WP4 – METHODOLOGY TO MONITOR AND ASSESS SOIL-IMPROVING CS IN STUDY SITES

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Objectives of WP4

The main objectives of WP4 is to develop a comprehensive methodology for assessing both benefits and drawbacks of different CS, which will serve for **monitoring** as well as **evaluation** purposes

WP4 – Deliverables

D4.1 – Final version of Assessment methodology for Study Sites [Month 52] → 30 November

D4.2 – Monitoring plan for Study Sites [Month 24]

First version : 21 March 2018
Second version : 12 March 2019

Monitoring

Work done

Sociocultural dimension

- Collect filled-out questionnaires 2019
- Data analysis (done)

Economic dimension

- Collect filled-out data sheets 2019
- Data analysis (in progress)

WP4

D4.1 – Final version of Assessment methodology for Study Sites [November 2020]

The aim is to **determine whether SICS is a success**

We should consider:

Benefits	all aspects recorded positive for the SICS (regarding the 3 dimensions)
Drawbacks	all aspects recorded negative for the SICS (regarding the 3 dimensions)
Profitability	Cost and benefits
Soil quality	defined by biological, chemical, and physical properties
Sustainability =	Overall sustainability

SoilCare deliverables – new dates

Number	Deliverable name	Work package number	Lead participant	Type	Dissemination level	Delivery month	Delivery date	New date
D4.1	Final version of assessment methodology for Study Sites	4	UNIBE	R	CO	52	30 June 2020	30 Nov 2020
D5.1	Database with monitoring data	5	KUL	R	CO	50	30 April 2020	30 Nov 2020

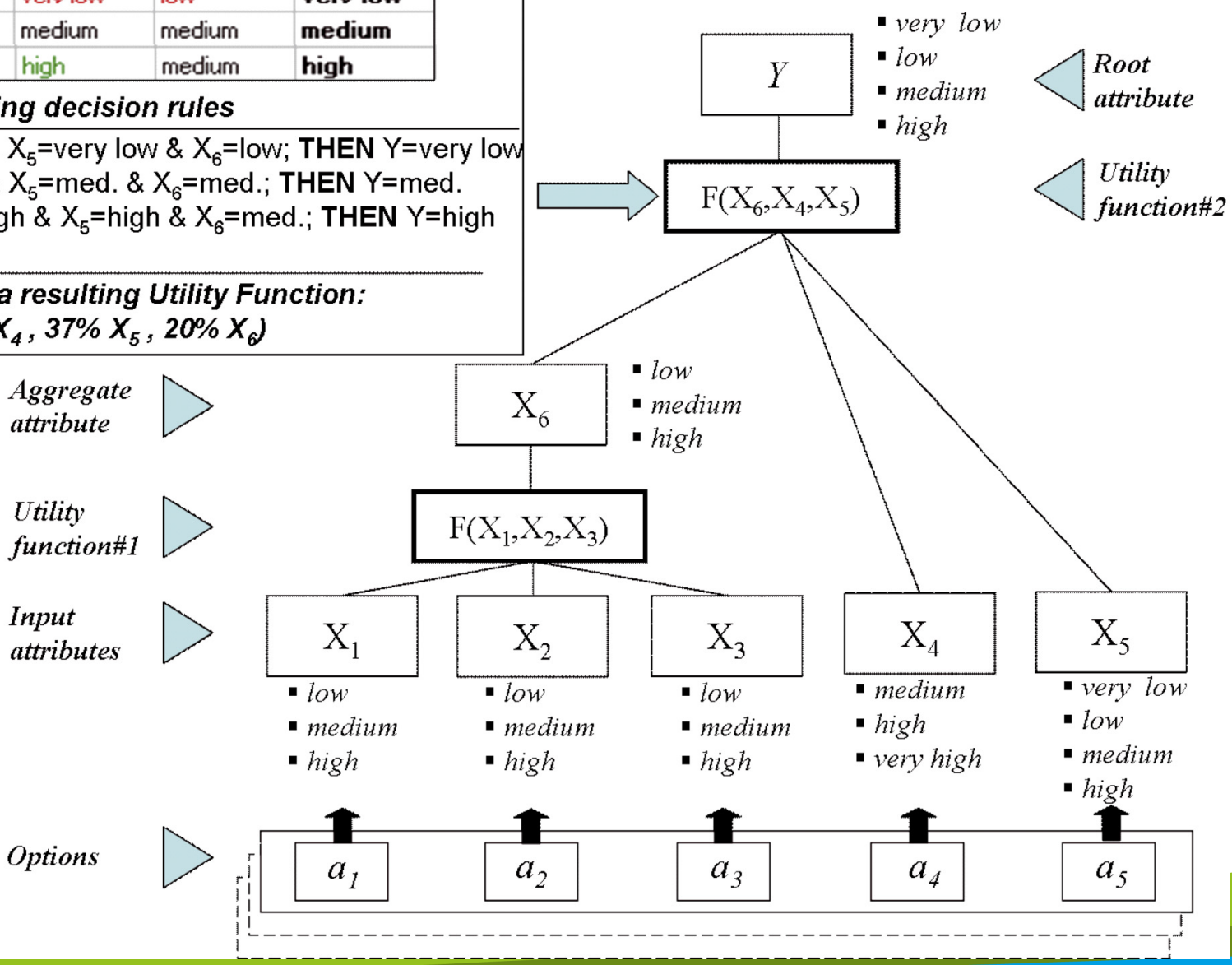
Example of a decision table (DEXi display)

	X4	X5	X6	Y
1	medium	very low	low	**very low**
8	medium	medium	medium	**medium**
35	very high	high	medium	**high**

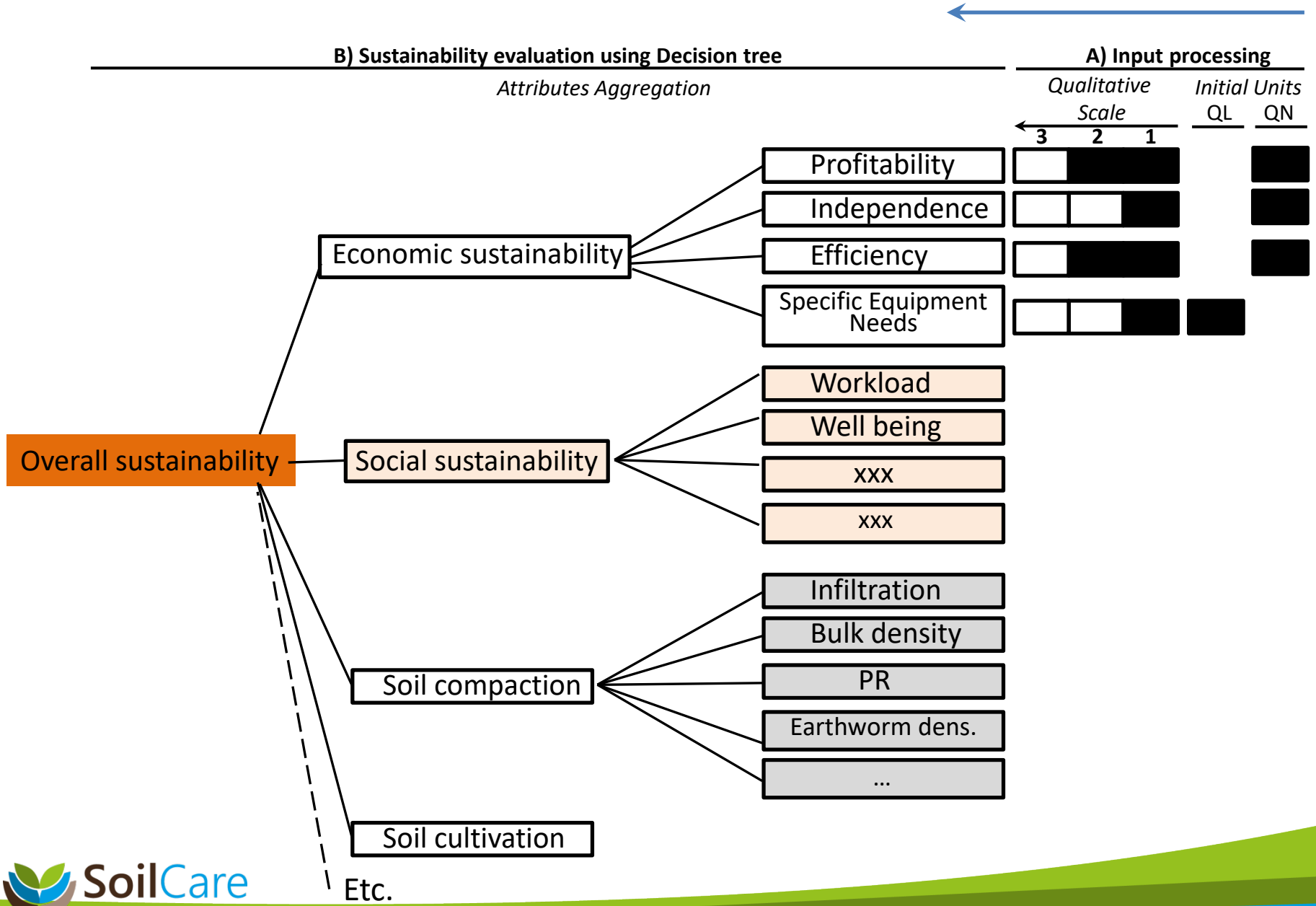
Corresponding decision rules

IF X_4=med. & X_5=very low & X_6=low; **THEN** Y=very low
IF X_4=med. & X_5=med. & X_6=med.; **THEN** Y=med.
IF X_4=very high & X_5=high & X_6=med.; **THEN** Y=high
ETC...

Example of a resulting Utility Function:
Y = F (43% X_4 , 37% X_5 , 20% X_6)



Sadok et al., 2009 - Agronomy for Sustainable Development


B) Sustainability evaluation using Decision tree
Attributes Aggregation
A) Input processing
Qualitative Scale
3
2
1
Initial Units
QL
QN
Overall sustainability
Economic sustainability
Profitability
Independence
Efficiency
Specific Equipment Needs
Social sustainability
Workload
Well being
xxx
xxx
Soil compaction
Infiltration
Bulk density
PR
Earthworm dens.
...
Soil cultivation
Etc.

General concept

To establish the index of overall sustainability, the following steps are defined:

- Qualitative multi-criteria model: based on criteria that are hierarchically organized into a decision tree.
- Criteria are being aggregated in order to assess the three dimensions of sustainability (economic, social and environmental)
- Basic criteria which correspond to the inputs of the decision tree (filled thanks to specific indicators). Aggregated criteria which are located at a higher level in the hierarchical tree, depending on those at lower levels.
- Aggregations are based on weights (%) according to utility functions defined by “If-Then” decision rules.

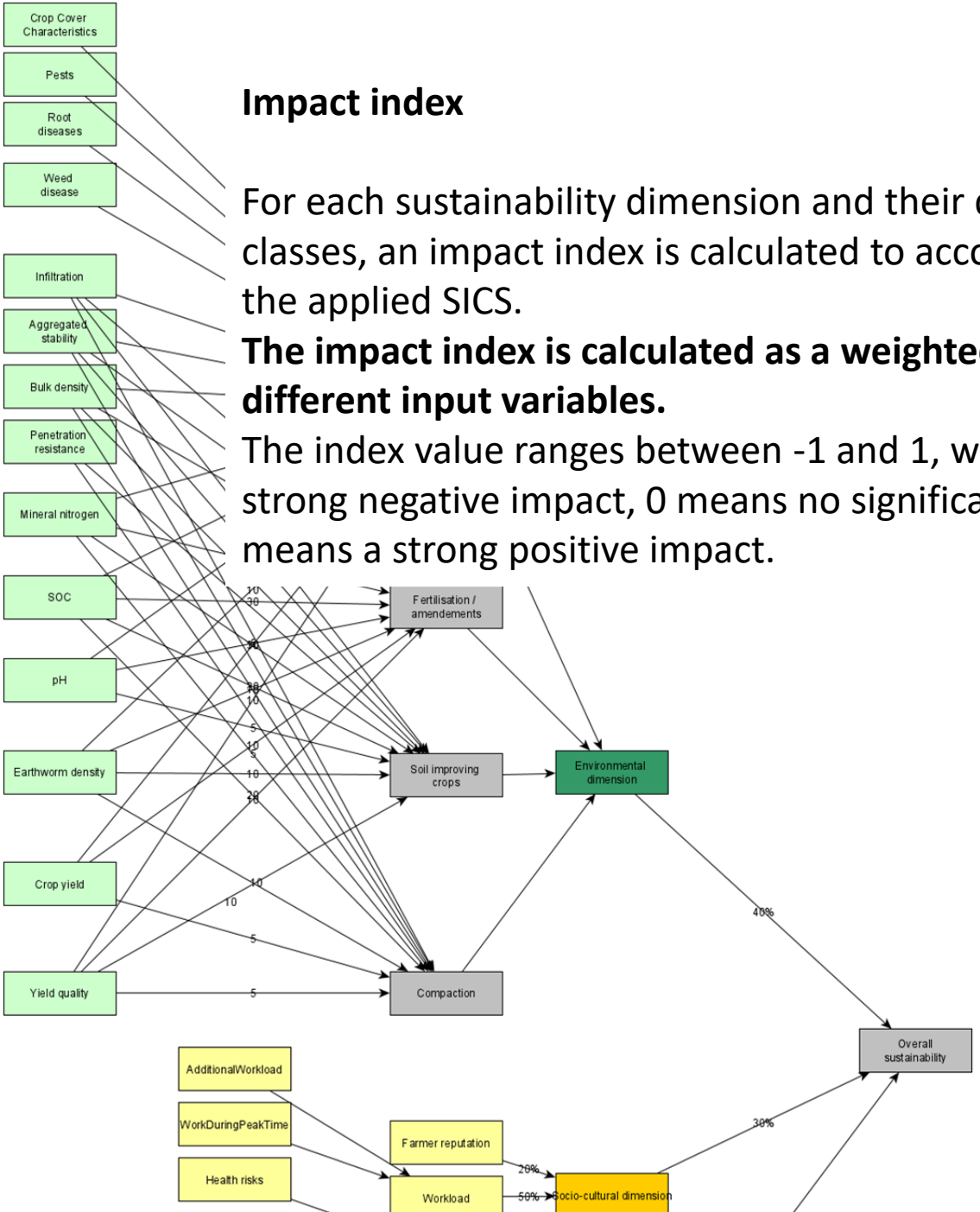
Variable	WeighInSoilcultivation	WeighInFertilisation	WeighInSoilImprovingCro	WeighInCompaction
Infiltration	0.02	0.02	0.05	0.1
AggregateStability	0	0.01	0.05	0.1
BulkDensity	0.01	0.01	0.05	0.1
PenetrationResistance	0	0	0	0.1
MineralNitrogen	0.05	0.15	0.05	0.05
SOC	0.05	0.15	0.05	0.05
pH	0	0.05	0.05	0.05
EarthwormDensity	0.05	0.05	0.05	0.05
CropYield	0.2	0.05	0.05	0.05
YieldQuality	0.05	0.05	0.05	0.05
HealthRisks	0	0.02	0.05	0
CropFailure	0.15	0.05	0.05	0.05
Conflicts	0.02	0.02	0.05	0
EconomicRisk	0.05	0.02	0.05	0.05
OtherRisks	0.05	0.05	0.05	0
AdditionalWorkload	0.05	0.05	0.05	0.05
WorkDuringPeakTime	0.05	0.05	0.05	0
FarmerReputation	0.05	0.05	0.05	0
CostBenefit	0.1	0.1	0.1	0.1
CropCoverCharacteristics	0.05	0.05	0.05	0.05
Pests	0	0	0	0
RootDiseases	0	0	0	0
WeedDiseases	0	0	0	0
Check sum	1	1	1	1

Impact index

For each sustainability dimension and their different indicator classes, an impact index is calculated to account for the impact of the applied SICS.

The impact index is calculated as a weighted mean of the different input variables.

The index value ranges between -1 and 1, whereas -1 means a strong negative impact, 0 means no significant impact, and +1 means a strong positive impact.



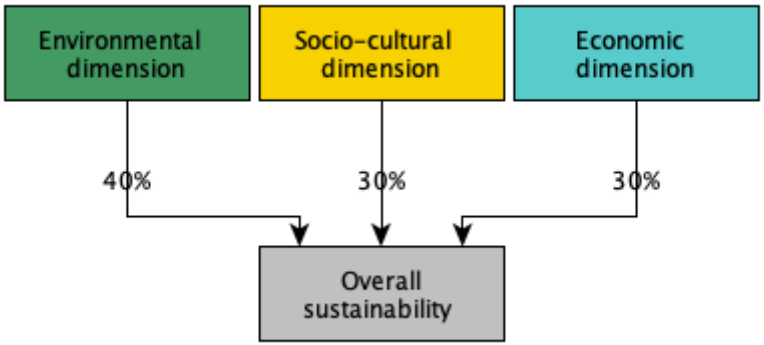
Overall sustainability

The environmental dimension is subdivided into different indicator categories. On the one hand, we calculate an impact index according to the different clusters (i.e. Soil cultivation, Fertilisation, Soil improving crops, and compaction) and, on the other hand, we calculate an impact index for the different properties (i.e. Physical properties, Chemical properties, and Biological properties). In addition, an impact index for the soil quality is calculated.

The socio-cultural dimension is subdivided into different indicator categories (i.e. Workload, Perceived risks, and Farmer reputation). The economic dimension, in contrast, consists only of a single indicator (i.e. cost benefit).

Economic dimension is assessed by the cost & benefit.

The overall sustainability is being calculated based on the results of the three sustainability dimensions according to the following weighing factors.



Input data – General description

Case study

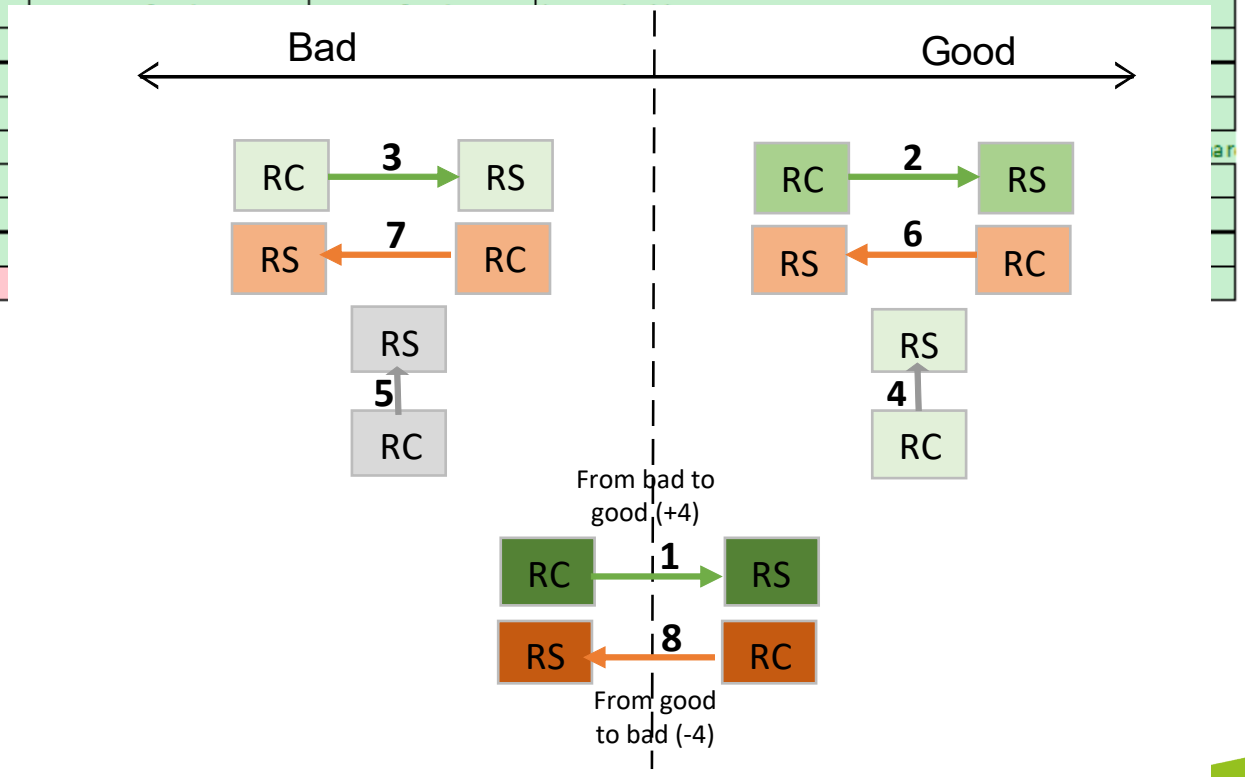
Study site	4. Frauenfeld, CH
Managing organisation	UBERN (9)
Proposed clustering	Compaction

Description	Grass stripes
Database code	UNIBE_EX1

Input data – Environmental dimension

Indicators	Significant difference	Rating control group	Rating SICS group	Measurement method
Infiltration	Positive change	Bad	Good	Double ring
Aggregate stability	No change	Good	Good	Wet sieving
Bulk density	Negative change	Good	Good	Core method-ISO11272
Penetration resistance	Positive change	Good	Good	Penetrometer Eijkelkamp
Mineral nitrogen	Positive change	Good	Good	Continuous flow analysis (ISO7150-2
SOC	Positive change			
pH	Positive change			
Earthworm density	Positive change			
Crop yield	Positive change			
Yield quality	Positive change			
Crop cover characteristics	Positive change			
Pests	Positive change			
Root diseases	Positive change			
Weed diseases	Negative change			

WP5



Input data – Sociocultural dimension

Sociocultural change is difficult to quantify and measure. Therefore, WP4 opted for a qualitative approach with semi-structured interviews.

The questionnaire covers the following topics:

1. Division of labour and impact on workload (gender disaggregated)
2. Perceived risks of SICS
3. SICS' influence on social relations and farmer reputation
4. Knowledge exchange on SICS
5. Perceived most positive and most negative changes of SICS implementation

Input data – Sociocultural dimension

Did the SICS testing/implementation affect the workload of women and men? To what extent?

- ✓ Yes, workload decreased strongly
- ✓ Yes, workload decreased slightly
- ✓ No, no change in workload
- ✓ Yes, workload increased slightly
- ✓ Yes, workload increased strongly

If the workload changed, did the change occur during peak time?

- ✓ Yes, workload changed at work peaktime
- ✓ No, workload changed at work lowtime

Input data – Sociocultural dimension

Do you perceive any risks that go along with the tested SICS? Please specify

- ✓ Health risk
  - Yes, potential health risk
  - No, no potential health risk
- ✓ Economic risk
  - Yes, potential economic risk
  - No, no potential economict risk
- ✓ Risk of crop failure
  - Yes, potential risk of crop failure
  - No, no potential risk of crop failure
- ✓ Risk of conflicts (with neighbours, withing community, etc.)
  - Yes, potential risk of conflicts
  - No, no potential risk of conflicts
- ✓ Any other risks
  - Yes, other potential risks
  - No, no other potential risks

Input data – Sociocultural dimension

Does the farmer reputation change due to the SICS implementation?

- Yes, farmer reputation improved
- No, farmer reputation did not change
- Yes, farmer reputation worsened

Input data – Economic dimension

Impact of SICS: Is there a significant difference in the cost-benefit between the control group and the SICS group? If yes, performs SICS better (positive change) or worse (negative change) than the control group?

Cost-benefit	Positive change
	No change
	Negative change
	No data

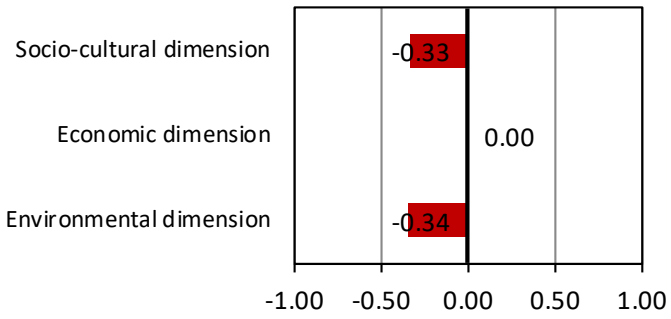
Outcomes of the Assessment tool
Environmental dimension

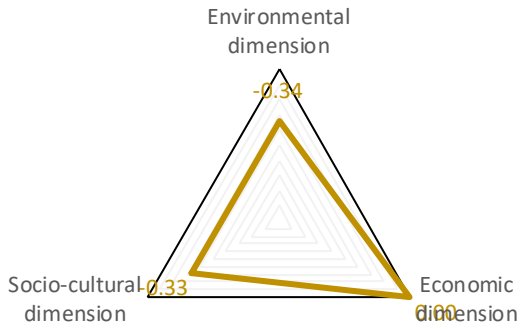
Environmental data

Indicator	Impact evaluation
Infiltration	From good to less good (-2)
Aggregate stability	From good to better (+3)
Bulk density	From bad to good (+4)
Penetration resistance	From bad to less bad (+2)
Mineral nitrogen	No change and good (+1)
SOC	No change and good (+1)
pH	No change and bad (-1)
Earthworm density	No change and bad (-1)
Crop yield	From good to less good (-2)
Yield quality	From good to bad (-4)
Crop cover characteristics	From bad to worse (-3)
Pests	From bad to worse (-3)
Root diseases	From good to better (+3)
Weed diseases	From good to bad (-4)

Overall sustainability

	Impact index -1 = Strong negative impact (red) 0 = No significant impact (white) 1 = Strong positive impact (green)
Sustainability	-0.24
Environmental dimension	-0.34
Economic dimension	0.00
Socio-cultural dimension	-0.33

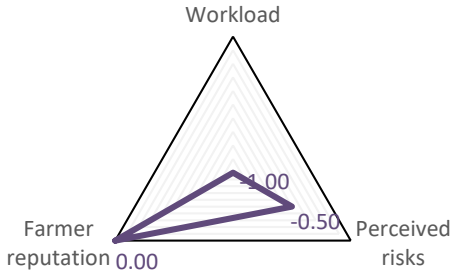


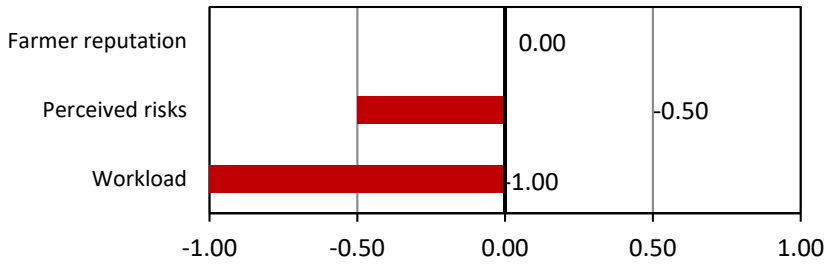


Outcomes of the Assessment tool
Sociocultural dim

Sociocultural data

	Impact index
	-1 = Strong negative impact (red) 0 = No significant impact (white) 1 = Strong positive impact (green)
Socio-cultural dimension	-0.33
Workload	-0.66
Perceived risks	0.00
Farmer reputation	, farmer reputation did not chan





Environmental dimension

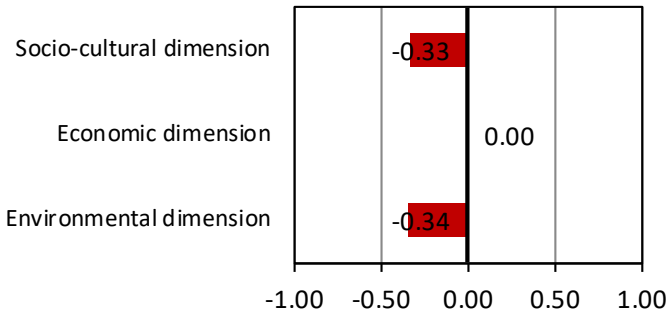
	Impact index -1 = Strong negative impact (red) 0 = No significant impact (white) 1 = Strong positive impact (green)	Method index (MI) 1 = Result are based on recommended methods 0 = Results are not based on recommended methods	Method rating MI > 0.8: Very good 0.8 >= MI > 0.6: Good 0.6 >= MI > 0.4: Acceptable MI <= 0.4: Insufficient
Envrionmental dimention	-0.34	0.48	Acceptable
Clusters			
Soil cultivation	-0.57	0.33	Insufficient
Fertilisation	-0.24	0.65	Good
SoilImprovingCrops	-0.40	0.35	Insufficient
Compaction	0.20	0.80	Good
Properties			
Physical properties	-0.57	0.33	Insufficient
Chemical properties	-0.24	0.65	Good
Biological properties	-0.40	0.35	Insufficient
Soil quality	-0.43	0.36	Insufficient

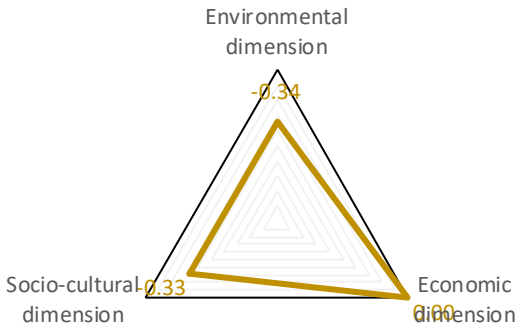
From the applied measurement methods, 7 out of 14 were recommended (50.0%)

Outcomes of the Assessment tool
Overall sustainability

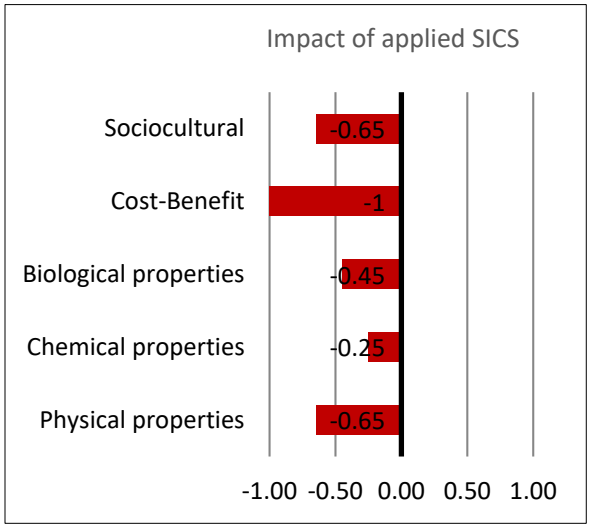
Overall sustainability

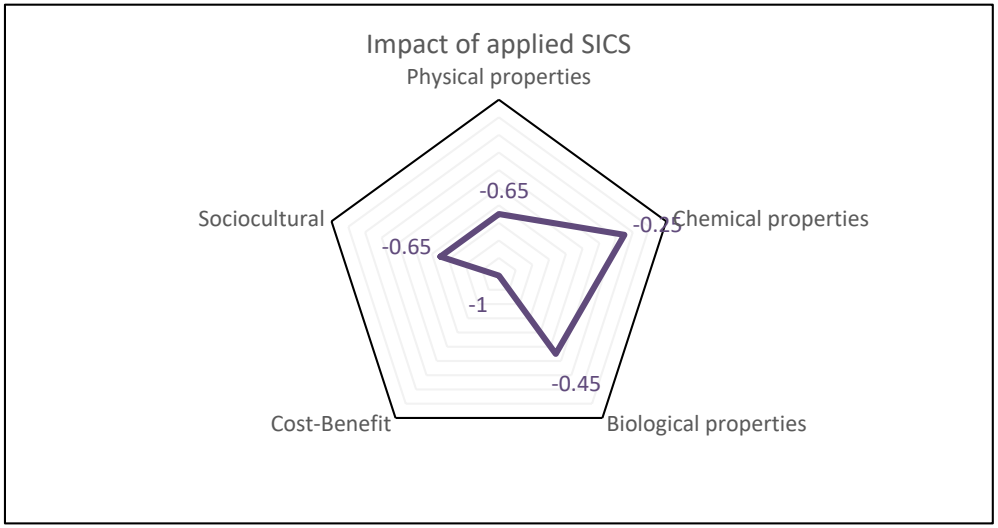
	Impact index -1 = Strong negative impact (red) 0 = No significant impact (white) 1 = Strong positive impact (green)
Sustainability	-0.24
Environmental dimension	-0.34
Economic dimension	0.00
Socio-cultural dimension	-0.33





Outcomes of the Assessment tool
Synthesis





Request from CSS leaders

Send the completed questionnaires of costs and benefits by end of **September 2020**

- Environmental data necessary for the assessment will be provided by WP5
- Remaining questions on the methodology used and economic dim:
  CSS leaders → Abdallah
- Threshold values for each indicator, I will contact all of you for help.

THANK YOU!

SoilCare