QuantiFarm Toolkit –
Directions for using the “Advanced decision support tool”

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Table of Contents

Overview

The “Advanced decision support tool” aims to help advisors support their customers (the farmers) in deciding which DATS is the most appropriate for their farm, taking into consideration their specific needs, strategic goals, and preferences, as well as the external environment they are operating in. The tool is built on a combination of Strategic Fit, Analytic Hierarchical Process (AHP) and Quality Function Deployment (QFD) methods. It was designed to address one of the key barriers in adopting digital technologies, which is the lack of knowledge and evidence regarding their (direct and indirect) actual benefits and costs. There is a number of factors that make difficult the identification of these benefits and costs and their importance to each specific farm:

- the volatile nature of agricultural production and its high dependence on external factors, such as the weather and climate change;
- the specific needs, preferences, goals and capacities of each farm;
- the complexity of relationships across the agri-food value chain;
- the difficulty in applying the technologies on the field under real life conditions in commercial farms and measuring their performance;
- the heterogeneity of the existing applications which are very different in shape and size (e.g. machinery solution vs FMIS vs earth observation-based solutions etc);
- the intangible nature of the many of the benefits offered by digital technologies, which cannot be quantified.

The first step of the tool uses strategic fit as a filter to exclude the services that do not comply with the farm's strategic goals. The second step uses QFD to evaluate the services based on customers’ and partners’ needs. The third step uses AHP to break down the problem to a hierarchical model which includes several criteria identified using the Technology, Organization, Environment (TOE) framework in the agri-food value chain.

The Advanced decision support tool is available here: https://www.quantifarmtoolkit.eu/tool5.html

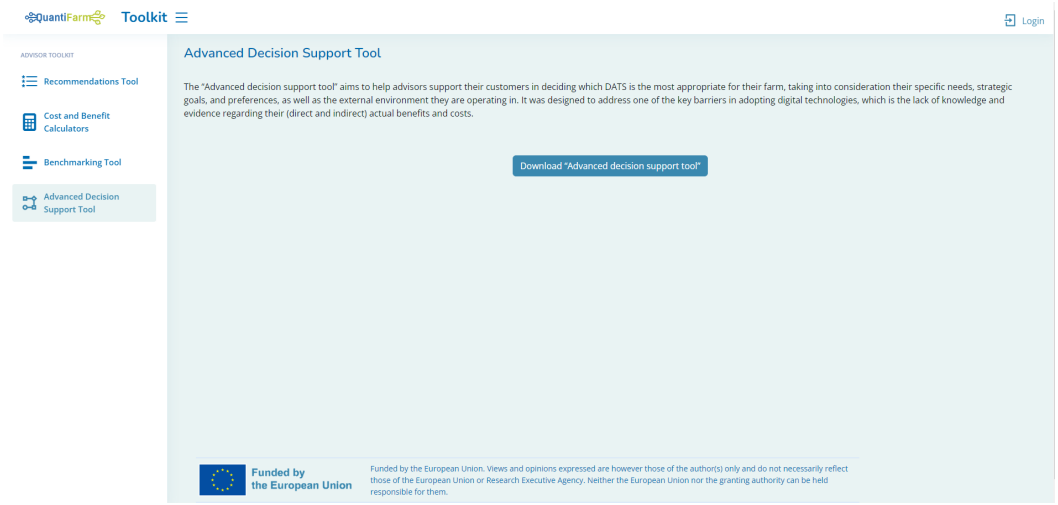

Figure 1 The Advanced decision support tool page in the Toolkit

The tool doesn’t require the user to register and/or login. The tool is currently available as a downloadable file (.xlsx format) that can be used offline. At a later stage, a 2nd “light” version of the tool will be implemented as a web app in the Toolkit, which will be used online. The light version will have a simpler process that is easier to be followed, but creates somewhat less accurate (but still absolutely valid) results.

User scenario

The problem to be solved by the tool is defined as the selection of the DATS with the biggest value to the farm. To select the best solution, all the possible alternatives have to be identified first. Based on the farmer's profile and location, the available possible alternative DATSs are presented to the advisor by the system. The alternatives that are not suitable with the business strategy, the organizational goals and the needs of the farmer, must be eliminated. The strategy of the examined farm/farmer is broken down to a set of specific organizational strategy goals that have to be defined in order to be used to evaluate the alternatives. This is done by selecting from a list of pre-defined criteria that were defined in the tool, i.e. 1) Cost Reduction, 2) High Quality Products, 3) Competitive Advantage, 4) Farm Growth/Development, 5) Economic Sustainability, 6) Environmental Sustainability, 7) Risk Reduction, 8) Ecosystem Services/Added Value Services, 9) Succession and 10) Innovation. Then, with the help of the advisor, the farmer assigns relative weight to each selected goal (where the relative weights of all goals sum to 1). Each alternative is then evaluated using a scale from 1 to 5 (where 1= very poorly and 5=very well) according to how well it fulfils each strategic goal (this is done by the advisor supporting the process, who has the appropriate knowledge). The final strategic fit score of an alternative is measured as the sum of the score on fulfilment of each of the strategic goals multiplied by the relative weight of this goal (e.g. SFA = 0,25*4 + 0,25*3 + 0,1*3 + 0,1*3 + 0,15*4 + 0,15*2 = 3,25). Alternatives with a score equal or better than 3, are qualified to the next phase. Alternatives with scores less than 3 are disqualified.

In the second step, a light version of QFD is used to let the farm's customers and partners (including retailers, food processing companies, intermediaries and/or consumers) evaluate the services and to correlate their needs with the needs of the farmer. This is done by selecting from a list of pre-defined needs that were defined in the tool, i.e. 1) Product Cost Reduction, 2) Yield Quantity Consistency, 3) Information Accuracy/ Traceability, 4) High Food Quality/Specific Quality Characteristics and 5) Sustainability. A 3-point scale (strong (5), average (3) or weak (1)) is used to evaluate customer satisfaction for each of the documented needs/demands. The evaluation scores are used in the next phase and used as input for the calculation of the AHP model.

In the third step, the final step of the evaluation of the selected alternative solutions is being completed with the use of AHP. In this step, the system (or the advisor supporting the process) selects the appropriate evaluation pre-defined criteria which cover all aspects of the problem (i.e. "Technology Characteristics", "External Environment", "Organizational Maturity/Internal Environment", "Perceived Benefits" and "Costs") and the farmer (with the help of the advisor that supports the process) assigns special weights to each criterion in order to evaluate each alternative. To achieve that, the farmer performs pairwise comparisons to examine the relative priority of each criterion of a level regarding the higher level of the model. Based on these comparisons, the system produces a final score. The solution with the highest score is the most appropriate one for the farmer.

Step 1 - Assessing DATSs against their ability to satisfy each strategic goal of the farm

The first step of the process focuses on assessing DATSs against their ability to satisfy each strategic goal of the farm. This process is completed in the spreadsheet tab named “Strategic Fit”.

Strategic Fit

1. Enter DATS alternatives (green)
2. Enter strategic goals (grey)
3. Fill in the special weight of each strategic goal (blue):
4. Evaluate alternatives' contibution value to each goal (orange) using the following scale:
1: very poorly
2: poorly
3: neutral
4: well
5: very well

5. Check final rating results! Keep only alternatives that scored 3 or higher

Strategic Goal, i	Special Weight, Wi	DATS, j									
		DATS1	DATS2	DATS3	DATS4	DATS5	DATS6	DATS7	DATS8	DATS9	DATS10
		Contribution Value Vij of Service j for the Strategic Goal i									
Cost Reduction											
High Quality Products											
Competitive Advantage											
Farm Growth/Development											
Economic Sustainability											
Environmental Sustainability											
Risk Reduction											
Ecosystem Services/Added Value Services											
Succession											
Innovation											
Strategic Fit, Fj	0	0	0	0	0	0	0	0	0	0	0

Figure 2 The Strategic Fit tab

The following diagram presents the process of completing step 1.

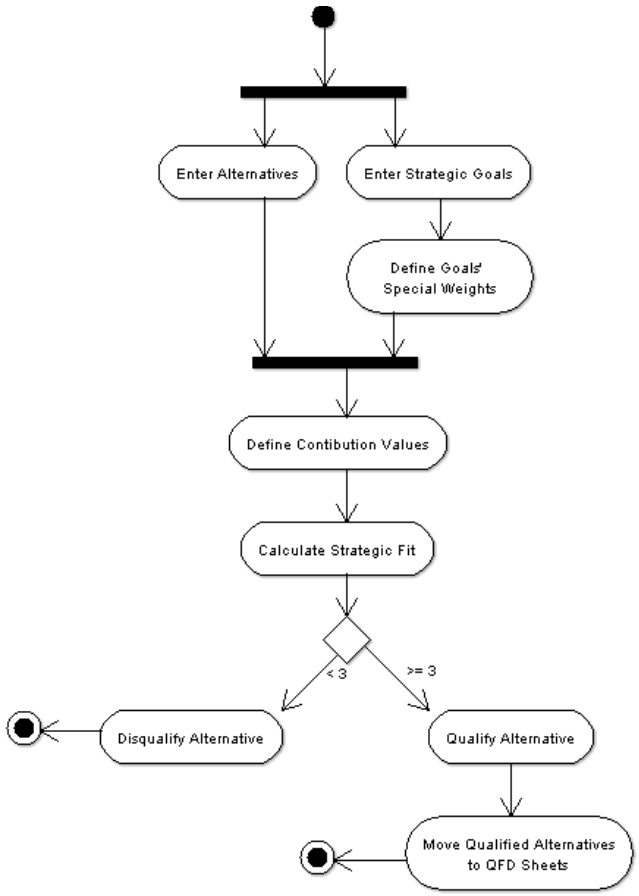

Figure 3 Overview of the process for completing the Strategic Fit tab

The top part of the sheet presents the instructions on how to complete this step.

1. Enter DATS alternatives (green)
2. Enter strategic goals (grey)
3. Fill in the special weight of each strategic goal (blue):
4. Evaluate alternatives' contibution value to each goal (orange) using the following scale:
1: very poorly
2: poorly
3: neutral
4: well
5: very well
5. Check final rating results! Keep only alternatives that scored 3 or higher

Figure 4 Instructions on how to complete the Strategic Fit tab

The advisor has to complete the green cells in row 17 with the alternative DATSs to be assessed, adding as many DATSs as needed (between 2 and 10).

DATS, j									
DATS1	DATS2	DATS3	DATS4	DATS5	DATS6	DATS7	DATS8	DATS9	DATS10

Figure 5 Area for completing the alternative DATSs to be assessed

The advisor check the list of Strategic Goals in the grey area and removes the Goals that are not relevant for this specific farm.

Strategic Goal, i
Cost Reduction
High Quality Products
Competitive Advantage
Farm Growth/Development
Economic Sustainability
Environmental Sustainability
Risk Reduction
Ecosystem Services/Added Value Services
Succession
Innovation
Strategic Fit, Fj

Figure 6 Area for completing relevant strategic goals of the farm

The following strategic goals can be selected in the tool:

1. **Cost Reduction:** Reduction of the agricultural production costs, usually related to the reduction of input costs (fertilisers, pesticides, water, etc), and/or the costs of operating farm.
2. **High Quality Products:** Producing products of higher quality.
3. **Competitive Advantage:** Gaining a competitive advantage against its peer farmers operating in the same sector/value chain/market.
4. **Farm Growth/Development:** Focusing on growing the size of the farm, to achieve economies of scale.
5. **Economic sustainability:** Focusing on maintaining margins and the farm's revenue.
6. **Environmental Sustainability:** Reducing the environmental footprint of the farm, helping towards the reduction of natural resources consumption and the mitigation of climate change.

7. **Risk Reduction:** Reducing the risk of the farm, through the provision of proactive advice on needed actions to address issues related to irrigation, pest management, fertilisation and more.
8. **Ecosystem Services/Added Value Services:** Offering ecosystem services or other types of added value services, with the help of the technology, to diversify the business model, improve the farm's image and/or have an extra revenue source.
9. **Succession**: Preparing the farm for succession by new generations.
10. **Innovation**: Keeping the farm at the forefront of innovation, piloting new technologies.

For each selected strategic goal, the advisor must complete its respective special weight. The sum of all special weights should be equal to 100%.

Strategic Goal, i	Special Weight, Wi
Cost Reduction	45%
High Quality Products	20%
Environmental Sustainability	35%
Strategic Fit, Fj	100%

Figure 7 Area for completing the special weights of the relevant strategic goals of the farm

For each selected strategic goal, the advisor must complete the orange cells and add a score of 1-5 to each DATS, against its fit with this goal.

Strategic Goal, i	Special Weight, Wi	DATS, j				
		DATS1	DATS2	DATS3	DATS4	
		Contribution Value Vij of Service j for the Strategic Goal i				
Cost Reduction	45%	4	3	3	3	
High Quality Products	20%	3	2	4	4	
Environmental Sustainability	35%	4	3	4	3	
Strategic Fit, Fj	100%	3,8	2,8	3,55	3,2	0

Figure 8 Area for completing the score of 1-5 to each DATS, against its fit with each strategic goal

The DATSs that have a score of 3 or higher, pass to the 2nd step.

Step 2 - Assessing DATSs based on the needs of the farm's customers and partners

The second step of the process focuses on assessing DATSs against their ability to satisfy the needs of the farm's customers and cooperators (including peer farmers, cooperatives, retailers, food processing companies, intermediaries and/or consumers). This process is completed in the spreadsheet tabs named "QFD - Customers" and "QFD - Partners".

QFD

1. Enter alternatives (green)
2. Enter Customers' Requirements and Farm Requirements (grey)
3. Fill in the special weight of each Customer's requirement (blue):
4. Enter each Customer's relative weight (tan)
5. Evaluate the correlation of Customers' and Port's Requirements (yellow)
6. Evaluate alternatives' contibution value to each goal (orange) using the following scale:
1: low
3: average
5: high
7. Check final rating results (bright green)!

Customers' Requirements	Relative Weight C1	Relative Weight C2	Relative Weight C3	Relative Weight C4	Relative Weight C5	Relative Weight C6	Relative Weight C7	Relative Weight C8	Relative Weight C9	Relative Weight C10	Total Relative Weight
Product Cost Reduction											0%
Yield Quantity Consistency											0%
Information Accuracy/ Traceability											0%
High Food Quality/Specific Quality Characteristics											0%
Sustainability											0%
											0%
											0%
											0%
											0%
											0%
SUM	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Customers Relative Importance											0%

		Farm Requirements								DATS Rating				
Customers' Requirements	Total Relative Weight									DATS1	DATS2	DATS3	DATS4	DATS5
Product Cost Reduction	0%													
Yield Quantity Consistency	0%													
Information Accuracy/ Traceability	0%													

Figure 9 The "QFD – Customers" tab

The following diagram presents the process of completing step 2.

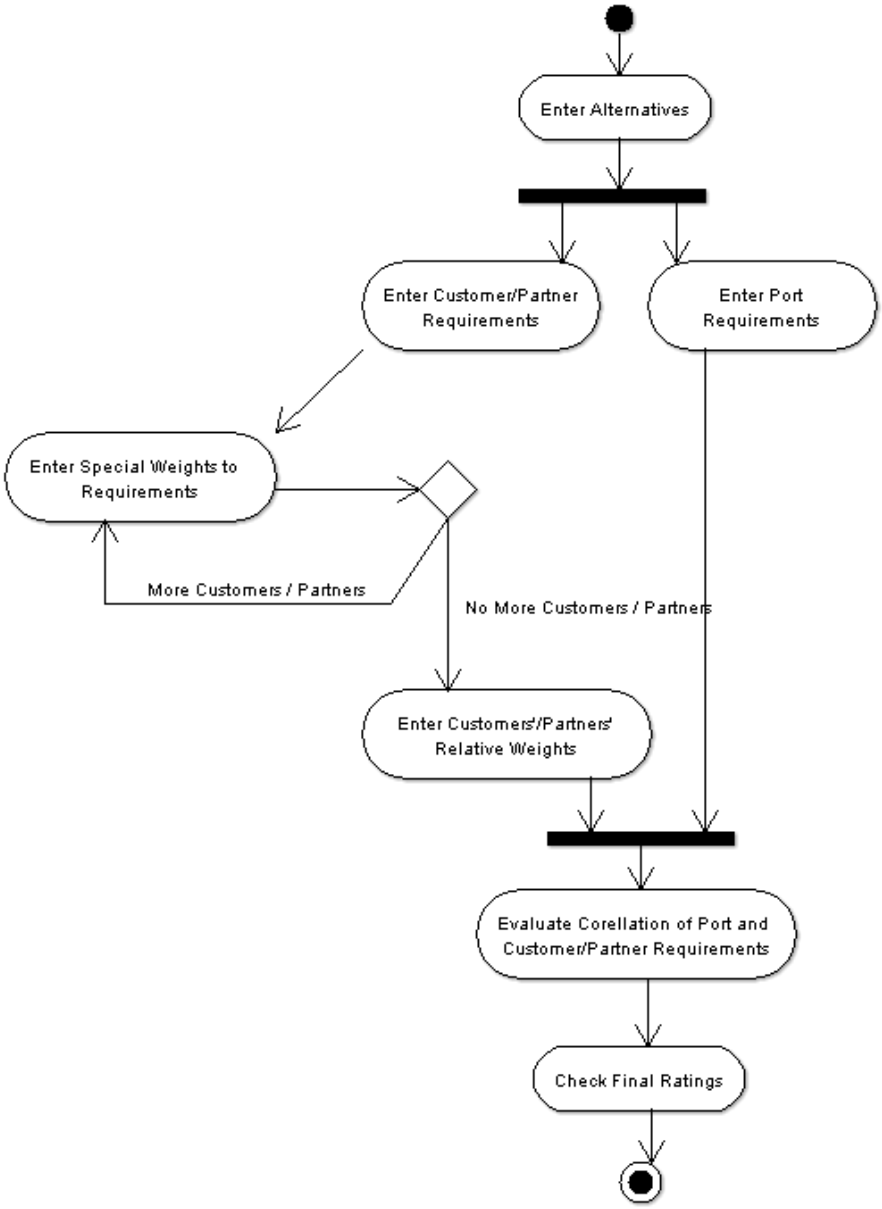

Figure 10 Overview of the process for completing the QFD tabs

The top part of the sheet presents the instructions on how to complete this step.

1. Enter alternatives (green)
2. Enter Customers' Requirements and Farm Requirements (grey)
3. Fill in the special weight of each Customer's requirement (blue):
4. Enter each Customer's relative weight (tan)
5. Evaluate the correlation of Customers' and Farm's Requirements (yellow) using the following scale:
1: low
3: average
5: high
6. Evaluate alternatives' contibution value to each goal (orange) using the following scale:
1: very poorly
2: poorly
3: neutral
4: well
5: very well
7. Check final rating results (bright green)!

Figure 11 Instructions on how to complete the QFD tab

First, the advisor has to add the DATSs promoted through step 1 "Strategic Fit", completing the green cells.

		Farm Requirements								DATS Rating				
Customers' Requirements	Total Relative Weight									DATS1	DATS3			
Product Cost Reduction	0%													
Yield Quantity Consistency	0%													
Information Accuracy/ Traceability	0%													
High Food Quality/Specific Quality	0%													
Sustainability	0%													
0	0%													
0	0%													
0	0%													
0	0%													
0	0%													
SUM	0%									0	0	0	0	0
Weight		0	0	0	0	0	0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Relative Weight		0	0	0	0	0	0	0	0					

Figure 12 Area for completing the DATS the passed the first step

Then the advisor adds the main customers or customer groups. For each of them, the advisor adds relevant weights, depending on their importance to the farm. The sum of all weights should be 100%.

Customers' Requirements	Relative Weight C1	Relative Weight C2	Relative Weight C3	Relative Weight C4		Total Relative Weight
Product Cost Reduction	20%	40%	50%	10%		26%
Yield Quantity Consistency	20%	20%	20%	15%		19%
Information Accuracy/ Traceability	20%	20%	10%	25%		19%
High Food Quality/Specific Quality Characteristics	20%	10%	10%	20%		17%
Sustainability	20%	10%	10%	30%		19%
						0%
						0%
						0%
						0%
						0%
SUM	100%	100%	100%	100%	0%	100%
Customers Relative Importance	50%	10%	20%	20%		100%

Figure 13 Area for completing the relevant weight of the customers/customer groups of the farm

Then the advisor selects the specific needs of all customers. The following needs can be selected:

1. **Product Cost Reduction**: Reduced price of the produced agrifood product.
2. **Yield Quantity Consistency**: The ability to deliver a consistent quantity by managing external risks like pest, drought etc.
3. **Information Accuracy/ Traceability**: The ability to offer timely and accurate information about the production conditions, the application of inputs/chemicals, the estimated time of harvest etc.
4. **High Food Quality/Specific Quality Characteristics**: The possibility to achieve specific quality characteristics, in the context of contractual agriculture or in other context that requires specific characteristics.
5. **Sustainability**: Reducing the environmental footprint of the farm, helping towards the reduction of the environmental footprint of the final product.

Customers' Requirements	Relative Weight C1	Relative Weight C2	Relative Weight C3	Relative Weight C4		Total Relative Weight
Product Cost Reduction	20%	40%	50%	10%		26%
Yield Quantity Consistency	20%	20%	20%	15%		19%
Information Accuracy/ Traceability	20%	20%	10%	25%		19%
High Food Quality/Specific Quality Characteristics	20%	10%	10%	20%		17%
Sustainability	20%	10%	10%	30%		19%
						0%
						0%
						0%
						0%
						0%
SUM	100%	100%	100%	100%	0%	100%
Customers Relative Importance	50%	10%	20%	20%		100%

Figure 14 Area for completing the customers' needs/requirements

Based on how important each need is for each customer/customer group, the advisor adds the respective relevant weights. The sum of all weights per customer/customer group should be 100%.

Customers' Requirements	Relative Weight C1	Relative Weight C2	Relative Weight C3	Relative Weight C4		Total Relative Weight
Product Cost Reduction	20%	40%	50%	10%		26%
Yield Quantity Consistency	20%	20%	20%	15%		19%
Information Accuracy/ Traceability	20%	20%	10%	25%		19%
High Food Quality/Specific Quality Characteristics	20%	10%	10%	20%		17%
Sustainability	20%	10%	10%	30%		19%
						0%
						0%
						0%
						0%
						0%
SUM	100%	100%	100%	100%	0%	100%
Customers Relative Importance	50%	10%	20%	20%		100%

Figure 15 Area for completing the relative weights of each need for each customer/customer group

Then the advisor correlates each customer need with each farm need. This allows the extraction of useful insights for the farm, on how its needs are linked to the needs of its customers.

		Farm Requirements		
Customers' Requirements	Total Relative Weight	Cost Reduction	High Quality Products	Environmental Sustainability
Product Cost Reduction	26%	5	1	1
Yield Quantity Consistency	19%	3	3	1
Information Accuracy/ Traceability	19%	3	5	3
High Food Quality/Specific Quality	17%	1	5	3
Sustainability	19%	1	3	5
0	0%			
0	0%			
0	0%			
0	0%			
0	0%			
SUM	100%			
Weight		13	17	13
Relative Weight		2,63	2,35	1,97

Figure 16 Area for assessing the relevance/correlation of customers' need with the goals/needs of the farm

For each need, the advisor adds a score of 1-5 to each DATS, against its ability to satisfy this need.

		Farm Requirements			DATS Rating		
Customers' Requirements	Total Relative Weight	Cost Reduction	High Quality Products	Environmental Sustainability	DATS1	DATS3	DATS4
Product Cost Reduction	26%	5	1	1	4	3	3
Yield Quantity Consistency	19%	3	3	1	4	3	3
Information Accuracy/ Traceability	19%	3	5	3	3	4	4
High Food Quality/Specific Quality	17%	1	5	3	3	4	4
Sustainability	19%	1	3	5	4	4	3
0	0%						
0	0%						
0	0%						
0	0%						
0	0%						
SUM	100%				3,64	3,55	3,36
Weight		13	17	13	0,345023697	0,336492891	0,318483412
Relative Weight		2,63	2,35	1,97			

Figure 17 Area for completing the scores of the each DATS, against its ability to satisfy each customers' need

The process is repeated with the farm's partners, in the same way. The tabs are identical.

Step 3 - Perform final assessment of DATSs though AHP

The final step of the process focuses on assessing DATSs with the use of AHP, against the following criteria:

K1. Technology Characteristics: refers to the specific characteristics of each DATS. The following sub-criteria are included:

K1.1 Maturity – Reliability: Contains metrics like downtime, operational performance and security.

K1.2 Innovation: Innovation is a parameter that can offer a competitive advantage to an organization, although it can contain risk that is linked to the reliability of the system.

K1.3 Interoperability/Vendor Lock-in: Interoperability refers to the capability to seamlessly integrate/ interact with other IT systems owned by the organization or other cooperating organizations. It also refers to whether collected data is exclusively connected to the vendor / hardware or free to extract and use as needed and/or transfer to a new vendor.

K1.4 Level of Integration/Automation: The Level of Integration examines the degree of sophistication and automation of a DATS. Depending on the preference of the farmer completing this, more automation or more farm participation/less automation can be used as the positive.

K1.5 Flexibility: The Flexibility of a DATS is depended on its "Expandability" and "Adaptability to Technological Changes", as well as the possibility for a farmer to make adjustments if needed.

K1.6 Implementation Complexity and Repairability: The level of complexity of installation, and the need for training the end user to use it properly. Moreover, this reflects repairability and supplier support.

K2. External Environment: Refers to the External Environment of the organization, the external stakeholders and everyone that influences the decision. The following sub-criteria are included:

K2.1 Customers: Customer is everyone that buys the products of the farm, such as food processing companies, consumers, intermediaries etc.

K2.2 Cooperators: Cooperators are everyone that collaborate with the farmer, such as other farmers within a cooperative structure (or not), farm advisors, food processing companies, other links of the agri-food value chain, etc.

K2.3 Peer Farmers: The term Peer Farmers refers to farmers that operate in the same sector/value chain/market.

K3. Organizational Maturity/Internal Environment: Refers to the dynamics on the farm, the readiness of the farmer and farm workers to adopt the proposed technology. The following sub-criteria are included:

K3.1 Compatibility with Users' Demands and Interests: Compatibility with Users' Demands and Interests is essential because if a DATS is not compatible then it's more difficult to be accepted and effectively utilized.

K3.2 Compatibility with organizational philosophy, goals and needs: The possibility of a non-successful incorporation of a DATS to an organization's operations is higher when the technology is not compatible with the Organizational Philosophy, Goals and Needs.

K3.3 Compatibility with Existing Systems: When a technology is not compatible with the existing DATSs, equipment and the overall production system, then the organization is burdened with additional cost and lost time to integrate the DATS.

K3.4 Organizational know-how and IT Skills: The existence of know-how and IT Skills in an organization is essential, because absence of them includes more implementation risk and leads to a need for more training, accounting to larger costs and more wasted time, or even a non-effective utilization of the DATS.

K4. Perceived Benefits: Perceived Benefits include all the benefits perceived from the farm to be expected from an investment to the new technology. The following sub-criteria are included:

K4.1 Operational Cost Reduction: A new DATS can provide the farm with the means to lower the cost of its operations. This leads to greater profit margin which can be an opportunity to sell the procution at a lower price, thus offering a competitive advantage.

K4.2 Service/Product Differentiation: The implementation of a new technology can lead to service differentiation either by providing new added-value services to the users either by providing enhanced services in terms of time, reliability, error rate and food safety or by offering ecosystem services.

K4.3 Farm Efficiency/ Effectiveness Improvement: A new DATS can lead to an improvement of the farm's operating performance.

K4.4 Administrative Efficiency/Effectiveness Improvement: There can by a performance enhancement of the farm management with bureaucracy optimization, better resource allocation management and more complete and efficient control of the farm's operations.

K4.5 Improved Organizational Image: A farm which adopts innovative technologies that improve its efficiency and/or sustainability impact, can be seen as a pioneer in the sector and improve its Organization Image, becoming more attractive to potential customers.

K4.6 Improved work-life balance: A new DATS can support the farmer with managing the farm flexibly such as choosing one's own place/time

K4.7 Social Benefits: Social Benefits include benefits that don't concern the farm but the greater area and the country in which the farm is located and conducts its business.

K5. Costs: Costs can be calculated as the sum of "Implementation Cost", "Operation Cost", "Maintenance Cost", "Training Cost" and "Indirect Costs".

This process is completed in the spreadsheet tabs named “AHP Q1” and all similar tabs till “AHP Q10”, depending on the number of collected questionnaires from the decision makers of the farm, as well as “AHP Total”. The following diagram presents the flow of the process.

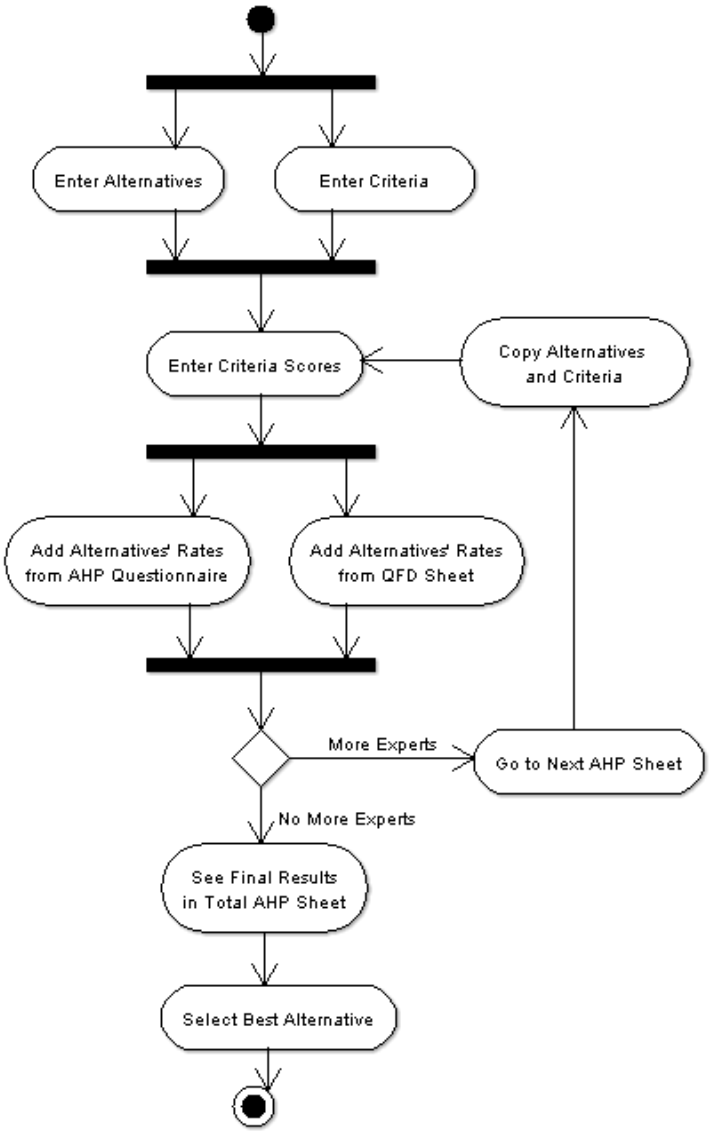

Figure 18 Overview of the process for completing the AHP step

This first part of the AHP process is to complete the spreadsheet tabs from “AHP Q1” till “AHP Q10”, depending on the number of collected questionnaires from the decision makers of the farm.

AHP

1. Enter alternatives in results box (green)	
2. Enter criteria (grey) in all levels	
3. Fill in top row of each criteria matrix (blue) using the following scale:	
1: both criteria of equal importance	0: no criteria for this position
2: left slightly more important than top	1/2: top slightly more important than left
3: left moderately more important than top	1/3: top moderately more important than left
4: left a lot more important than top	1/4: top a lot more important than left
5: left absolutely more important than top	1/5: top absolutely more important than left
4. Fill in top row of each alternatives matrix (blue) using the following scale:	
1: both alternatives of equal value	0: no alternative for this position
2: left slightly better than top	1/2: top slightly better than left
3: left moderately better than top	1/3: top moderately better than left
4: left a lot better than top	1/4: top a lot better than left
5: left absolutely better than top	1/5: top absolutely better than left
5. Check final rating results or if you have more questionnaires go to the next sheet.	

Final Results	
DATS1	
DATS2	
DATS3	

Criteria

Level Two	Techno.	Extern.	Organi.l	Percei.	Cost			
Technology Characteristics								
External Environment								
Organizational Maturity/Internal Environment								
Perceived Benefits								
Cost								

Figure 19 The AHP tab

The top part of the sheet (sheets “AHP Q1” till “AHP Q1”) presents the instructions on how to complete the QFD tabs for each decision maker of the farm involved in the process.

1. Enter alternatives in results box (green)	
2. Enter criteria (grey) in all levels	
3. Fill in top row of each criteria matrix (blue) using the following scale:	
1: both criteria of equal importance	0: no criteria for this position
2: left slightly more important than top	1/2: top slightly more important than left
3: left moderately more important than top	1/3: top moderately more important than left
4: left a lot more important than top	1/4: top a lot more important than left
5: left absolutely more important than top	1/5: top absolutely more important than left
4. Fill in top row of each alternatives matrix (blue) using the following scale:	
1: both alternatives of equal value	0: no alternative for this position
2: left slightly better than top	1/2: top slightly better than left
3: left moderately better than top	1/3: top moderately better than left
4: left a lot better than top	1/4: top a lot better than left
5: left absolutely better than top	1/5: top absolutely better than left
5. Check final rating results or if you have more questionnaires go to the next sheet.	

Figure 20 Instructions on how to complete the tabs from “AHP Q1” to “AHP Q10”

First, the advisor has to add the DATSs promoted through step 1 “Strategic Fit”, completing the green cells.

Final Results	
DATS1	
DATS2	
DATS3	

Figure 21 Area for completing the DATS the passed the first step

Then, the advisor completes the blue cells for each criterion, using the respective value that corresponds to the pairwise comparison of the criteria the same level. Based on that, the relevant weight of each criterion is calculated.

Criteria

Level Two	Techno.	Extern.	Organi.l	Percei.	Cost			
Technology Characteristics	1,0000	0,2500	0,2500	0,2000	0,2000			5,0%
External Environment	4,0000	1,0000	0,3333	0,3333	0,3333			11,2%
Organizational Maturity/Internal Environment	4,0000	3,0000	1,0000	1,0000	3,0000			34,5%
Perceived Benefits	5,0000	3,0000	1,0000	1,0000	1,0000			26,9%
Cost	5,0000	3,0000	0,3333	1,0000	1,0000			22,5%
								100,0%

Level Three Technology Characteristi Matrix	Maturi.	Innova.	Intero.	Level .	Flexib.	mplem.epairabilit		
Maturity – Reliability	1,0000	0,2500	0,2500	0,2000	0,2000	0,2000		0,1%
Innovation	4,0000	1,0000	0,2000	0,2000	3,0000	3,0000		0,9%
Interoperability/Vendor Lock-in	4,0000	5,0000	1,0000	2,0000	2,0000	0,2500		1,1%
Level of Integration/Automation	5,0000	5,0000	0,5000	1,0000	0,5000	0,2000		0,8%
Flexibility	5,0000	0,3333	0,5000	2,0000	1,0000	0,3333		0,5%
Implementation Complexity and Repairability	5,0000	0,3333	4,0000	5,0000	3,0000	1,0000		1,5%

Figure 22 Area for completing the results of the pairwise comparison of the different criteria of each level

After that, for each criterion, the advisor completes the blue cells, using the respective value that corresponds to the pairwise comparison of the alterative DATSs in terms of how well the satisfy this criterion, using a scale of 0,2 to 5. In the case of the criteria “Customers” and “Cooperators”, the adviosrs inserts the scores of the DATSs as resulting from stage 2 (QFD).

Alternatives

Maturity – Reliability	DATS1	DATS2	DATS3			
DATS1	1,0000	1,0000	2,0000			0,001
DATS2	1,0000	1,0000	1,0000			0,000
DATS3	0,5000	1,0000	1,0000			0,000

Innovation	DATS1	DATS2	DATS3			
DATS1	1,0000	1,0000	2,0000			0,004
DATS2	1,0000	1,0000	1,0000			0,003
DATS3	0,5000	1,0000	1,0000			0,002

Interoperability/Vendor Lock-in	DATS1	DATS2	DATS3			
DATS1	1,0000	1,0000	2,0000			0,004
DATS2	1,0000	1,0000	1,0000			0,004
DATS3	0,5000	1,0000	1,0000			0,003

Figure 23 Area for completing the scores of the DATSs for each criterion

The above step leads to the calculation of the final scores for each DATS, for the specific decision maker of the farm. The results are visible as shown in the figure below. The DATS with the highest score is the most suitable for this specific farm.

Final Results	
DATS1	0,536
DATS2	0,255
DATS3	0,209
	1

Figure 24 Assessment results for the specific decision maker of the farm

If there is another decision maker, the next tab (from “AHP 2” to “AHP 10”) is completed in the exact same way. If there is a single decision maker for this farm, this was the end of the process.

When the results from all decision makers are completed, then the advisor goes to the tab “AHP Total”. The number of decision makers involved in the process is completed in the blue cell.

AHP

1. Enter criteria (grey) in all levels
2. Enter alternatives in results box (green)
3. Enter number of completed questionnaires (blue)
5. Check final rating results!

Final Results	
DATS1	0,530
DATS2	0,260
DATS3	0,207
	1

No
2

Figure 25 Assessment results for the specific decision maker of the farm

After that, the final score is calculated. The DATS with the highest score is the one proposed for adoption.

AHP

1. Enter criteria (grey) in all levels
2. Enter alternatives in results box (green)
3. Enter number of completed questionnaires (blue)
5. Check final rating results!

Final Results	
DATS1	0,530
DATS2	0,260
DATS3	0,207
	1

No
2

Figure 26 Assessment results for the specific decision maker of the farm

More than that, the advisor and the farmer(s) can see what was the relevant weight of each criterion after taking into consideration the views of each decision maker. This is useful to understand the internal processes, views and dynamics within the farm.

Level Two	Techno.	Extern.	Organi.l	Percei.	Cost			
Technology Characteristics	1,0000	0,2500	0,6250	0,2000	0,2000			**0,067**
External Environment	4,0000	1,0000	0,6667	0,3333	0,3333			**0,134**
Organizational Maturity/Internal Environment	2,5000	2,0000	1,0000	1,0000	3,0000			**0,297**
Perceived Benefits	5,0000	3,0000	1,0000	1,0000	1,0000			**0,268**
Cost	5,0000	3,0000	0,3333	1,0000	1,0000			**0,234**
								1,000
Sub-Criteria								
Technology Characteristi Matrix	Maturi.	Innova.	Intero.	Level .	Flexib.	F1		
Maturity – Reliability	1,0000	0,2500	0,2500	0,2000	0,2000	0,2000		**0,002**
Innovation	4,0000	1,0000	0,2000	1,1000	3,0000	3,0000		**0,014**
Interoperability	4,0000	5,0000	1,0000	2,0000	2,0000	0,2500		**0,016**
Level of Integration	5,0000	2,7500	0,5000	1,0000	0,5000	0,2000		**0,009**
Flexibility	5,0000	0,3333	0,5000	2,0000	1,0000	0,3333		**0,007**
F1	5,0000	0,3333	4,0000	5,0000	3,0000	1,0000		**0,020**
								0,067

Figure 27 Assessment results for the specific decision maker of the farm

This is the end of the process.