
Circular Performance Indicators Validation Questionnaire

Respondent Identity

Name :

Address :

Age :

Gender :

Profession :

1. Please choose in what field do you work

- ☐ Government (Village/District/Regency)
- ☐ Farm
- ☐ Private
- ☐ Media
- ☐ Academics
- ☐ Other....

2. Please give a score to the indicator below (score 1 –disagree, 2 – agree, 3 – strongly agree)

Category	Indicators	Description	Score (1 to 3)
Regeneration of natural resources	Water quality improvement	Shows improvement of water quality at local level	
	Soil quality improvement	Evaluate the actual improvement of soil conditions at the local level	
	Contributes to phosphorus balance	Evaluate the performance of the phosphorus cycle by demonstrating a local surplus of P	
	Contributes to nitrogen balance	Evaluate the performance of the nitrogen cycle by demonstrating a local surplus of N	
	Income/savings from natural resource regeneration	Denotes income or savings from the regeneration of natural capital at the local level	
Maintain resource usage	Circular Index (CI)	Evaluate the circularity of products/re-resources/materials based on two indicators of Circular Use and Circular Flow	-
	Circular Use (CU)	Consider the contribution of life cycle extension, sharing and "product as a service" for circularity	
	Circular Flow (CF)	Maximum Achievable Turnover	
	Income/savings from maintaining resource usage	Savings from the implementation of circularity both at the local and organizational/sectoral levels	
Waste management	Additional income/income from the processing of livestock waste	Savings and income from minimizing negative externalities	
	Total waste reduction	Measures the waste reduction achieved in the system due to circular action	
	Total reduction of soil pollution	Measures the reduction in soil contamination achieved in the system due to circular action	
	Total reduction of water pollution	Measures the reduction in water pollution achieved in the system due to circular action	
	Waste Index (WAI)	A measure of the ratio of resources consumed that are returned as waste to disposal	

Assessment of Relations Between Variables/Indicators by Expert

Name :

Institution :

1. Assessment guide

The following symbols (V,A,X,O) are symbols for assessing the intended variable.

	Relations Between Variables	Description
V	$i \rightarrow j$	Variable i is more influential / influencing variable j
A	$j \rightarrow i$	Variable j has more influence/influence on variable i
X	$i \leftrightarrow j$	Variables i and j influence each other
O	$i \times j$	Variables i and j are not related

2. In your opinion, in the management of solid waste on dairy farms at Taruna Mukti Farmer Group, what is the relationship between the variables below? Please put a check mark (✓) on one of the symbols (columns that are blocked in gray do not need to be filled in).

i	Indicator	V	A	X	O	Indicators	j
A1	Water quality improvement					Soil quality improvement	A2
						Contributes to phosphorus balance	A3
						Contribute to nitrogen balance	A4
						Income/savings from natural resource re-generation	A5
						Circular Index (CI)	B1
						Circular Use (CU)	B2
						Circular Flow (CF)	B3
						Income/savings from keeping resources in use	B4
						Additional income/revenue from the processing of livestock waste	C1
						Total waste reduction	C2
						Total reduction in soil pollution	C3
						Total reduction in water pollution	C4
						Waste Index (WAI)	C5

i	Indicator	V	A	X	O	Indicators	j
A2	Soil quality improvement					Water quality improvement	A1
						Contributes to phosphorus balance	A3
						Contribute to nitrogen balance	A4
						Income/savings from natural resource re-generation	A5
						Circular Index (CI)	B1
						Circular Use (CU)	B2
						Circular Flow (CF)	B3
						Income/savings from keeping resources in use	B4
						Additional income/revenue from the processing of livestock waste	C1
						Total waste reduction	C2
						Total reduction in soil pollution	C3
						Total reduction in water pollution	C4
						Waste Index (WAI)	C5

i	Indicator	V	A	X	O	Indicators	j
A3	Contributes to phosphorus balance					Water quality improvement	A1
						Soil quality improvement	A2
						Contribute to nitrogen balance	A4
						Income/savings from natural resource re-generation	A5
						Circular Index (CI)	B1
						Circular Use (CU)	B2
						Circular Flow (CF)	B3
						Income/savings from keeping resources in use	B4
						Additional income/revenue from the processing of livestock waste	C1
						Total waste reduction	C2
						Total reduction in soil pollution	C3
						Total reduction in water pollution	C4
						Waste Index (WAI)	C5

i	Indicator	V	A	X	O	Indicators	j
A4	Contribute to nitrogen balance					Water quality improvement	A1
						Soil quality improvement	A2
						Contributes to phosphorus balance	A3
						Income/savings from natural resource re-generation	A5
						Circular Index (CI)	B1
						Circular Use (CU)	B2
						Circular Flow (CF)	B3
						Income/savings from keeping resources in use	B4
						Additional income/revenue from the processing of livestock waste	C1
						Total waste reduction	C2
						Total reduction in soil pollution	C3
						Total reduction in water pollution	C4
						Waste Index (WAI)	C5

i	Indicator	V	A	X	O	Indicators	j
A5	Income/savings from natural resource regeneration					Water quality improvement	A1
						Soil quality improvement	A2
						Contributes to phosphorus balance	A3
						Contribute to nitrogen balance	A4
						Circular Index (CI)	B1
						Circular Use (CU)	B2
						Circular Flow (CF)	B3
						Income/savings from keeping resources in use	B4
						Additional income/revenue from the processing of livestock waste	C1
						Total waste reduction	C2
						Total reduction in soil pollution	C3
						Total reduction in water pollution	C4
						Waste Index (WAI)	C5

i	Indicator	V	A	X	O	Indicators	j
B1	Circular Index (CI)					Water quality improvement	A1
						Soil quality improvement	A2
						Contributes to phosphorus balance	A3
						Contribute to nitrogen balance	A4
						Income/savings from natural resource re-generation	A5
						Circular Use (CU)	B2
						Circular Flow (CF)	B3
						Income/savings from keeping resources in use	B4
						Additional income/revenue from the processing of livestock waste	C1
						Total waste reduction	C2
						Total reduction in soil pollution	C3
						Total reduction in water pollution	C4
						Waste Index (WAI)	C5

i	Indicator	V	A	X	O	Indicators	j
B2	Circular Use (CU)					Water quality improvement	A1
						Soil quality improvement	A2
						Contributes to phosphorus balance	A3
						Contribute to nitrogen balance	A4
						Income/savings from natural resource re-generation	A5
						Circular Index (CI)	B1
						Circular Flow (CF)	B3
						Income/savings from keeping resources in use	B4
						Additional income/revenue from the processing of livestock waste	C1
						Total waste reduction	C2
						Total reduction in soil pollution	C3
						Total reduction in water pollution	C4
						Waste Index (WAI)	C5

i	Indicator	V	A	X	O	Indicators	j
B3	Circular Flow (CF)					Water quality improvement	A1
						Soil quality improvement	A2
						Contributes to phosphorus balance	A3
						Contribute to nitrogen balance	A4
						Income/savings from natural resource re-generation	A5
						Circular Index (CI)	B1
						Circular Use (CU)	B2
						Income/savings from keeping resources in use	B4
						Additional income/revenue from the processing of livestock waste	C1
						Total waste reduction	C2
						Total reduction in soil pollution	C3
						Total reduction in water pollution	C4
						Waste Index (WAI)	C5

i	Indicator	V	A	X	O	Indicators	j
B4	Income/savings from keeping resources in use					Water quality improvement	A1
						Soil quality improvement	A2
						Contributes to phosphorus balance	A3
						Contribute to nitrogen balance	A4
						Income/savings from natural resource re-generation	A5
						Circular Index (CI)	B1
						Circular Use (CU)	B2
						Circular Flow (CF)	B3
						Additional income/revenue from the processing of livestock waste	C1
						Total waste reduction	C2
						Total reduction in soil pollution	C3
						Total reduction in water pollution	C4
						Waste Index (WAI)	C5

i	Indicator	V	A	X	O	Indicators	j
C1	Additional income/revenue from the processing of live-stock waste					Water quality improvement	A1
						Soil quality improvement	A2
						Contributes to phosphorus balance	A3
						Contribute to nitrogen balance	A4
						Income/savings from natural resource re-generation	A5
						Circular Index (CI)	B1
						Circular Use (CU)	B2
						Circular Flow (CF)	B3
						Income/savings from keeping resources in use	B4
						Total waste reduction	C2
						Total reduction in soil pollution	C3
						Total reduction in water pollution	C4
						Waste Index (WAI)	C5

i	Indicator	V	A	X	O	Indicators	j
C2	Total waste reduction					Water quality improvement	A1
						Soil quality improvement	A2
						Contributes to phosphorus balance	A3
						Contribute to nitrogen balance	A4
						Income/savings from natural resource re-generation	A5
						Circular Index (CI)	B1
						Circular Use (CU)	B2
						Circular Flow (CF)	B3
						Income/savings from keeping resources in use	B4
						Additional income/revenue from the processing of livestock waste	C1
						Total reduction in soil pollution	C3
						Total reduction in water pollution	C4
						Waste Index (WAI)	C5

i	Indicator	V	A	X	O	Indicators	j
C3	Total reduction in soil pollution					Water quality improvement	A1
						Soil quality improvement	A2
						Contributes to phosphorus balance	A3
						Contribute to nitrogen balance	A4
						Income/savings from natural resource re-generation	A5
						Circular Index (CI)	B1
						Circular Use (CU)	B2
						Circular Flow (CF)	B3
						Income/savings from keeping resources in use	B4
						Additional income/revenue from the processing of livestock waste	C1
						Total waste reduction	C2
						Total reduction in water pollution	C4
						Waste Index (WAI)	C5

i	Indicator	V	A	X	O	Indicators	j
C4	Total reduction in water pollution					Water quality improvement	A1
						Soil quality improvement	A2
						Contributes to phosphorus balance	A3
						Contribute to nitrogen balance	A4
						Income/savings from natural resource re-generation	A5
						Circular Index (CI)	B1
						Circular Use (CU)	B2
						Circular Flow (CF)	B3
						Income/savings from keeping resources in use	B4
						Additional income/revenue from the processing of livestock waste	C1
						Total waste reduction	C2
						Total reduction in soil pollution	C3
						Waste Index (WAI)	C5

Interpretive Structure Modelling Result

1. VAXO Assessment Results by expert

	[,1]	[,2]	[,3]	[,4]	[,5]	[,6]	[,7]	[,8]	[,9]	[,10]	[,11]	[,12]	[,13]	[,14]
[1,]	NA	"X"	"A"	"A"	"V"	"X"	"X"	"X"	"A"	"V"	"A"	"A"	"X"	"X"
[2,]	NA	NA	"A"	"A"	"V"	"O"	"O"	"V"	"A"	"X"	"A"	"A"	"A"	"A"
[3,]	NA	NA	NA	"X"	"A"	"O"	"O"	"V"	"O"	"A"	"A"	"A"	"A"	"X"
[4,]	NA	NA	NA	NA	"O"	"O"	"O"	"X"	"O"	"X"	"X"	"A"	"A"	"X"
[5,]	NA	NA	NA	NA	NA	"X"	"X"	"X"	"A"	"A"	"V"	"A"	"A"	"X"
[6,]	NA	NA	NA	NA	NA	NA	"X"	"X"	"A"	"A"	"A"	"X"	"X"	"X"
[7,]	NA	NA	NA	NA	NA	NA	NA	"X"	"A"	"A"	"X"	"X"	"X"	"X"
[8,]	NA	NA	NA	NA	NA	NA	NA	NA	"A"	"A"	"X"	"X"	"X"	"X"
[9,]	NA	NA	NA	NA	NA	NA	NA	NA	NA	"A"	"X"	"X"	"X"	"O"
[10,]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	"V"	"V"	"V"	"V"
[11,]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	"V"	"X"	"X"
[12,]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	"V"	"V"
[13,]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	"X"
[14,]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

2. Results of Substitution Value of Each Variable (Initial reachability matrix)

	[,1]	[,2]	[,3]	[,4]	[,5]	[,6]	[,7]	[,8]	[,9]	[,10]	[,11]	[,12]	[,13]	[,14]
[1,]	1	1	0	0	1	1	1	1	0	1	0	0	1	1
[2,]	1	1	0	0	1	0	0	1	0	1	0	0	0	0
[3,]	1	1	1	1	0	0	0	1	0	0	0	0	0	1
[4,]	1	1	1	1	0	0	0	1	0	1	1	0	0	1
[5,]	0	0	1	0	1	1	1	1	0	0	1	0	0	1
[6,]	1	0	0	0	1	1	1	1	0	0	0	1	1	1
[7,]	1	0	0	0	1	1	1	1	0	0	1	1	1	1
[8,]	1	0	0	1	1	1	1	1	0	0	1	1	1	1
[9,]	1	1	0	0	1	1	1	1	1	0	1	1	1	0
[10,]	0	1	1	1	1	1	1	1	1	1	1	1	1	1
[11,]	1	1	1	1	0	1	1	1	1	0	1	1	1	1
[12,]	1	1	1	1	1	1	1	1	1	0	0	1	1	1
[13,]	1	1	1	1	1	1	1	1	1	0	1	0	1	1
[14,]	1	1	1	1	1	1	1	1	0	0	1	0	1	1

3. Final reachability matrix

	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4	C5
A1	1	1	0	0	1	1	1	1	0	1	1	1	1	1
A2	1	1	0	0	1	1	1	1	0	1	1	1	1	1
A3	1	1	1	1	0	0	0	1	0	1	1	1	1	1
A4	1	1	1	1	0	0	0	1	0	1	1	1	1	1
A5	0	0	1	0	1	1	1	1	0	0	1	1	1	1
B1	1	0	0	0	1	1	1	1	0	0	1	1	1	1
B2	1	0	0	0	1	1	1	1	0	0	1	1	1	1
B3	1	0	0	1	1	1	1	1	0	0	1	1	1	1
B4	1	1	0	0	1	1	1	1	1	0	1	1	1	1
C1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
C2	1	1	1	1	0	1	1	1	1	0	1	1	1	1
C3	1	1	1	1	1	1	1	1	1	0	0	1	1	1
C4	1	1	1	1	1	1	1	1	1	0	1	0	1	1
C5	1	1	1	1	1	1	1	1	0	0	1	0	1	1

4. Canonical matrix

	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4	C5	DriverPower	Rank	Dependence
A1	1	1	0	0	1	1	1	1	0	1	1	1	1	1	11	3	12
A2	1	1	0	0	1	1	1	1	0	1	1	1	1	1	11	3	10
A3	1	1	1	1	0	0	0	1	0	1	1	1	1	1	10	4	8
A4	1	1	1	1	0	0	0	1	0	1	1	1	1	1	10	4	8
A5	0	0	1	0	1	1	1	1	0	0	1	1	1	1	9	5	11
B1	1	0	0	0	1	1	1	1	0	0	1	1	1	1	9	5	12
B2	1	0	0	0	1	1	1	1	0	0	1	1	1	1	9	5	12
B3	1	0	0	1	1	1	1	1	0	0	1	1	1	1	10	4	14
B4	1	1	0	0	1	1	1	1	1	0	1	1	1	1	11	3	5
C1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	13	1	5
C2	1	1	1	1	0	1	1	1	1	0	1	1	1	1	12	2	13
C3	1	1	1	1	1	1	1	1	1	0	0	1	1	1	12	2	12
C4	1	1	1	1	1	1	1	1	1	0	1	0	1	1	12	2	14
C5	1	1	1	1	1	1	1	1	0	0	1	0	1	1	11	3	14

5. MICMAC Analysis

