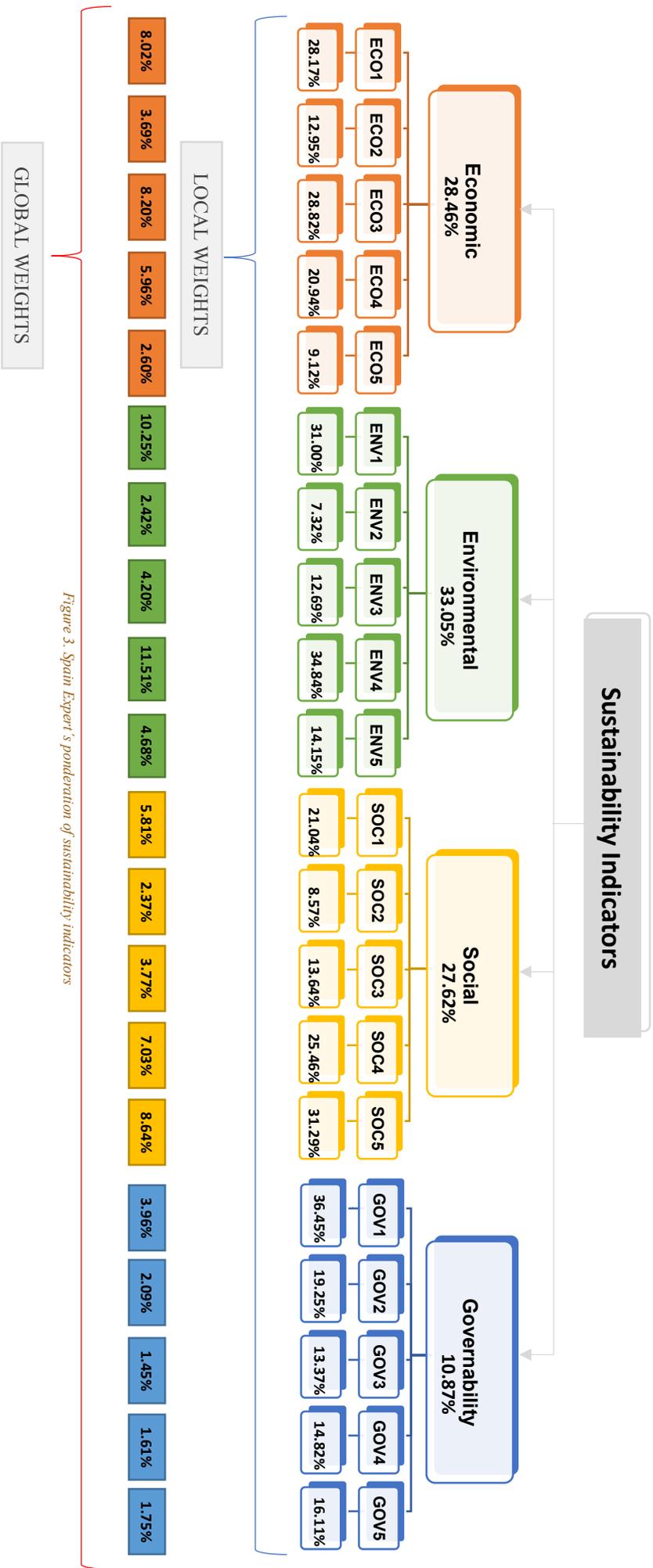


Figure 3. Spain Expert's ponderation of sustainability indicators



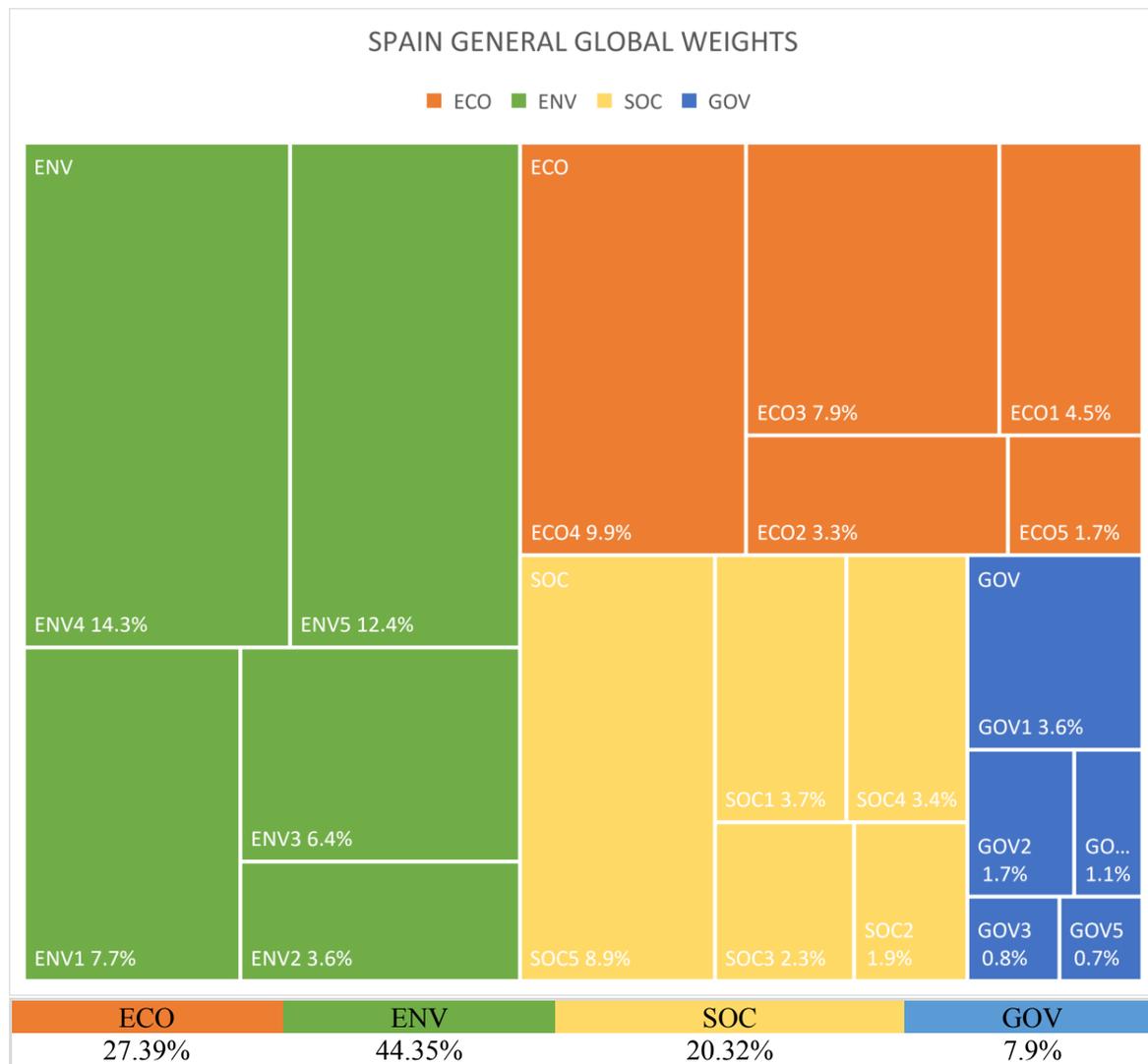


Figure 4. Final results about sustainability indicators from the general point of view

Table 5. Final Spain General perspective on Sustainability Honey Distribution Channels

Aggregation	ECO	ENV	SOC	GOV	CHANELTotal
ALT1 Wholesaler	3.77%	4.19%	1.54%	0.68%	10.18%
ALT2 Direct Sales	4.25%	8.50%	2.99%	1.65%	17.39%
ALT3 e commerce	2.40%	6.70%	2.33%	0.78%	12.22%
ALT4 Small retailer	3.31%	7.31%	2.41%	1.19%	14.22%
ALT5 Supermarkets	3.14%	3.93%	1.80%	0.61%	9.48%
ALT6 Industry	3.82%	3.81%	2.06%	0.59%	10.28%
ALT7 Restaurants	2.73%	4.28%	2.37%	0.81%	10.19%
ALT8 Cooperatives	3.97%	5.62%	4.81%	1.63%	16.04%



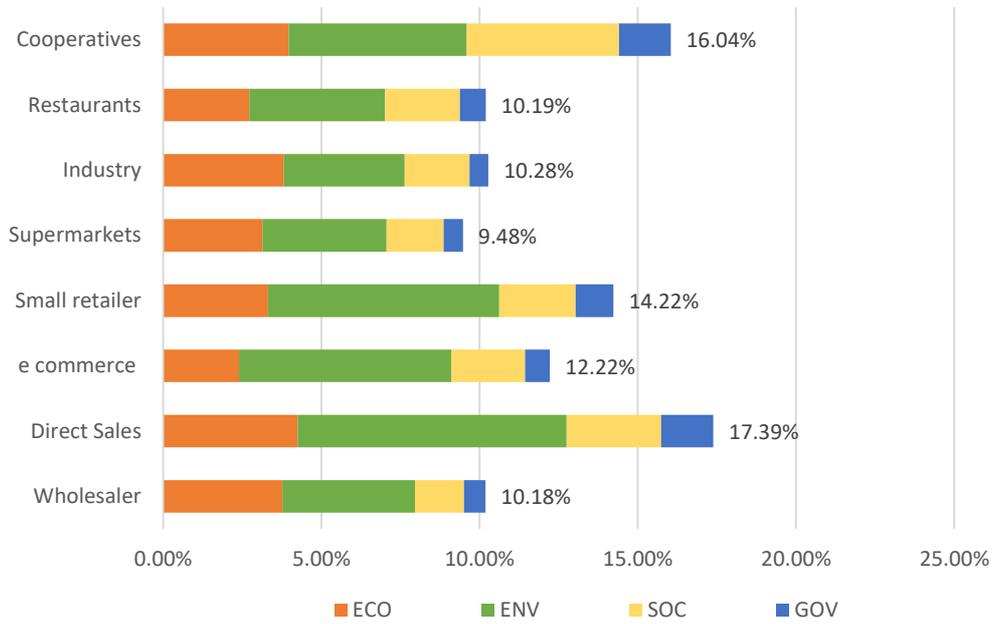


Figure 5. Sustainability of the Honey Distribution Channels (Spain general perspective)



3.2 TUNISIA HONEY SUPPLY CHAIN

The Tunisian panel consisted of nine experts in the field of honey value chain: two farmers (beekeepers), one representative of restaurants, hotels, and catering (HORECA), one wholesaler, two representatives of food processing industries, one distributor, and two researchers, including the INAT research group.

3.2.1 FIRST ROUND

According to the results obtained with the **experts’ opinions** in the DELPHI first round, the importance of the social and environmental indicators is highlighted whereas the importance of governance is noticeably low. **The local weighting** obtained, it is seen that from indicators: economic the “ECO3 - Stability of Supplier Relationships”, in environmental indicators “ENV1-Locally adapted varieties and breeds”, in the social indicators “SOC5-Safety of Workplace, operations and facilities” and from governance indicators group “GOV1-Transparency” were identified as the most important indicators on sustainability with values over 25% in each of these indicators (Figure 6).

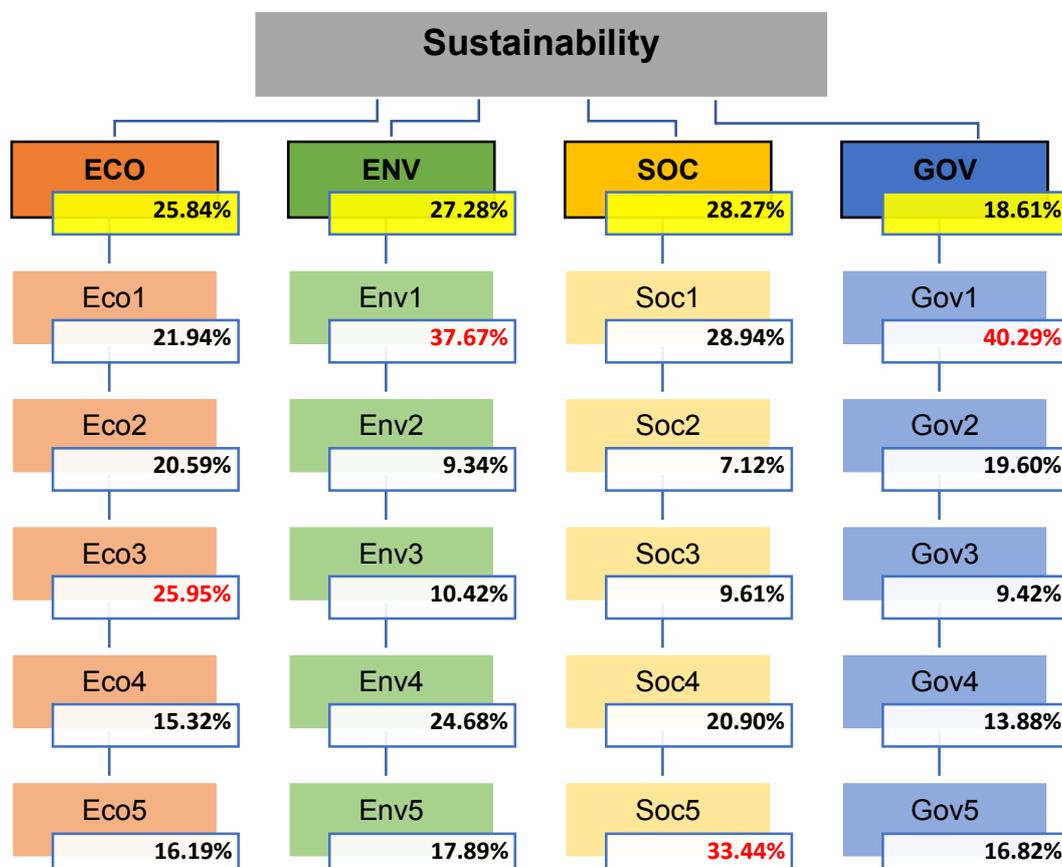


Figure 6: Tunisia Honey supply chain experts’ ponderations of sustainability indicators



The evaluation made by the **researchers** (Table 6) showed that economic indicators of sustainability were considered the most important with 63% of the weight. In this table also can be observed that researchers gave the governability indicator the fewest ponderation (3%).

Combined results to have a **general** point of view of **experts and researchers** (Table 7) maintained at local level the economic indicator with the highest ponderation (44,26%) and governance was again rated with the lowest ponderation (11%). At **global level** weighs of ECO1 "Cost of Production", ECO2 "Net income", and ENV3 "Energy consumption" corresponded to the 3 principal sustainability indicators with the highest ponderation assigned (14,7%, 10,7% and 8,4% respectively).

Finally, the analysis of the channels (Table 8) showed that the most important distribution channel is **Direct Sales**, followed by the distribution channel thought **cooperatives**.



RESULTS FIRST ROUND (TUNISIA)

Table 6. Tunisia researchers' ponderations

ECO		ENV					SOC					GOV							
63%		26%					8%					3%							
44.7%	27.7%	6.6%	2.9%	18.2%	18.8%	13.9%	52.9%	11.7%	2.7%	20.9%	3.0%	5.4%	41.8%	28.8%	35.2%	4.9%	4.8%	35.9%	19.2%
28.00%	17.36%	4.14%	1.79%	11.39%	4.80%	3.57%	13.53%	2.99%	0.69%	1.73%	0.25%	0.45%	3.46%	2.39%	1.22%	0.17%	0.17%	1.24%	0.67%

Table 7. Tunisia general (experts and researchers) ponderations of sustainability indicators

ECO					ENV					SOC					GOV				
44.26%					26.43%					18.27%					11.0%				
33.3%	24.1%	16.3%	9.1%	17.2%	28.2%	11.6%	31.7%	18.2%	10.3%	24.9%	5.0%	7.5%	31.4%	31.1%	37.8%	12.2%	7.1%	24.9%	18.0%
ECO1	ECO2	ECO3	ECO4	ECO5	ENV1	ENV2	ENV3	ENV4	ENV5	SOC1	SOC2	SOC3	SOC4	SOC5	GOV1	GOV2	GOV3	GOV4	GOV5
14.7%	10.7%	7.2%	4.0%	7.6%	7.5%	3.1%	8.4%	4.8%	2.7%	4.6%	0.9%	1.4%	5.7%	5.7%	4.2%	1.3%	0.8%	2.7%	2.0%

Table 8. Tunisia General Sustainability of Honey Distribution Channels

Aggregation	ECO	ENV	SOC	GOV	
ALTI1	Wholesaler	3.38%	2.78%	1.37%	0.86%
ALTI2	Direct Sales	10.89%	5.88%	2.39%	2.32%
ALTI3	e-commerce	5.06%	3.66%	2.45%	1.18%
ALTI4	Small retailer	4.60%	2.92%	1.98%	1.10%
ALTI5	Supermarkets	3.57%	1.96%	2.27%	1.02%
ALTI6	Industry	5.49%	2.33%	2.97%	0.92%
ALTI7	Restaurants	4.68%	2.76%	2.23%	1.03%
ALTI8	Cooperatives	6.59%	4.15%	2.61%	2.61%



3.2.2 SECOND ROUND

Results of the second round allowed to see that **Tunisian experts' opinions** changed (**Figure 7**), collocating the economic indicators in first place of importance (29.44%). The ENV1 indicator "Locally adapted varieties and breeds" obtained the first place of importance at local level. In the global level "ENV1-Locally adapted varieties and breeds" maintained the first place (11.18%), and it was followed by the "GOV1-Transparency" and the social indicator "SOC5-Safety of workplace operations and facilities" which got the (9.78%) and (9.18%) of the preference respectively. **Researchers** did not change their valuations.

The final results from **experts and researchers' point of view**, allocated the economic indicator of sustainability as the most important with a weight of 42% (see Figure 8). The ECO1 "Cost of Production", ECO2 "Net income", and ENV3 "Energy consumption" maintained the 3 principal places with the highest ponderation after the second round with a really few variations respect the first round (14.3%, 10.8% and 8.6% respectively). The indicators of governance were identified as the less sustainable in the honey value chain.

Regarding the analysis of the **distribution channels**, Figure 9 allowed clear observe that Direct sales corresponded to the most important distribution channel (21.44%), with the highest economic and environmental influence from the experts and researchers' points of view. The second distribution channel was assigned to the cooperatives (16.1%). These results highlight the importance given to the short supply chain in the Tunisian honey sector.



RESULTS SECOND ROUND (TUNISIA)

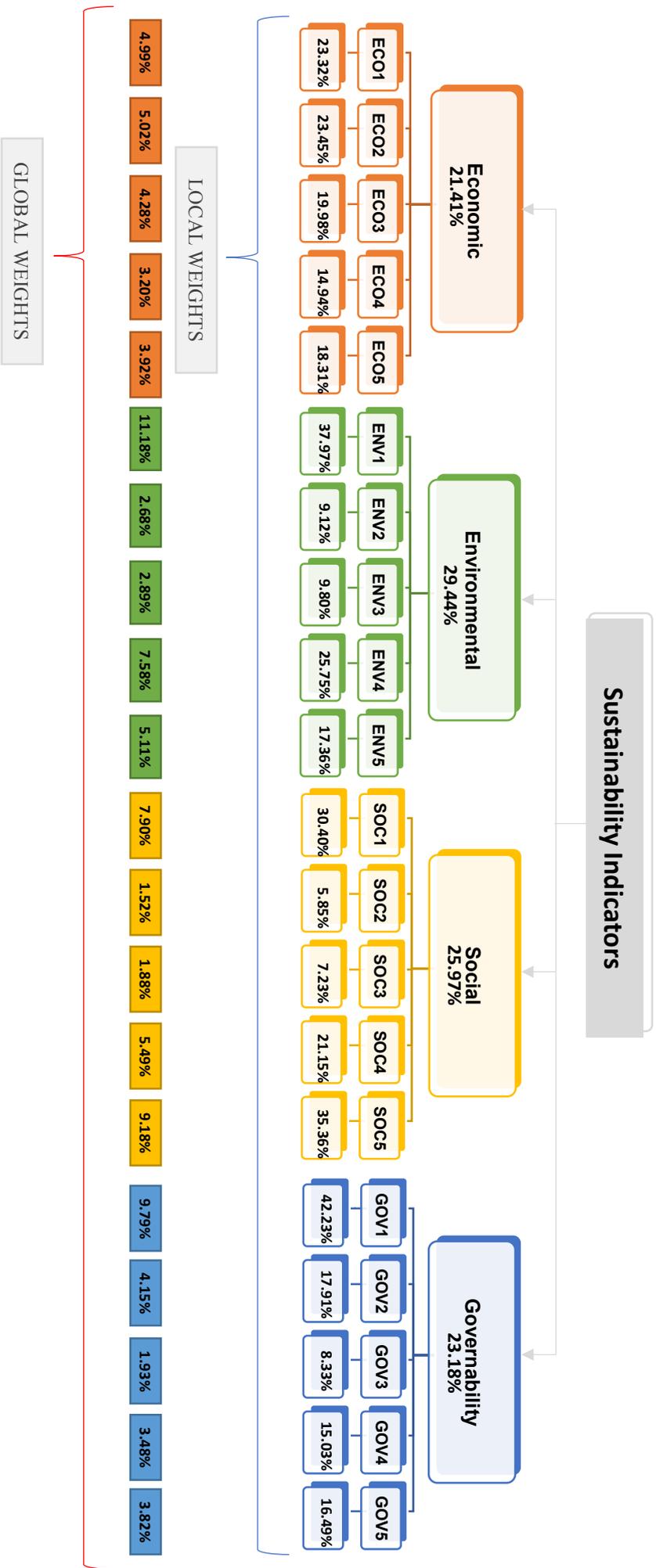


Figure 7: Tunisia Expert's ponderation of sustainability indicators



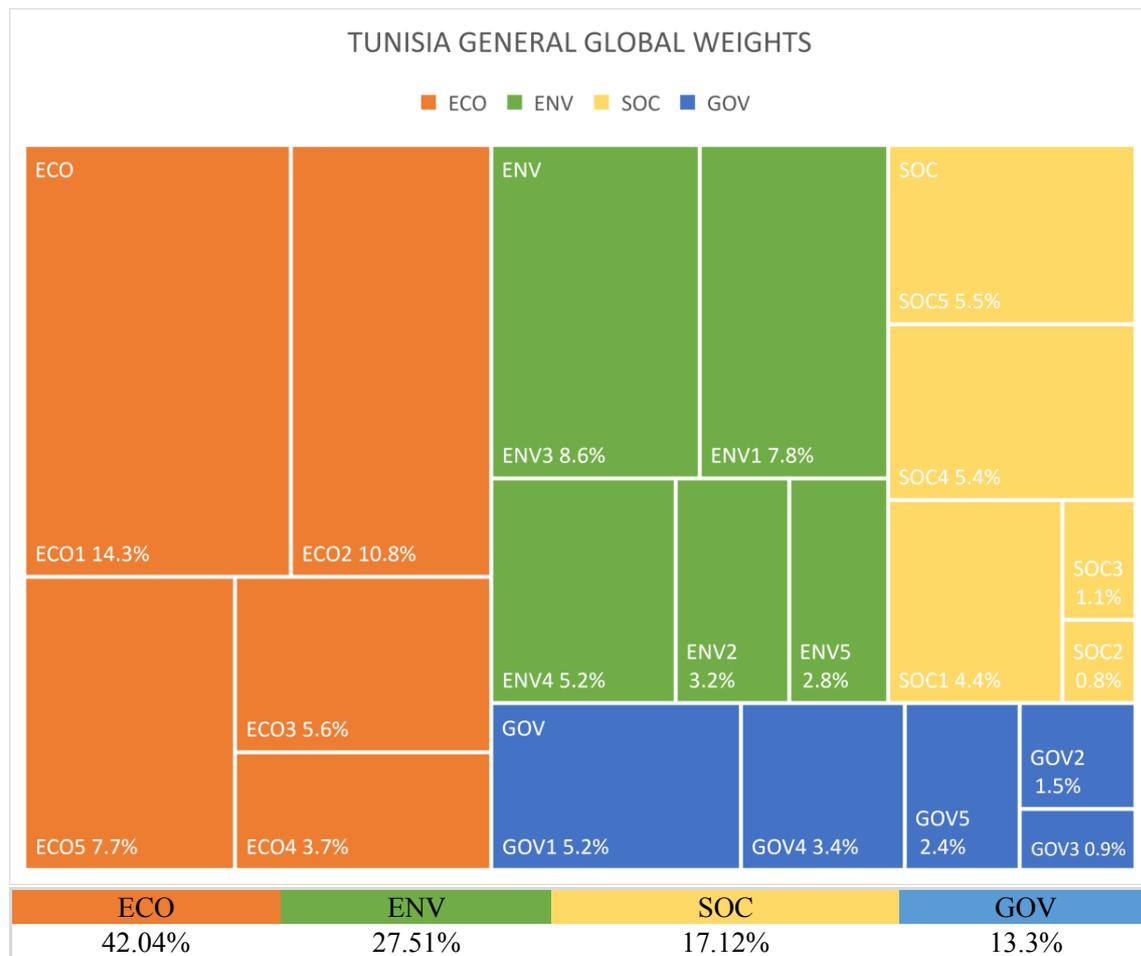


Figure 8. Final results about sustainability indicators from the general point of view

Table 9. Final Tunisia General perspective on Sustainability Honey Distribution Channels

Aggregation		ECO	ENV	SOC	GOV	CHANELTotal
ALT1	Wholesaler	3.20%	2.95%	1.27%	1.04%	8.46%
ALT2	Direct Sales	10.34%	6.09%	2.22%	2.79%	21.44%
ALT3	e commerce	4.83%	3.81%	2.33%	1.44%	12.41%
ALT4	Small retailer	4.42%	3.03%	1.86%	1.32%	10.62%
ALT5	Supermarkets	3.41%	2.03%	2.14%	1.23%	8.82%
ALT6	Industry	5.17%	2.42%	2.81%	1.11%	11.51%
ALT7	Restaurants	4.45%	2.87%	2.08%	1.23%	10.64%
ALT8	Cooperatives	6.21%	4.31%	2.42%	3.15%	16.10%



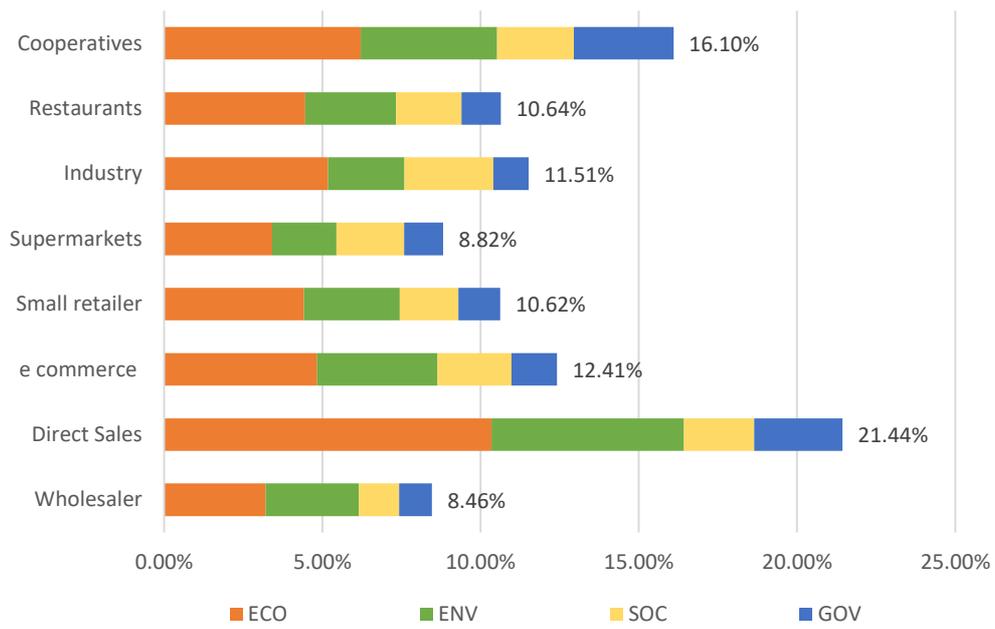


Figure 9: Sustainability of the Honey Distribution Channels (General perspective)



3.3 TURKEY HONEY SUPPLY CHAIN

3.3.1 FIRST ROUND

The initial round of the DELPHI analysis, based on the assessments of **experts from Turkey**, revealed a greater prioritization of environmental indicators (46.58%), whereas social indicators were considered the least relevant (14.77%).

At the local level, the indicators ranked with the highest significance within their respective categories were: “ECO4 – Local Procurement” (30.97%), “ENV1 – Locally adapted varieties and breeds” (38.17%), “SOC1 – Employment Relations” (28.10%), and “GOV1 – Transparency” (34.11%), as it is illustrated in Figure 10.

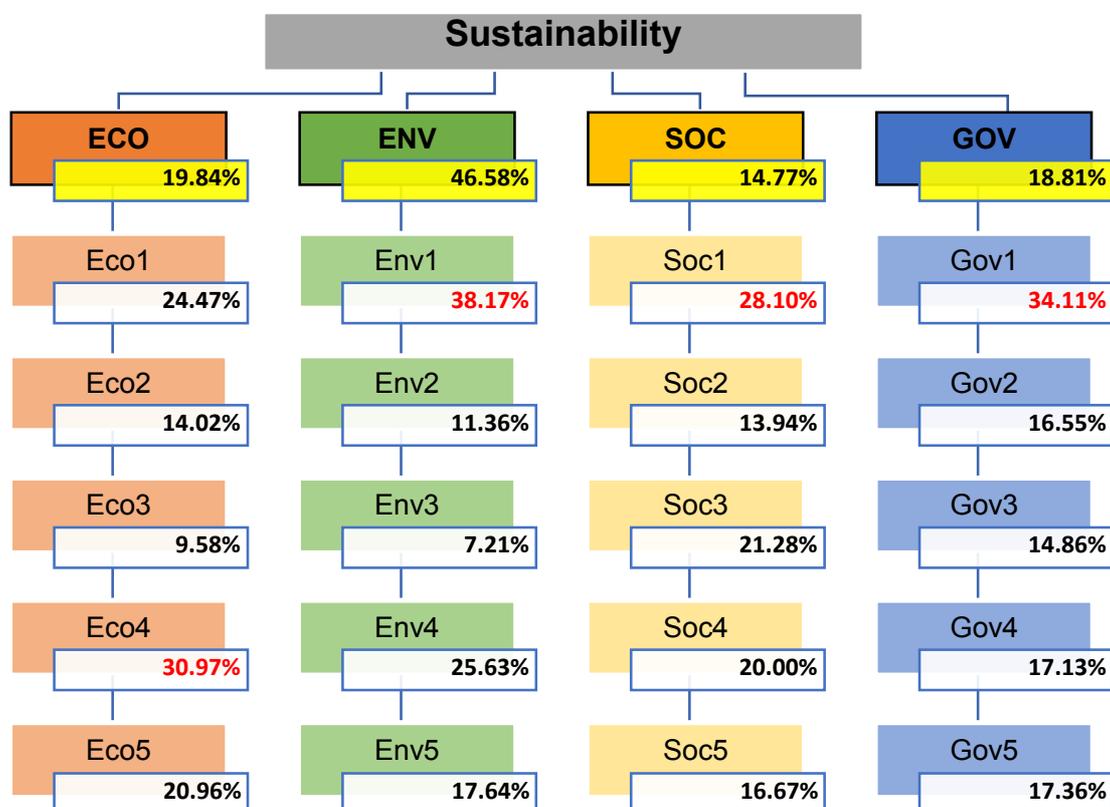


Figure 10: Turkey Honey supply chain experts' ponderations of sustainability indicators

In parallel, the evaluation conducted with **researchers** (Table 10) indicated a predominant emphasis on economic sustainability indicators (62%), followed by social indicators (21%). Governance indicators were assigned with the lowest relevance according to this group's appraisal with only a (7%) of the importance assigned.



The aggregated analysis that considered both stakeholder groups “**experts and researchers**” (Table 11) corroborated the prominence of economic indicators, particularly highlighting as the most important indicator for sustainability the “ECO5 – Price Determination”, defined as the mark-up amplitude, i.e., the differential between the selling price and the unit cost of production.

Lastly, consensus of **experts and researchers’** opinions identified Cooperatives as the principal distribution channel, followed by Direct sales, as detailed in Table 12 according to the total percentage accumulated by each distribution channel.



RESULTS FIRST ROUND (TURKEY)

Table 10. Turkey researchers ponderations

ECO		ENV					SOC					GOV							
62%		9%					21%					7%							
4,0%	35,7%	23,7%	7,0%	29,7%	53,9%	27,8%	4,3%	3,6%	10,4%	7,3%	5,7%	41,8%	28,2%	17,0%	44,7%	8,1%	3,5%	8,6%	35,1%
2,46%	22,19%	14,73%	4,33%	18,48%	4,91%	2,53%	0,39%	0,33%	0,95%	1,55%	1,22%	8,92%	6,02%	3,62%	3,29%	0,60%	0,26%	0,63%	2,58%

Table 11. Turkey general sustainability indicators ponderations (experts and researchers)

ECO		ENV					SOC					GOV							
41,02%		27,85%					18,05%					13,1%							
14,2%	24,9%	16,6%	19,0%	25,3%	46,0%	19,6%	5,8%	14,6%	14,0%	17,7%	9,8%	31,6%	24,1%	16,8%	39,4%	12,3%	9,2%	12,9%	26,2%
5,8%	10,2%	6,8%	7,8%	10,4%	12,8%	5,4%	1,6%	4,1%	3,9%	3,2%	1,8%	5,7%	4,4%	3,0%	5,2%	1,6%	1,2%	1,7%	3,4%

Table 12. Turkey General Sustainability Honey Distribution Channels

Aggregation	ECO	ENV	SOC	GOV	Channel	
ALTI1	Wholesaler	3,66%	2,64%	1,51%	1,21%	9,01%
ALTI2	Direct Sales	6,43%	4,43%	2,59%	1,81%	15,27%
ALTI3	e commerce	5,93%	4,08%	2,41%	2,12%	14,53%
ALTI4	Small retailer	5,09%	3,14%	2,04%	1,53%	11,81%
ALTI5	Supermarkets	4,22%	3,13%	1,84%	1,40%	10,59%
ALTI6	Industry	4,13%	3,15%	2,03%	1,30%	10,62%
ALTI7	Restaurants	4,33%	2,93%	1,86%	1,30%	10,42%
ALTI8	Cooperatives	7,23%	4,36%	3,76%	2,40%	17,75%



3.2.2 SECOND ROUND

After the second round, the Turkey **expert** maintained their opinions as can be observed on **Figure 11**. Experts reinforced the in first place the environmental indicators, followed by the economic, the governance and finally the social indicators (46.58%, 19.84%, 18.81%, and 14.77% respectively). Comparing all indicators about sustainability at **global level**, we can observe that environmental indicators “ENV1 – Locally adapted varieties and breeds”, “ENV4 - Water conservation Practices”, and “ENV5- Food loss and waste reduction” obtained the highest weigh (17.78%, 11.94%, and 8.11%). In the Turkey case of study, **researchers** also maintained their indicators valuations without any change.

Final results from **experts and researchers’ point of view**, passionate the economic indicators of sustainability as the most important, accumulating in total 41% of the preference (see Figure 12). The group of environmental, social and governance indicators obtained a relevance of (27.85 %, 18.05 % and 13.1 %) respectively.

At the global level, it is important to remark that, although the group of indicators related to the environment obtained the second place of importance by group (27.85%), the environmental indicator "ENV1- Locally adapted varieties and breeds" obtained the highest ponderation (12.8%). The "ECO1 - Cost of Production" (10.4%), and "ECO2 - Net income" (10.2%), two economic indicators were positioned in the second and the third position of importance respectively. And indicators of governance were identified as the least sustainable in the honey value chain.

The analysis of the **distribution channels** allowed us to clearly observe that Cooperative were identified as the most important distribution channel (17.75%) (Figure 13). In this distribution channel, the importance given to the economic indicators had the highest influence (7.23%) followed by the environmental indicators’ influence (4.36%). The second distribution channel was assigned to the Direct sales (15.27%) and the economic and environmental indicators importance where the principal component (with 6.43% and 4.43% respectively).



RESULTS SECOND ROUND (TURKEY)

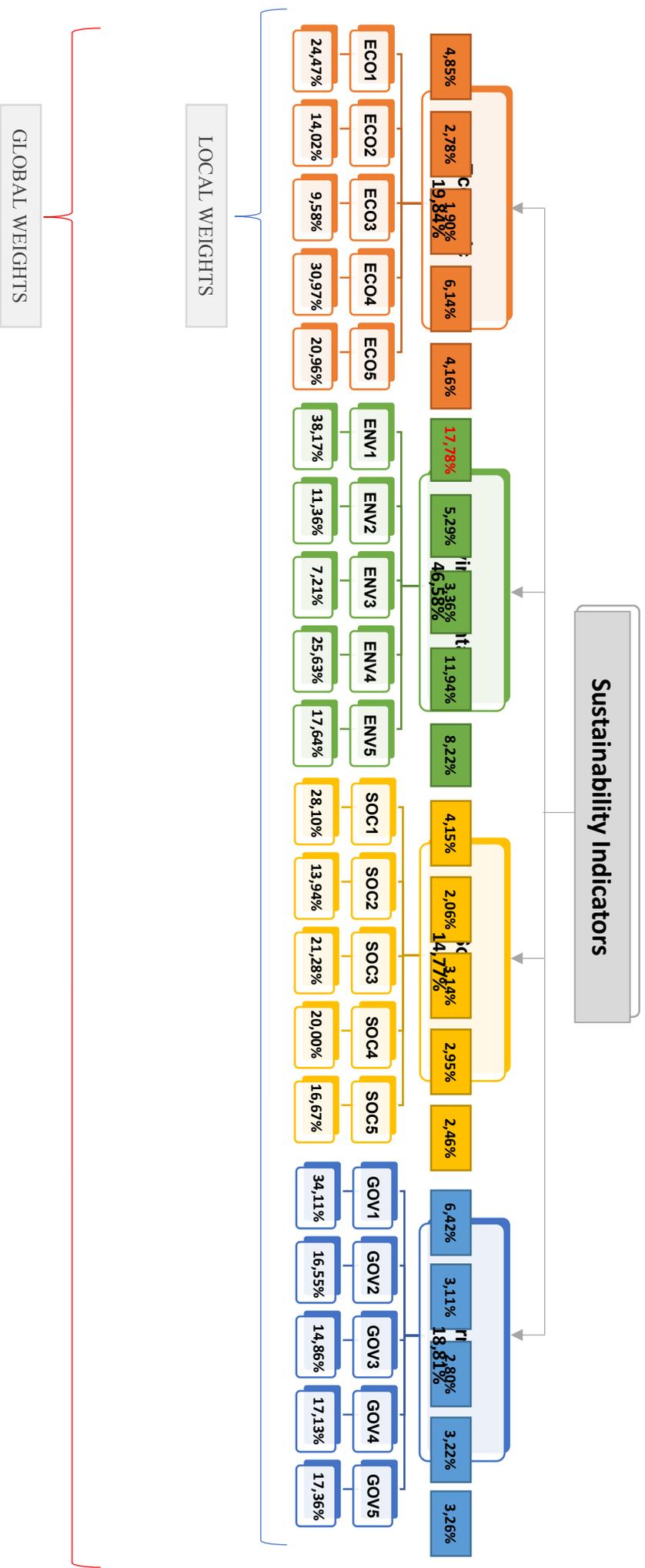


Figure 11: Turkey Expert's ponderation of sustainability indicators



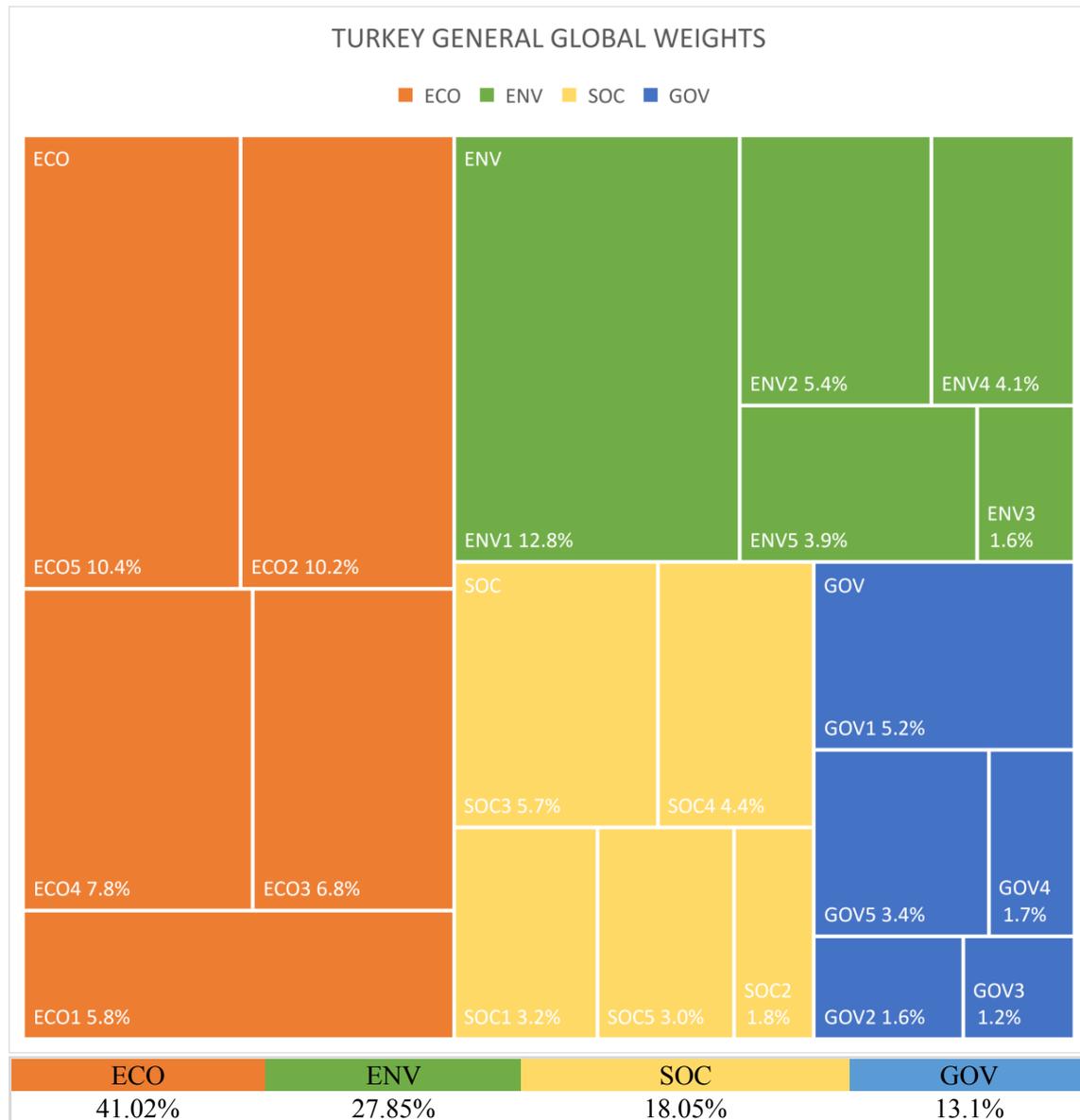


Figure 12: Results about sustainability indicators since the general point of view

Table 13. Final Turkey General perspective on Sustainability Honey Distribution Channels

Aggregation		ECO	ENV	SOC	GOV	CHANELTotal
ALT1	Wholesaler	3.66%	2.64%	1.51%	1.21%	9.01%
ALT2	Direct Sales	6.43%	4.43%	2.59%	1.81%	15.27%
ALT3	e commerce	5.93%	4.08%	2.41%	2.12%	14.53%
ALT4	Small retailer	5.09%	3.14%	2.04%	1.53%	11.81%
ALT5	Supermarkets	4.22%	3.13%	1.84%	1.40%	10.59%
ALT6	Industry	4.13%	3.15%	2.03%	1.30%	10.62%
ALT7	Restaurants	4.33%	2.93%	1.86%	1.30%	10.42%
ALT8	Cooperatives	7.23%	4.36%	3.76%	2.40%	17.75%



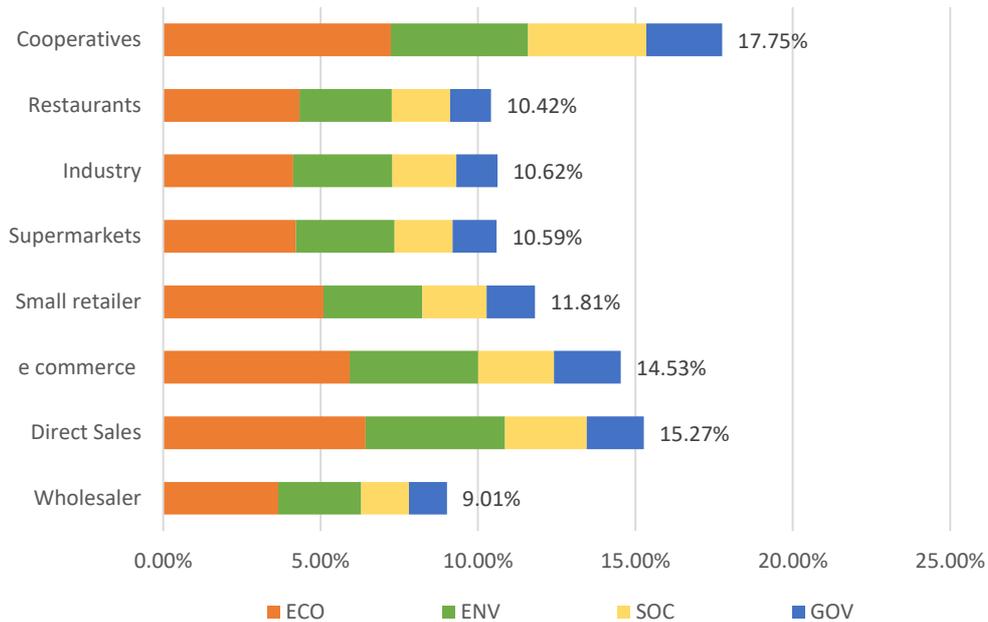


Figure 13: Sustainability of the Honey Distribution Channels (General perspective)

3.4 LUXEMBURG HONEY SUPPLY CHAIN

Info: The sustainability analysis in the Luxembourg Honey value Chain was not conducted. The Luxembourg partners did not submit information (data that should have been obtained using the Delphi tool in the first and second rounds).

3.5 MOROCCO HONEY SUPPLY CHAIN

Info: The sustainability analysis for the Morocco Honey Value Chain is not submitted. Although only partner ENAM attending meetings related to this task, the second Moroccan partner did not respond to any communications or attend meetings regarding Task 1.4. As a result, the sustainability analysis for the Morocco Honey Value Chain is not submitted.

3.6 ALGERIA HONEY SUPPLY CHAIN

Info: The sustainability analysis in the Algeria Honey value Chain was not conducted. The Algeria partners did not submit information (data that should have been obtained using the Delphi tool in the first and second rounds).



CONCLUSIONS

The comparative analysis of the honey supply chains in Spain, Tunisia, and Turkey reveals significant insights into the sustainability of distribution channels for small-scale agrifood producers. By applying a multidimensional framework based on the SAFA methodology and combining expert consensus through the Delphi method with quantitative weighting via AHP, the study provides a robust evaluation of sustainability across economic, environmental, social, and governance dimensions.

Across all three countries, **short supply chains**—particularly **direct sales and cooperatives** emerged as the most sustainable distribution channels. These channels consistently received the highest scores due to their alignment with key sustainability indicators, especially those related to environmental and economic performance. This finding underscores the relevance of localized and community-based distribution models in promoting sustainable practices within the honey sector.

KEY FINDINGS:

- **Spain:** Environmental indicators were prioritized by both experts and researchers, with "Water Conservation Practices" (ENV4) being the most valued. Direct sales, cooperatives, and small retailers were identified as the most sustainable channels, highlighting the importance of short value chains in the Spanish context.
- **Tunisia:** The first round emphasized social and environmental indicators, but in the second round, economic indicators gained prominence. "Cost of Production" (ECO1), "Net Income" (ECO2), and "Energy Consumption" (ENV3) were the top indicators. Direct sales and cooperatives were again the preferred channels, reinforcing the role of economic viability in sustainability perceptions.
- **Turkey:** Environmental indicators dominated expert evaluations, particularly "Locally Adapted Varieties and Breeds" (ENV1). However, researchers emphasized economic indicators, with "Price Determination" (ECO5) being the most critical. Cooperatives were the most sustainable channel, followed by direct sales, with economic and environmental factors driving their relevance.



CROSS-COUNTRY INSIGHTS:

1. **Environmental Sustainability:** Indicators such as water conservation, biodiversity, and energy efficiency were consistently rated highly, especially in Spain and Turkey. This reflects growing awareness of ecological challenges and the role of sustainable practices in mitigating them.
2. **Economic Viability:** Tunisia and Turkey placed strong emphasis on economic indicators, suggesting that financial sustainability remains a core concern for producers and stakeholders in these regions.
3. **Governance Indicators:** Across all three countries, governance indicators were consistently rated as the least important. This may indicate a lack of institutional trust or limited perceived impact of governance mechanisms on day-to-day operations in the honey value chain.
4. **Social Indicators:** While not dominant, social indicators such as workplace safety and employment relations were recognized as relevant, particularly in Tunisia.
5. **Distribution Channels:** The preference for **direct sales and cooperatives** across all cases suggests that **short supply chains** are more compatible with sustainability goals. These channels offer better control over production practices, closer relationships with consumers, and reduced environmental impact due to minimized transportation and intermediaries.

The cross-country analysis (Figure 14) allows us to see that Spain stands out for its strong focus on environmental issues. Tunisia and Turkey prioritize economic issues, reflecting concerns about financial viability. Governance is the lowest-rated area in all countries, which could indicate a low perception of its direct impact on the honey value chain.

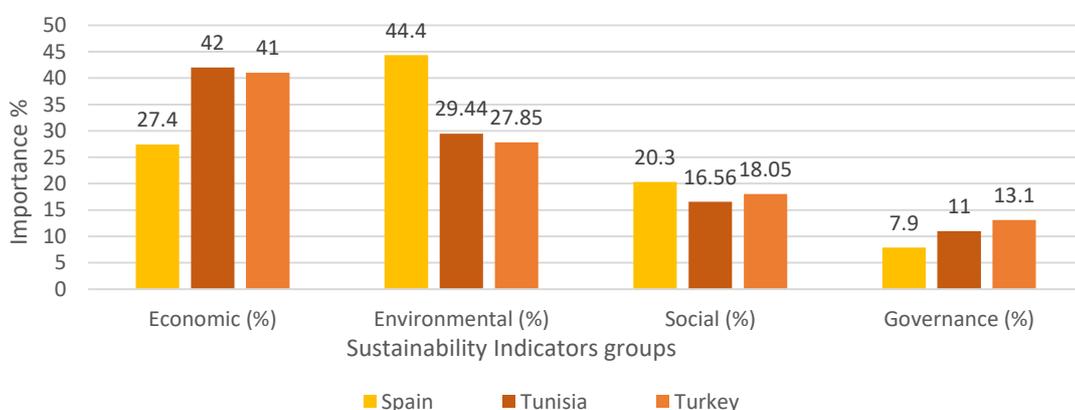


Figure 14. Importance of Country Sustainability Indicator Groups, experts and researchers' perspective.



The importance of the most sustainable distribution channels, according to the perspective of experts and researchers in each country analyzed, can be clearly seen in the next graph (Figure 15). It shows that direct sales are the most valued channel in Spain and Tunisia. Cooperatives lead in Turkey and are also relevant in the other countries. Small retailers only stand out in the Spanish case.

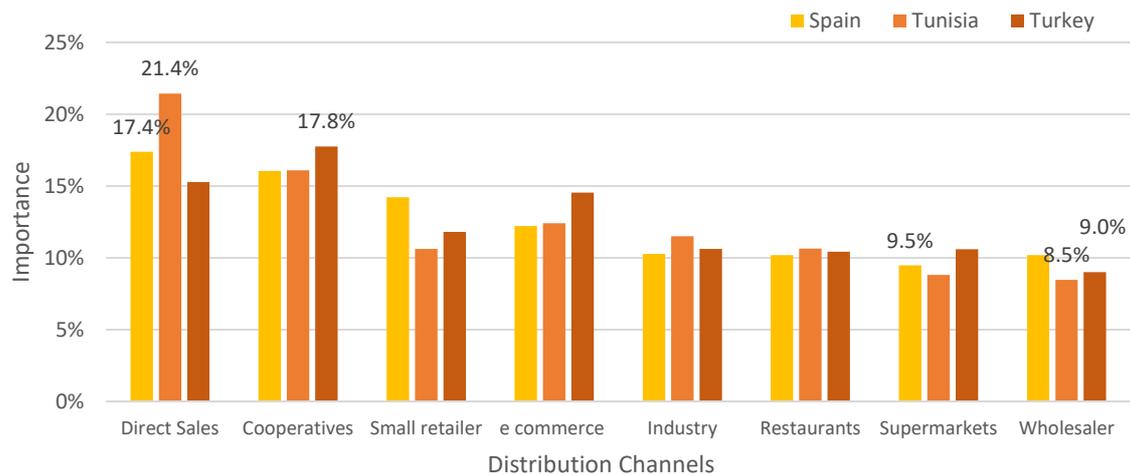


Figure 15. Importance of Distribution Channels, experts and researchers' perspective.

FINAL REFLECTION:

The study highlights the importance of **contextualizing sustainability assessments** within local realities. While certain indicators are universally valued, their relative importance varies depending on economic structures, cultural norms, and institutional frameworks. The use of participatory methods such as Delphi ensures that the evaluation reflects stakeholder perspectives, while AHP provides a rigorous quantitative foundation.

Moving forward, policy interventions and support mechanisms should focus on strengthening short supply chains, enhancing environmental practices, and improving economic resilience for small-scale producers. Additionally, efforts to improve governance structures and transparency could help elevate the role of governance indicators in future sustainability assessments.



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ANNEX 1

DELPHI PROTOCOL - SAFA INDICATORS -AHP

1. INTRODUCTION

To determine the most optimal and sustainable distribution channels for agri-food smallholders requires a common framework for defining and evaluating the mentioned "sustainability".

In terms of sustainability, this framework focuses on a list of indicators that allow a homogeneous, comparable, robust and synthetic analysis. To this end, **WPI** is committed to developing a multidimensional framework by setting an **impact index** to assess the economic, social and environmental impact of the selected supply chains. Our approach is an adaptation of the **SAFA indicators** (Sustainability Assessment for Food and Agriculture systems) proposed by FAO (2014) –a list of 118 indicators classified into 4 dimensions (Economic Resilience, Social Well-being, Good Governance and Environmental Integrity).

However, indicators may not all be equally important in determining sustainability and –therefore, different weights may be attributed. This weighting is based on subjective criteria, as there is no correct or scientific way of calculating it.

Where available, databases providing existing social, economic and environmental information will be employed to derive key indicators. For this reason, we resort to a methodology that gathers the opinions of different informants to develop a coherent and consensus-based index –**the Delphi method**.

The **Delphi method** is an appropriate method where there is a lack of authoritative objective information, and instead, the opinions of experts are sought. This method is described as a “systematic solicitation and collation of informed judgments on a particular topic” which encourages the sharing and investigation of various points of view (Turoff, 1970:149). Thus, we rely on the opinion of experts in agri-food systems, local-regional value chains and existing supply channels to build our panel of indicators. As experts may express different opinions, –due to different backgrounds, experience and preferences–, the proposed indicator weights may also differ.

Four key features in Delphi approach (Woudenberg, 1991):

- Respondents are experts in relation to the field of investigation.
- The responses are anonymous.
- Data collection is iterative (series of rounds).
- The feedback of other experts' responses is provided to participants.



Anonymity is Delphi's crucial feature –it gives each participant an equal chance to present their ideas with no bias due to the identity of other participants (Linstone and Turoff, 1975). Whereas the main assumption of the Delphi technique is that “group opinion is more valid than individual opinion” (Snape et al., 2014), its particularity lies in the mediated discussion to avoid bias. Even so, we must bear in mind that it has its limitations. Turoff (1970) lists these potential dangers:

- 1) Content validity depends on the quality of participants.
- 2) There may exist a content bias if the respondents are committed to a particular interest in the policy topic.
- 3) The wording may favour a particular viewpoint –therefore the study may be biased.

The objective of this task is to identify candidate indicators for use in sustainability evaluation of value chains. Thus, the information we should retrieve from the experts is the scoring of the perceived usefulness of a variety of economic, environmental, and social indicators for assessing sustainability. To this end, the role of experts and the Delphi procedure will be defined in the protocol below.

2. STEPS TO CONDUCT THE DELPHTHI STUDY

2.1 PARTICIPANTS DEFINITION

The Delphi technique seeks to use expert opinion for developing understanding and problem solving within a particular field. However, it is necessary to provide a definition of the experts and arrange the selection criteria. In order to avoid this bias, the selection of experts and proposed indicators have to be properly justified.

First: **who are the experts?** Anyone academically or professionally involved in the issue at hand and whose reasoned and independent judgment in the field is acknowledged. Thus, the Delphi sampling is purposeful, not random –it is based on the experience and merits of the candidates.

As a suggestion for the selection of potential candidates, we propose to assess the following information:

- Profession of the respondents.
- Knowledge and experience of the key areas.
- Professional and personal ties to the issue.

In Techoney project, respondents should be at least one EXPERT of each level of the **honey value chain**

- 1) Beekeepers (Producers)
- 2) Wholesalers
- 3) Industry
- 4) Retailers
- 5) Academy



2.2 INDICATORS SELECTION

The indicators to be evaluated with in the Living labs are in (TABLE 1). The identification of the main sustainability indicators applicable to apiculture sector for the evaluation of the honey supply chain, was on the basis of indicators on Sustainability Assessment on Food and Agriculture Systems for sustainable development (SAFA indicators), they consider the Economic, Environmental, Social and Governance dimensions.

Table 1: Selected Indicators

Indicators		Description
C Economic resilience		
C 1.4.2 Cost of Production	ECO1	Economic or accounting indicator that refers to the costs related to the distribution channel: Energy, water, labor costs, packaging.
C 1.4.1 Net income	ECO2	Total revenue earned in the last five years associated with production
C2.2.2 Stability of supplier relationships	ECO3	This indicator measures the share of supplier contracts/business relationship that has remained ongoing over the last 5 years, or since the enterprise is in business for a period of less than five years.
C4.2.1 Local Procurement	ECO4	This indicator measures whether the enterprise has purchased its inputs/ingredients/products from local suppliers when equal or similar conditions exist, in comparison to non-local suppliers.
C 1.4.3 Price determination	ECO5	The amplitude of the mark-up (i.e. the difference between the selling price and the cost per unit of production)
E Environmental Integrity		
E4.3.3 Locally adapted varieties and breeds	ENV1	Determine what the share of production (by area, animal number of live weight) is accounted for by: locally adapted plant varieties or animal breeds; rare; and traditional (heirloom) crop varieties and livestock breeds.
E5.1.4 Intensity of material use	ENV2	The replacement of virgin non-renewable materials by recycled and renewable materials and the reduction of the material intensity of production (i.e. increased eco-efficiency) are two central pillars of a green economy.
E5.2.3 Energy consumption	ENV3	This indicator measures how has the enterprise' direct energy consumption per unit of produce changed during the past five years.
E2.1.2 Water conservation Practices	ENV4	Practices that aim at saving water in agriculture chains
E5.3.4 Food loss and waste reduction	ENV5	The topic of this indicator relates to food losses that occur during production, post-harvest and processing operations, as well as food waste that occurs at different distribution channels
S Social Well-being		
S3.1.1 Employment relations	SOC1	Well-paid employment, working conditions
S4.2.1 Gender equality	SOC2	Female workers presence



S 2.2.1 Rights of Suppliers	SOC3	Suppliers, particularly primary producers, rights to freedom of association and collective bargaining are basic freedoms that form the necessary basis and prerequisite conditions for fair trading with buyers. This indicator refers to buyers treating the primary producers who supply them with farm products with respect, as well as other suppliers such as processors and other businesses.
S2.1.1 Fair pricing and transparent contracts	SOC4	For sustained trading relationships to exist, buyers must pay primary producers' prices for their products that reflect the real cost of the entire process of sustaining a regenerative ecological system. This includes supporting a decent livelihood for primary producers, their families and workers by providing living wages that cover producer's costs
S5.1.2 Safety of workplace operations and facilities	SOC5	This qualitative indicator measures whether the enterprise has been ensuring a safe, clean and healthy workplace for employees by determining if facilities and structures, equipment, practices, and food offered are safe and meet employee needs for healthy lifestyles.
G Good governance		
G2.3.1 Transparency	GOV1	Real transparency involves understanding the information needs of stakeholders and making accurate, timely and relevant information available in an accessible way.
G3.1.2 Stakeholder engagement	GOV2	The enterprise is able to effectively engage with stakeholders. Excellent performance in this indicator will be evidenced by engagement activities customized for stakeholder type, resulting in comprehensive and mutually satisfactory engagement which is sustained over time
G3.1.3 Engagement barriers	GOV3	The enterprise understands how asymmetries of power can prevent the engagement of vulnerable stakeholders. It has a commitment to identifying barriers to engagement for all stakeholder groups and working with those groups to overcome barriers. Barriers can include but are not limited to knowledge/information, financial, physical, geographic, cultural, religious, linguistic/communication and status barrier
G3.1.4 Effective participation	GOV4	Any enterprise which has genuinely engaged its stakeholders should be able to show the effect of this engagement on the enterprise's decisions and actions
G4.3.1 Civic responsibility	GOV5	This is achieved when all parts of the supply chain are free from exploitation of individuals, communities and the environment across all four dimensions of sustainability.

2.3 ITERATIVE SURVEY

The Delphi method is structured in a sequence of questionnaires by rounds. This method is based on an **iterative survey technique**:

- 1) **First round**: participants are initially asked to complete a questionnaire, the results of which are collated by the research team.



- 2) **Second round:** the participants are provided with the feedback of First round, based on the aggregated survey results. Then, participants are invited to amend their First-round answers in light of the feedback received concerning the opinions of other participants.
- 3) **Further rounds** of questionnaires and feedback may follow until a group opinion emerges, though not necessarily consensual.

Previously to start the rounds of questionnaires application, an Introduction of the project, the objectives, what about is the study and what we need from them, have to be explained to the experts to increase their interest and intention to participate on this activity. The introductory explanation could be as in the next example:

"The TECHONEY project

TECHONEY is a Research and Development project for the Mediterranean area that aims to identify strategies and establish lines of resilience for beekeepers and the honey-food supply chain on a local as well as international level for the Mediterranean countries. The project is based on analyzing the implementation of tools that allow controlling the authentication and traceability of honey, as well as the detection of its adulteration.

The main objectives of TECHONEY are:

- SO1: **Map the current added-value chains** and complexity level for honey products in five case studies (Spain, Algeria, Tunisia, Turkey, Luxembourg and Morocco).*
- SO2: Increase the competitiveness and power of the beekeeping supply chain by understanding consumers' and retailers' opinions and acceptance through non-hypothetical methods.*
- SO3: To promote the traceability to differentiate local honey and guarantee the food safety of honey produced in the Med area by characterizing it in a reliable, certifiable, and documentable manner.*
- SO4: Design and explore the feasibility of new traceability ecosystems and effective business models across different stakeholders.*
- SO5: Development of a new "Multichannel distribution" e-commerce platform implementing new business model.*
- SO6: Maximize outreach and beneficial influence of the project results and reach the target users (beekeepers, small-scale food manufacturers, and local distributors, canteens and retailers, local public authorities).*

*TECHONEY is funded by the **Partnership on Research and Innovation in the Mediterranean Area (PRIMA)**, with the participation of the participant National Agencies and coordinated by Aragon Agri-*



Food Research and Technology Center (CITA) in Spain. For more information, please visit our website <https://www.techoney.org/> or write an e-mail to techoney@cita-aragon.es

The Delphi Study

As part of the project we will need to compare the **sustainability of the different value chains** (Objective SO1). This is complicated as each chain has different dimensions, distribution channels, actors involved and practices. For example, we have to figure out the economic, social and ecological impact of a beekeeper selling his produce to the conventional wholesaler rather than directly at his farm.

In particular, we wish to compare the **sustainability of different channels of distribution** to help establish whether or not their use is viable. With this information, we will be able to describe the different distribution channels in terms of sustainability.

We would be very grateful if you could help us with this task by participating in a Delphi study. A Delphi study is a means of gathering the opinions of experts using a sequence of simple questionnaire surveys. **Responses are anonymous** and are summarized to provide feedback to all participants after the first round of the survey. This feedback is accompanied by a **second survey** to allow respondents to give new answers after observing the general opinion in the first round.

What we need you to do

We would like you to complete the questionnaire provided on the attached **EXCEL FILE**. The questionnaires are being sent to experts from different disciplinary backgrounds.

In the questionnaire we have provided a list of indicators and would like to learn your opinion about how relevant they are, and their relative importance. We kindly request you to fill in this questionnaire and return it (as an e-mail attachment) to **XXXXXXXXXX** by **XXXXXXXXXXXX, 2024**. The questionnaire will take approximately 20 minutes to complete.

What we will do

All information received will be treated in confidence and used only for research purposes. If you have any questions about the Delphi study or the TECHONEY project, please do not hesitate to contact us.

We would like to thank you in advance for your time and cooperation."

2.3.1 FIRST ROUND QUESTIONNAIRE

The **questionnaire** is structured in four sections, and it **should be answered by the experts** on the attached **EXCEL FILE "Delphi protocol Tool (TH).xls"**.

SECTION 1. Introductory questions



On the EXCEL FILE, sheet "Your Expertise", information about respondent is request (profession, knowledge, experience and relation with the issue). Experts should fill the yellow-coloured cells (see Figure 1), and specifically for questions 1.1 to 1.3 on this sheet, they should use the menus to select the appropriated answered according to their opinions.

These introductory questions tell us more about you.																									
Name:																									
Surname:																									
email:																									
This information is for administrative purposes. Your answers are confidential.																									
1.1 At which level of the agri-food value chain is your activity located?																									
ACTIVITY ON THE AGRI-FOOD VALUE CHAIN																									
1.2 Please rate on a scale from 1 to 5 – where 1 is 'none at all' and 5 is 'high' – YOUR LEVELS OF KNOWLEDGE about the Honey value chain (select your appropriate level)																									
LEVEL OF KNOWLEDGE																									
a. Honey																									
1.3 Please rate on a scale from 1 to 5 – where 1 is 'none at all' and 5 is 'very high' – YOUR LEVEL OF KNOWLEDGE about each of the following areas relating to agifood value chain (select your appropriate level)																									
LEVEL OF KNOWLEDGE																									
a. The economics of honey production																									
b. The economics of honey distribution																									
c. The supply chain for honey																									
d. The environmental impacts of honey production																									
e. Environmental impacts of honey distribution																									
f. Honey consumption attitudes																									
g. Regulation on the honey value chain																									
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="background-color: #92d050;">Activity</th> <th style="background-color: #92d050;">Knowledge</th> </tr> </thead> <tbody> <tr> <td>a. Farmer (beekeeper)</td> <td>0). none at all</td> </tr> <tr> <td>b. Distributor</td> <td>1).</td> </tr> <tr> <td>c. Wholesaler</td> <td>2).</td> </tr> <tr> <td>d. Food retailing</td> <td>3).</td> </tr> <tr> <td>e. Restaurants, hotels, caterings (HORECA)</td> <td>4).</td> </tr> <tr> <td>f. Food processing industry</td> <td>5). intermediate level</td> </tr> <tr> <td>g. Consumer organization</td> <td>6).</td> </tr> <tr> <td>h. Researcher</td> <td>7).</td> </tr> <tr> <td>i. Farm advisory service, technical consultant</td> <td>8).</td> </tr> <tr> <td>j. Public policy and regulation</td> <td>9).</td> </tr> <tr> <td>Other (please specify)</td> <td>10). high</td> </tr> </tbody> </table>		Activity	Knowledge	a. Farmer (beekeeper)	0). none at all	b. Distributor	1).	c. Wholesaler	2).	d. Food retailing	3).	e. Restaurants, hotels, caterings (HORECA)	4).	f. Food processing industry	5). intermediate level	g. Consumer organization	6).	h. Researcher	7).	i. Farm advisory service, technical consultant	8).	j. Public policy and regulation	9).	Other (please specify)	10). high
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<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="background-color: #92d050; color: white;">Your Expertise</td> <td style="background-color: #d3d3d3;">LEGEND</td> <td style="background-color: #d3d3d3;">AHP_Indicators</td> <td style="background-color: #d3d3d3;">Distrib. channels evaluation</td> <td style="background-color: #d3d3d3;">Comments</td> </tr> </table>		Your Expertise	LEGEND	AHP_Indicators	Distrib. channels evaluation	Comments																			
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FIGURE 1 INFORMER EXPERTISE

SECTION 2. Evaluation of sustainability indicators.

A) Explanatory information: list of the indicators and purpose of the sustainability evaluation. In this section we want to compare the sustainability of the various available value chains. Defining sustainability as ‘the long-term viability of an activity’, for the purposes of this exercise.

We will measure the impacts of the value chains on sustainability using a series of **indicators**. These will show whether the impact is good or bad for sustainability, or neutral. To do this part of the activity, we have selected a set of **20 indicators** from the FAO’s **Sustainability assessment of food and**



agriculture systems (SAFA) (<https://www.fao.org/3/i3957e/i3957e.pdf>). This set of indicators is sorted into four groups:

- Environmental integrity
- Economic resilience
- Social wellbeing
- Good governance

The list with the description of the 20 selected indicators is provide in the sheet "LEGEND" from the EXCEL FILE. (see Figure 2)

EC01	Cost of Production (C 1.4.2)	Economic indicator that refers to the costs incurred to acquire and transform direct materials, so as to produce and sell products.	Lower cost of Production is more economically sustainable
EC02	Net Income (C 1.4.1)	Total revenue earned in the last five years associated with production	Higher net income is more economically sustainable
EC03	Stability of Supplier Relationships (C 2.2.2)	This indicator measures the share of supplier contracts/business relationship that has remained ongoing over the last 5 years, or since the enterprise is in business for a period of less than five years.	Higher stability of supplier relationship is more economically sustainable
EC04	Local Procurement (C 4.2.1)	This indicator measures whether the enterprise has purchased its inputs/ingredients/products from local suppliers when equal or similar conditions exist, in comparison to non-local suppliers.	Higher Local procurement is more economically sustainable
EC05	Price determination (C 1.4.3)	The amplitude of the mark-up (i.e. the difference between the selling price and the cost per unit of production)	Higher Percentage of the selling price compared to the conventional counterpart (conventional wholesaler)
ENV1	Locally adapted varieties and breeds (E 4.3.3)	Determine what is the share of production (by area, animal number of live weight) accounted for by: locally adapted plant varieties or animal breeds; rare; and traditional (heirloom) crop varieties; and livestock breeds.	Higher share of local variety is more environmentally sustainable
ENV2	Intensity of Material Use (E 5.1.4)	The replacement of virgin non-renewable materials by recycled and renewable materials and the reduction of the material intensity of production (i.e. increased eco-efficiency) are two central pillars of a green economy.	Higher share of recycled or renewable material or with less material use is more environmentally sustainable
ENV3	Energy Consumption (E 5.2.3)	This indicator measures how has the enterprise' direct energy consumption per unit of produce changed during the past five years.	Lower energy consumption is more environmentally sustainable
ENV4	Water conservation practices (E 2.1.2)	Practices that aim at saving water in agriculture chains	Lower water intensity consumption is more environmentally sustainable
ENV5	Food Loss and Waste Reduction (E 5.3.4)	The topic of this indicator relates to food losses that occur during production, post-harvest and processing operations, as well as food waste that occurs at different distribution channels	Lower product loss in the analysed supply chain is more environmentally sustainable
SOC1	Employment Relations (S 3.1.1)	Well-paid employment, working conditions	Better working conditions is more socially sustainable
SOC2	Gender Equality (S 4.2.1)	Female workers presence	Better gender equality is more socially sustainable
SOC3	Rights of Suppliers (S 2.2.1)	Suppliers, particularly primary producers, rights to freedom of association and collective bargaining are basic freedoms that form the necessary basis and prerequisite conditions for fair trading with buyers. This indicator refers to buyers treating the primary producers who supply them with farm products with respect, as well as other suppliers such as processors and other.	Better rights, freedom of associations and collective bargaining is more socially sustainable
SOC4	Fair Pricing and transparent contracts (S 2.1.1)	For sustained trading relationships to exist, buyers must pay primary producers prices for their products that reflect the real cost of the entire process of sustaining a regenerative ecological system. This includes supporting a decent livelihood for primary producers, their families and workers by providing living wages that cover producer's costs	Fair contracts is more socially sustainable
SOC5	Safety of Workplace, Operations and Facilities (S 5.1.2)	This qualitative indicator measures whether the enterprise has been ensuring a safe, clean and healthy workplace for employees by determining if facilities and structures, equipment, practices, and food offered are safe and meet employee needs for healthy lifestyles.	Better safe, clean and healthy workplace is more socially sustainable
GOV1	Transparency (G 2.3.1)	Real transparency involves understanding the information needs of stakeholders and making accurate, timely and relevant information available in an accessible way.	Higher information transparency across stakeholders is more governance sustainable
GOV2	Stakeholder Engagement (G 3.1.2)	The enterprise is able to effectively engage with stakeholders. Excellent performance in this indicator will be evidenced by engagement activities customized for stakeholder type, resulting in comprehensive and mutually satisfactory engagement which is sustained over time	Higher engagement of stakeholder is more governance sustainable
GOV3	Engagement Barriers (G 3.1.3)	The enterprise has an understanding of how asymmetries of power can prevent the engagement of vulnerable stakeholders. It has a commitment to identifying barriers to engagement for all stakeholder groups and working with those groups to overcome barriers. Barriers can include but are not limited to knowledge/information, financial, physical, geographic, cultural, religious, linguistic/communication, and status barrier.	Low engagement barriers is more governance sustainable
GOV4	Effective Participation (G 3.1.4)	Any enterprise which has genuinely engaged its stakeholders should be able to show the effect of this engagement on the enterprise's decisions and actions	Higher effective stakeholders participation is more governance sustainable
GOV5	Civic Responsibility (G 4.3.1)	This is achieved when all parts of the supply chain are free from exploitation of individuals, communities and the environment across all four dimensions of sustainability.	Higher civic responsibility is more governance sustainable
ALT1	Wholesaler		
ALT2	Direct Sales		
ALT3	e-commerce		
ALT4	Small retailer		
ALT5	Supermarkets		
ALT6	Industry		
ALT7	Restaurants		
ALT8	Cooperatives		

FIGURE 2 LEGEND - INDICATORS DESCRIPTION

B) AHP Indicators. Once the indicators are introduced (sheet "LEGEND"), we will ask you to give **your opinion** on the general usefulness of the different categories of sustainability indicators.



To do so, you must make a series of **JUDGMENTS THROUGH SIMPLE PAIRED COMPARISONS** of all possible combinations of the indicators. In other words, all the indicators must be evaluated in pairwise two by two on a scale from 1 to 9, as is described on the table below:

Indicator A									Indicator B							
9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9
More important (usefulness) ←								Equal importance	→ More important (usefulness)							

FIGURE 3 SCALE FOR- INDICATORS EVALUATION

<i>Degree of importance rating</i>	<i>Definition of the scale</i>
1	The two elements have the same importance
2	The first element has an importance between 1 and 3 against the compared element
3	The preferred element is slightly more important
4	The first element has an importance between 3 and 5 against the compared element
5	The preferred element is moderately more important
6	The first element has an importance between 5 and 7 against the compared element
7	The preferred element is strongly more important
8	The first element has an importance between 7 and 9 against compared element
9	The preferred element is absolutely more important

At sheet "**AHP Indicators**", respondents are asked to rate the usefulness of the indicators following the Analytical Hierarchical Process (Goepel, 2013; Sipahi and Timor, 2010). The 3 steps to follow on this sheet are described on the EXCEL –where experts should fill the yellow-colored cells, by making comparisons between each pair of indicators.



1

First step: Expert should evaluate the relative importance of 5 indicators within each dimension of the sustainability that would be relevant to describe the sustainability of the food supply chain. The evaluation will target the economic, environmental, social and governance indicators

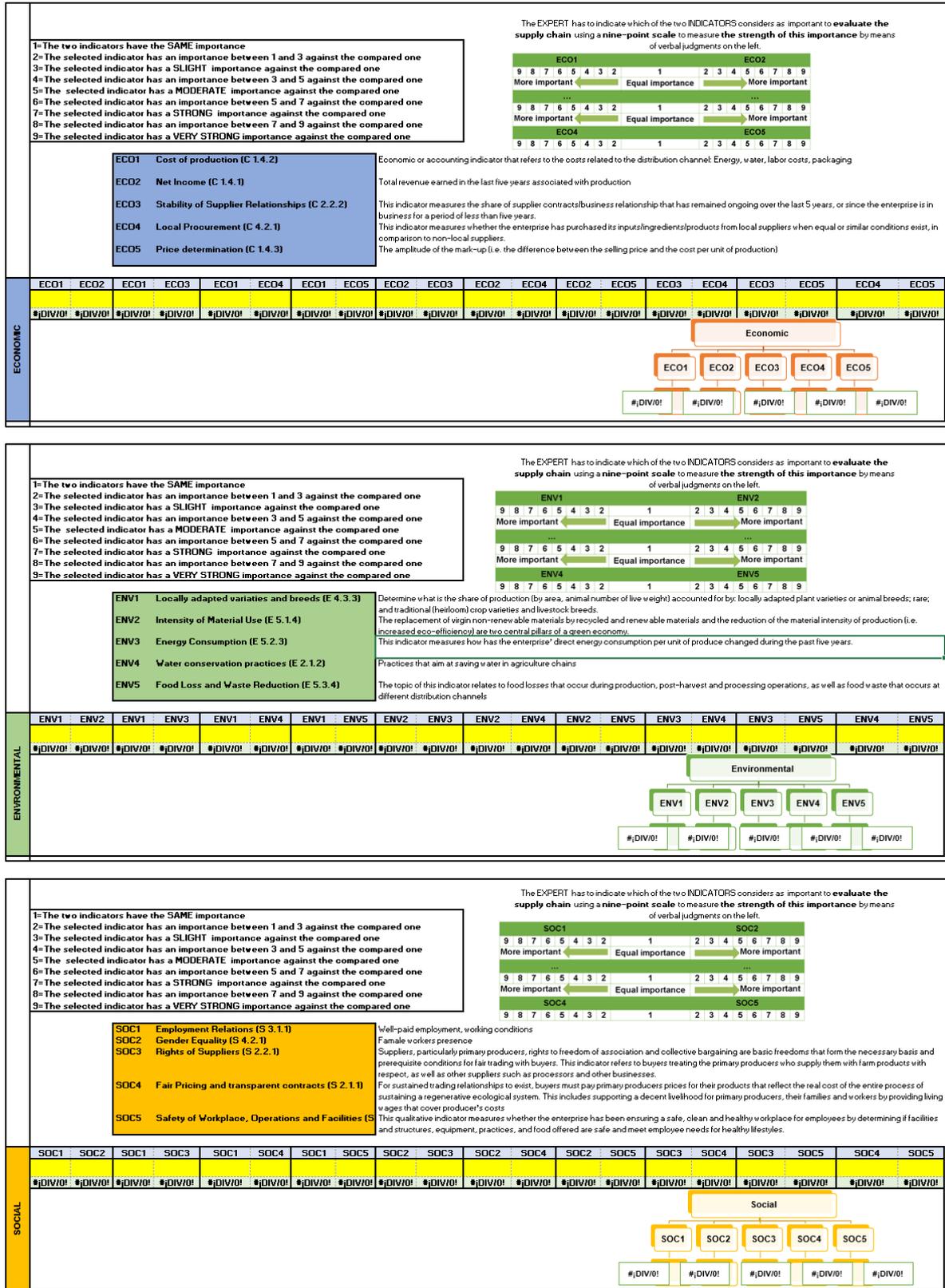


FIGURE 4 DELPHI'S FIRST STEP



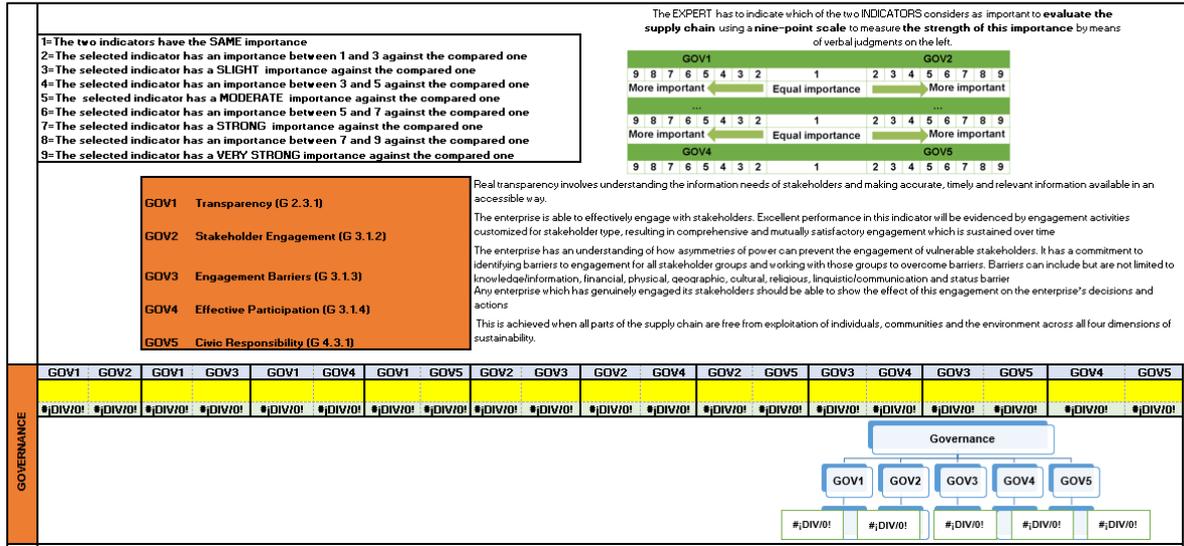


FIGURE 4 DELPHI'S FIRST STEP

2 **Second step:** Experts should evaluate the relative importance of the 4 dimensions of the sustainability when applied to the food supply chain.

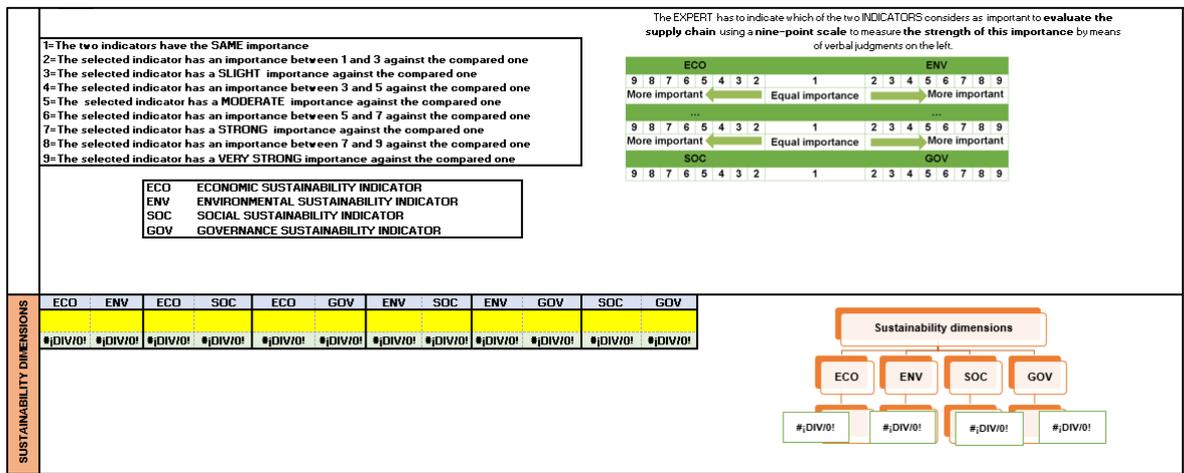


FIGURE 5 DELPHI'S SECOND STEP

3 **Third step:** the global relative importance of all indicators is automatically estimated. The global relative importance will allow us to compare indicators even if they proceed from different dimensions.

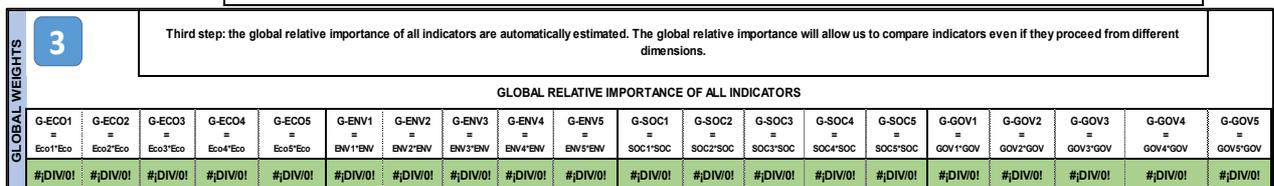


FIGURE 6 DELPHI'S THIRD STEP



SECTION 3. Distribution channel alternatives

This section is focus on the distribution channels evaluation. In it, we ask the experts to evaluate the performance of each indicator according to each of the eight representative distribution channels (step 4).

The 8 channels are as follows:

- Wholesaler
- Direct Sales
- e commerce
- Small retailer
- Supermarkets
- Industry
- Restaurants
- Cooperatives

The experts should assess the indicators for each distribution channel considering the table provided on the EXCEL sheet "**Distrib. channels evaluation**", taking the wholesaler as a reference value. Values should be indicated as the next example:

4

Forth step: In this section we propose the 8 most usual distribution channels for the farmer. We then ask you to determine for each of the 8 channels the degree of compliance with each sustainability indicator.

Next, we ask you to compare the degree of compliance of each channel with respect to the wholesaler. Following the example below, if they have the same degree, indicate 0%, if it is half as sustainable -50% and if it is twice as sustainable +100%, indicating the degree that you think is appropriate.

EXAMPLE	ECO1	
	Cost of production	
	Economic or accounting indicator that refers to the costs related to the distribution channel: Energy, water, labor costs, packaging.	
Wholesaler	100%	<p>Interpretation: The wholesaler is used as a reference value. The value is set. Direct sales have the same distribution costs than the wholesaler. e-commerce has twice the distribution costs of wholesaler. Small retailers have 10% more distribution costs than the wholesaler. Supermarkets have 10% less distribution costs than the wholesaler. The industry has half the distribution costs of the wholesaler. Commercialisation to restaurants does not incur distribution costs.</p>
Direct Sales	0%	
e commerce	100%	
Small retailer	10%	
Supermarkets	-10%	
Industry	-50%	
Restaurants	-100%	
Cooperatives	0%	

FIGURE 7 COMPARISON OF DISTRIBUTION CHANNELS (GUIDANCE)

According to the previous example, experts should valuate economic, environmental social and governance indicators, for each the distribution channels respect to the wholesaler channel using the EXCEL Sheet (see Figure 8).



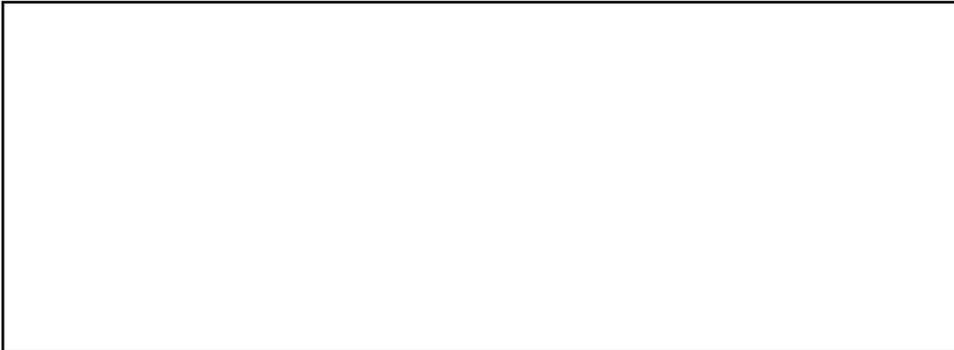
GOVIAL WELLBEING INDICATORS	GOV1	GOV2	GOV3	GOV4	GOV5
	Transparency Real transparency involves understanding the information needs of stakeholders and making accurate, timely and relevant information available in an accessible way.	Stakeholder Engagement The enterprise is able to effectively engage with stakeholders. Excellent performance in this indicator will be evidenced by engagement activities customized for stakeholder type, resulting in comprehensive and mutually satisfactory engagement which is sustained over time	Engagement Barriers The enterprise has an understanding of how asymmetries of power can prevent the engagement of vulnerable stakeholders. It has a commitment to identifying barriers to engagement for all stakeholder groups and working with those groups to overcome barriers. Barriers can include but are not limited to knowledge/information, financial, physical, geographic, cultural, religious, linguistic/communication and status barrier	Effective Participation Any enterprise which has genuinely engaged its stakeholders should be able to show the effect of this engagement on the enterprise's decisions and actions	Civic Responsibility This is achieved when all parts of the supply chain are free from exploitation of individuals, communities and the environment across all four dimensions of sustainability.
Wholesaler	100%	100%	100%	100%	100%
Direct Sales					
e commerce					
Small retailer					
Supermarkets					
Industry					
Restaurants					
ECONOMIC INDICATORS	ECO1	ECO2	ECO3	ECO4	ECO5
	Cost of production Economic or accounting indicator that refers to the costs related to the distribution channel: Energy, water, labor costs, packaging	Net Income Total revenue earned by distribution channel	Stability of Supplier This indicator measures the share of supplier contracts/business relationship that has remained ongoing over the last 5 years, or since the enterprise is in business for a period of less than five years.	Local Procurement This indicator measures whether the enterprise has purchased its inputs/ingredients/products from local suppliers when equal or similar conditions exist, in comparison to non-local suppliers.	Price determination The difference between varieties and channel, and categories (Standards)
Wholesaler	100%	100%	100%	100%	100%
Direct Sales					
e commerce					
Small retailer					
Supermarkets					
Industry					
Restaurants					
ENVIRONMENTAL INDICATORS	ENV1	ENV2	ENV3	ENV4	ENV5
	Locally adapted varieties and breeds Determine what is the share of production (by area, animal number of live weight) accounted for by: locally adapted plant varieties or animal breeds; rare; and traditional (heirloom) crop varieties and livestock breeds.	Intensity of Material Use The replacement of virgin non-renewable materials by recycled and renewable materials and the reduction of the material intensity of production (i.e. increased eco-efficiency) are two central pillars of a green economy.	Energy Consumption This indicator measures how has the enterprise' direct energy consumption per unit of produce changed during the past five years.	Water conservation practices Practices that aim at saving water in agriculture chains	Food Loss and Waste Reduction The topic of this indicator relates to food losses that occur during production, post-harvest and processing operations, as well as food waste that occurs at different distribution channels
Wholesaler	100%	100%	100%	100%	100%
Direct Sales					
e commerce					
Small retailer					
Supermarkets					
Industry					
Restaurants					
SOCIAL WELLBEING INDICATORS	SOC1	SOC2	SOC3	SOC4	SOC5
	Employment Relations Well-paid employment, working conditions	Gender Equality Female workers presence	Rights of Suppliers Suppliers, particularly primary producers, rights to freedom of association and collective bargaining are basic freedoms that form the necessary basis and prerequisite conditions for fair trading with buyers. This indicator refers to buyers treating the primary producers who supply them with farm products with respect, as well as other suppliers such as processors and other businesses.	Fair Pricing and transparent contracts For sustained trading relationships to exist, buyers must pay primary producers prices for their products that reflect the real cost of the entire process of sustaining a regenerative ecological system. This includes supporting a decent livelihood for primary producers, their families and workers by providing living wages that cover producer's costs	Safety of Workplace, Operations and Facilities This qualitative indicator measures whether the enterprise has been ensuring a safe, clean and healthy workplace for employees by determining if facilities and structures, equipment, practices, and food offered are safe and meet employee needs for healthy lifestyles.
Wholesaler	100%	100%	100%	100%	100%
Direct Sales					
e commerce					
Small retailer					
Supermarkets					
Industry					
Restaurants					

FIGURE 8 COMPARISON OF DISTRIBUTION CHANNELS



SECTION 4. To finalise the first round, an open space for comments or suggestions from the experts is included on the last EXCEL Sheet "**Comments**". In it are also included some instructions to return filled file to the research leader.

Please make any further comments here.



THANK YOU FOR COMPLETING THIS QUESTIONNAIRE. PLEASE SEND IT AS AN E-MAIL ATTACHMENT TO XXXXXXXXXXXXXXXXXXXX

THE SECOND ROUND OF THIS QUESTIONNAIRE WILL BE SENT ONCE THE FIRST ROUND DATA HAS BEEN COLLATED

More information about the TECHONEY project can be found at:
<https://www.techoney.org/>

FIGURE 9 COMENTS

The administration of the questionnaire should follow these guidelines:

- It should be sent out as an e-mail attachment to the selected experts, a message explaining the purpose and procedure of the survey is required.
- It may be translated if needed.
- A proper period of completion must be set: 2 or 3 weeks may be a reasonable time span. It is recommended to send a reminder email.

Collation of First round results:

- Following the AHP analysis, the results may focus on the prioritizing of the indicators (weight per indicator in percentage) and the Level of consensus.

2.3.2 SECOND ROUND QUESTIONNAIRE

The Second-round survey must be sent to the First-round respondents. The experts will receive the results of the first round of the Delphi panel. They will then be given the opportunity to redraft their answers taking into account the average opinion of the other experts.

- The questionnaire should be answered on the same EXCEL FILE.
- This may result in an attrition of the sample, as all participants are not expected to respond.
- Again, a period of completion must be set.



2.3.3 SUSTAINABILITY INDICATORS ACTIVITY CONDUCTION

1) Living labs leaders will conduct this activity with one expert of each level of the honey supply chain (**Producers, wholesalers, industry, retailers**, academy, consumer association).

2) Additionally, living labs leaders will rate all indicators and alternatives of supply chain according to the AHP method by using the EXCEL file “**DELPHI tool Researcher Complete.xls**”.

The 3 first sheets this file are similar to the excel file for experts "Delphi protocol Tool (TH).xls", but it additional includes 4 sheets to make a complete analysis of the alternative distribution channels "Economic ECO, environmental ENV, social SOC and governance GOV" (see Figure 10) and in the end, there is one sheet with the results obtained for all indicators, the sheet has the name of "SUST INDICATORS".



FIGURE 10 SHEETS FROM THE EXCEL FILE “DELPHI tool Researcher Complete.xls” FOR ALTERNATIVE ANALYSIS.

These sheets allow us to analyse all alternatives regarding each indicator (ECO steps 4.1 to 4.5, ENV steps 5.1 to 5.5, SOC steps 6.1 to 6.5, and GOV steps 7.1 to 7.5). See the example for the Economic, **cost production** Indicator C 1.4.2 and the 8 Identified alternatives.

Researcher (Leader of the living Lab) will fill yellow cells, according to the scale of comparison of 9 points, between each pair of alternatives.

Lower cost of distribution is more economically sustainable

Cost of Production (C 1.4.2) : Economic or accounting indicator that refers to the costs related to the distribution channel: Energy, water, labor costs, packaging

ALT 1	ALT 2	ALT 3	ALT 4	ALT 5	ALT 6	ALT 7	ALT 8
#DIV/0!							
ALT 4	ALT 5	ALT 2	ALT 4	ALT 3	ALT 5	ALT 4	ALT 6
#DIV/0!							
ALT 1	ALT 4	ALT 2	ALT 5	ALT 3	ALT 6	ALT 4	ALT 7
#DIV/0!							
ALT 4	ALT 5	ALT 2	ALT 6	ALT 3	ALT 7	ALT 4	ALT 8
#DIV/0!							
ALT 4	ALT 6	ALT 2	ALT 7	ALT 3	ALT 8	ALT 4	ALT 8
#DIV/0!							
ALT 4	ALT 7	ALT 2	ALT 8	ALT 3	ALT 8	ALT 4	ALT 8
#DIV/0!							

SCALE

- 1=The two indicators have the SAME importance
- 2=The selected indicator has an importance between 1 and 3 against the compared one
- 3=The selected indicator has a SLIGHT importance against the compared one
- 4=The selected indicator has an importance between 3 and 5 against the compared one
- 5=The selected indicator has a MODERATE importance against the compared one
- 6=The selected indicator has an importance between 5 and 7 against the compared one
- 7=The selected indicator has a STRONG importance against the compared one
- 8=The selected indicator has an importance between 7 and 9 against the compared one
- 9=The selected indicator has a VERY STRONG importance against the compared one

ALTERNATIVES	
ALT1	Wholesaler
ALT2	Direct Sales
ALT3	e commerce
ALT4	Small retailer
ALT5	Supermarkets
ALT6	Industry
ALT7	Restaurants
ALT8	Cooperatives

FIGURE 11 SHEET ECO FROM THE EXCEL FILE “DELPHI tool Researcher Complete.xls” (step 4.1 INDICATOR Lower cost of distribution is more economically sustainable- alternatives ALT1 to ALT8.)

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For example: On step 4.1, for the economic indicator "cost of production", indicate which alternative of distribution channel has lower cost of distribution: ALT1 Wholesalers or ALT2 Direct sales?

A) If both have the same then write 1 in both cells

4.1

	ALT 1	ALT 2
	1	1
	1.00	1.00

B) If ALT1 has lower cost, write in the cell under ALT1 in which level it is lowest (from 2 to 9). Automatically the cell under ALT2 will fill black.

4.1

	ALT 1	ALT 2
	3	
	3.00	0.33

C) In other case, when alternative ALT2 has lower cost, write in the cell under ALT2 in which level it is lowest (from 2 to 9), and automatically the cell under ALT1 will fill black.

4.1

	ALT 1	ALT 2
		3
	0.33	3.00

D) Repeat the two pair comparison for all alternatives and indicators to complete the AHP analysis. When all yellow cells be filled, you will be able to see the rate for each aggregated indicator on sheet "SUST INDICATORS", in column "Z".

← **Estimated from the previous sheets
ECO, ENV, SOC, GOV**

Aggregation	
#jDIV/0!	ALT1 Wholesaler
#jDIV/0!	ALT2 Direct Sales
#jDIV/0!	ALT3 e commerce
#jDIV/0!	ALT4 Small retailer
#jDIV/0!	ALT5 Supermarkets
#jDIV/0!	ALT6 Industry
#jDIV/0!	ALT7 Restaurants
#jDIV/0!	ALT8 Cooperatives
#jDIV/0!	

3) Send to CREDA all excel filled files from experts ("Delphi protocol Tool (TH).xls") and the researcher filled file ("DELPHI tool Researcher Complete.xls"). CREDA will generate results and will send to you back to continue with the second round.

