Sustainability assessment of farming systems in the Philippines with the RISE tool

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

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12.04.2018

f Applied Sciences

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RISE (Response-Inducing Sustainability Evaluations)

Contents

List of Abbreviation

ATI	Agricultural Training Institute – Regional Training Center VIII
CA	Conservation agriculture
DS	Degree of sustainability
GJ	Giga joule
ha	Hectare
HACCP	Hazard Analysis and Critical Control Points
HAFL	School of Agricultural, Forest and Food Sciences (Bern University of Applied Sciences)
LLU	Large livestock unit
PCA	Philippian Coconut Authority
PPP	Plant protection product
RISE	Response-Inducing Sustainability Evaluation
SGS	Société Générale de Surveillance

Acknowledgement

I would like to thank Karlheinz Riedel and Emiel XY, from the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH for the perfect and flexible organization of the RISE assessments. Thanks also to Vilma M. Patindol, Center Director of the Agricultural Training Institute - Regional Training Center VIII in VSU, Visca, Baybay City, Leyte for her interest in the topic of sustainable agriculture and her great support.

Thanks also to the participating farmers and farm managers for their collaboration, openness and confidence.

I am also grateful to my colleague Laura Jakobeit and Rebekka Wyss of the RISE team at HAFL for their backstopping and valuable discussions of the results.

1 Introduction

1.1 Objectives of this study

The Sector Project Sustainable Agriculture in cooperation with GIZ Philippines and the Agricultural Training Institute (ATI) conducted RISE analyses with the objective to compare different production systems in the Philippian provinces Leyte and Southern Leyte.

The aim was to

a) evaluate different production systems, and

b) identify sustainability issues to be integrated in the extension service.

Four systems were selected (five LER-ATI learning site-farms, one KAANIB PCA model farm, three irrigated rice farms in Southern Leyte, one SC Global coconut farm). The final choice of systems and treatments was decided locally with ATI and GIZ Philippines. Staff of GIZ Philippines and of ATI partner organization were trained on the job in the application of the RISE tool.

1.2 Sustainable development and sustainable agriculture

The vision of a sustainable development that satisfies human needs in a fair manner, while maintaining the integrity of natural ecosystems, politically emanates from the 1987 report “Our common future” of the World Commission on Environment and Development (WCED, 1987). It was globally legitimated through the 1992 United Nations Conference on Environment and Development in Rio de Janeiro and a continuing follow-up process. One of the 1992 summit ‘s major outcomes, Agenda 21, includes a whole chapter (Chapter 14) on sustainable agriculture and rural development.

Sustainable development in the agricultural sector is “characterized by an appropriate balance between food self-sufficiency and food self-reliance, employment and income generation in rural areas, and natural resource conservation and environment protection” (FAO Council, 1989). Such development will likely not be realized through a single technology or type of production, but can be realized through different pathways, adapted to the respective local circumstances (FAO-NRDD, 2012). At the level of a single farm or company, sustainability translates into managing the enterprise with a long-term and multi-dimensional view on the use of natural, human and financial resources. In processing companies who depend on a steady supply with high-quality raw materials, reliable knowledge on the sustainability of suppliers is becoming an ever more important success factor.

The practical application of the sustainability paradigm in strategy development and everyday management is a major challenge, as balances must be maintained between short-term profits and long-term economic resilience, and between a holistic view of the company or farm and the identification of priority areas where immediate action is needed.

2 Methodology

2.1 The RISE method

The Response-Inducing Sustainability Evaluation (RISE) is a method for assessing the environmental, social and economic sustainability of agricultural production at farm level (Grenz et al., 2016). It has been developed at the School of Agricultural, Forest and Food Sciences (HAFL) a department of Bern University of Applied Sciences in Switzerland. RISE has been applied on more than 3500 farms since the year 2000 in various production systems in 57 countries around the world.

Principally, the goals of a RISE assessment are: (1) to enable a discussion about sustainable farming based on an objective analysis, (2) to initiate reflection through awareness rising and (3) to induce an intrinsically motivated process of continuous improvement of the sustainability performance.

RISE results may also allow farmers and management to monitor their own performance over several years, to design scenarios in a process of strategic planning, to compare results with colleagues and to discuss common issues in farmer groups.

A RISE analysis usually starts with the collection of information on the ecological, economic and social aspects through a questionnaire-based interview with the farmer. The most precise and reliable sources of data available are used. Where available, the documentation of the past farm-year is used, otherwise the best estimate is taken. No measurements are conducted. The interview always includes a walk-around on the farm site.

Data is stored in a central database. A computer program then uses these data to calculate 47 sustainability indicators, condensed into ten sustainability themes. Results are presented to and thoroughly discussed with farmers. The RISE approach is meant to address the intrinsic motivation of farmers by placing the long-term consequences of farmer's actions, even across generations, in the centre of discussion.

The last part of the RISE process focuses on the implementation of concrete measures for improving sustainability at the farm level. The concrete procedure of this follow-up process depends on the project framework. The best results were achieved when the analysis was an integrated part of a process, structure or project promoting the implementation of sustainable and practicable solutions (Thalmann & Grenz, 2012).

Calculation of parameters and indicators

The RISE indicator framework follows the following logic:

- **Raw data level:** Basic information (e.g. distance to rivers, details on agrochemicals application).
- **Indicator level:** Information on a specific subject of a theme (e.g. particular risks to water quality).
- **Theme level:** Overview of a specific theme (e.g. water use). The 10 themes are described by 48 indicators.
- **Sustainability polygon:** Global picture of the farm's sustainability themes.

The farm **raw data** entered to the computer program during the interview are combined with reference data and transformed into a scale from 0 to 100, using one or several valuation functions resulting in **indicator** values. The scores reflect no pass-or-fail classification, but position the farm's performance on a continuum ranging from 0 points (intolerable) to 100 points (fully in line with the sustainability goal of the parameter).

All valuated data are visualized using a “traffic light” colour code: red indicates problems (inacceptable), yellow means that further scrutiny is recommended (critical), and green (optimal) indicates practices that can most likely be continued without major sustainability risks.

The **themes** scores, termed as “**degrees of sustainability**”, are the arithmetic means of three to seven equally weighted indicators.

Themes scores are not further aggregated into a single “sustainability index” to prevent a masking of relevant information. Thus, a very high score of one theme, e.g. economic viability, cannot outbalance a problematic situation of another, e.g. nutrient flows.

The most aggregated form of the RISE results is the **sustainability polygon** in which the degrees of sustainability of all indicators are shown at a glance (Fig. 10). An optimal result would be one where all indicator scores are in the green area and no parameter scores in the red area.

The interpretation of results starts with the RISE polygon, which gives an overview of the sustainability performance of the farms. The red line connects the scores of the ten sustainability themes on a scale from 0 (worst) to 100 (best). The indicator values, which are presented in tabular form for every indicator (further below), are the entry points to a more specific, measure-oriented discussion.

The ideal farm according to the RISE model would have the lines building a balanced polygon in the green (positive) area, with no scores in the red and yellow (critical resp. negative) areas. This means that economical dimension is not maximised at the expense of the environmental or social dimension. Due to trade-offs between e.g. animal production and ammonia emissions, or crop productivity and biodiversity promotion, achieving 100 points for every single indicator on one farm is not possible.

2.2 Study design and process

For this study, farm data were collected by the participants of a RISE training course. The course took place at the ATI-RTC in Baybay City, Leyte, Philippines from February 28th to March 9th, 2018 (Fig. 1). The training comprised a theoretical part dealing with sustainability in agriculture and the RISE method. The practical part included software handling, interviewing farmers for data collection, data processing, verification and interpretation of the results of the analysis and giving afeedback to the farmer on those results.

Fig. 1 Cass room training to introduce RISE.

In total, eight persons from agricultural extension services (ATI-RTC 8, PCI-NW Leyte), agricultural administration (DA-RFO 8), research (VSU-ITEEM) and development cooperation (GIZ/DA RFO 6) participated in the RISE training (Appendix1). For conducting the interviews, the participants worked in groups of two to four persons under the supervision of Dr Christian Thalmann of HAFL (Fig. 2).

Fig. 2 Interviews between RISE training participants and farmers.

An important part of the interview was the tour around the farm, where the farmer showed all major parts of the farm (Fig. 3).

Fig. 3. On all farms a tour was done together with the farmer.

For this study, ten farms were selected and contacted in advance by GIZ staff. The participation in the RISE sustainability evaluation was voluntary for the farmers. Nine questionnaires from the total sample were sufficiently completed to calculate all indicators. These are considered in this report. During the training, particiapnts met three farmers a second time for an evaluation feedback (Fig. 4).

Fig. 4. After data analysis and preparation of a report, feedback discussion with the farmers took place at the ATI.

Thereby individual results were explained, farm strengths and weaknesses discussed and opportunities for improving the sustainability performance identified. Farms received a detailed and translated report of the sustainability evaluation and the recommendations for documentation. The most important results were also translated by the participants.

The RISE model was calibrated to the conditions in Leyte prio to the training by HAFL. Regional data such as climate, yield level, minimal income and other data were collected. Before and during the field visit these data were discussed with the participants and personnel from GIZ and ATI.

2.3 System boundary

Temporal system boundary: The RISE analysis considers the farm activities in from January to December 2017. Data on areas, yields, cultivation methods (e.g. pesticide use), use of resources, employment, salaries and finances refer to that year. Only some information such as soil degradation, deforestation and reforestation refer to the last 5 to 20 years.

Spatial and financial system boundary: There is consistency with the spatial (cultivated area) and financial (only farming activities (no off-farm income considered)) system boundaries. For the analysis of the wage levels, it was ensured to achieve consistency with the income sources considered and the required working time for earning these incomes.

At regional level, data were summarized to identify tendencies within the group of observed farms and to draw more general conclusions, where possible.

2.4 Farm profiles

The analysed farms are locted in the municipalities Baybay City, Albuera, and Ormoc City in Leyte province. In Southern Leyte province the farms are in the municipality of Hiunangan (Fig. 5). The agricultural areas are between 1 and 9 ha, with an average size of 3.4 ha (Tab. 1). One farm in the Kanaga municipality was excluded from the analysis because of an incomplete data set.

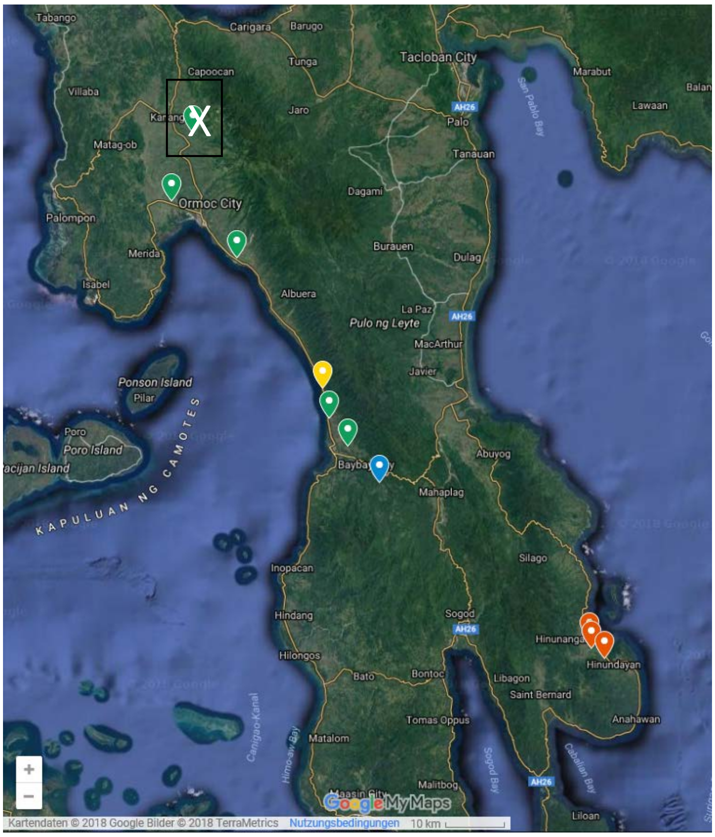

Fig. 5. Location of the analysed farms in the provinces of Leyte and Southern Leyte (map: http://www.ezilon.com/maps/africa/ghana-physical-maps.html). One interviewed farm was excluded from the analysis (X) because not all required data could be collected.

Of the nine analysed farms, about 43% of the agricultural area is used for coconut production. Coconut is cultivated in mixed stands with other trees or crops. Frequently, coconut trees grow along field margins. The age of the trees varies considerably.

The analysed farms are: 1 SC Global coconut farm. 4 LER-ATI learning site-farms, 1 KAANIB PCA model farm and 3 irrigated rice farms in Southern Leyte.

2.4.1 SC Global coconut farm

This farm delivers its main product to SC Global Coco Products, Inc, a coconut processing company located in Baybay. It is certified organic by Ecocert, Kosher certified by Star K and HACCP certified by SGS. The company is engaged in producing organic coconut oil processed to manufacture various edible, industrial and cosmetic products.

The analysed farm is a mixed farm with the main crops being coconut, banana and tomatoes. Some part of the products is produced for self-sufficiency. There is no considerable livestock production. Therefore, the theme "Animal husbandry" is excluded from the RISE analysis.

Fig. 6. Mixed coconut stand with mainly intercropping with tomatoes, bananas and other crops. Young plants are grown in seedling nurseries. Livestock is limited to self-sufficiency.

2.4.2 ATI learning sites

The Agricultural Training Institute (ATI) implements the concept of knowledge transfer from farmer to farmer. Thereto they support learning sites at existing farms. In many Barangays "schools of practical agriculture" are established for major crops and major livestock. In a continuous development process the learning site farms improve their performance, knowledge and skills. Besides agricultural production, the development may also include tourism, gastronomy and marketing. From its nature, the sample of this group (4 farms) is rather heterogenous with respect to crops, livestock and agricultural practices.

Fig. 7. Different farms at ATI learning sites. The four analysed farms vary in agricultural acticities and practices.

2.4.3 KAANIB PCA model farm

The Philippines Coconut Authority (PCA) follows a similar approach to the ATI by supporting selected farmers. Such farms serve as model farms for other farmers. Besides building-up of knowledge and skills in the domain of coconut production, PCA improves livelihood and sustainability of the farms by supporting crop diversification (e.g. intercropping, cocoa plants, jackfruits) as alternative income sources. One PCA model farm (KAANIB) was analysed in the scope of this assignment.

Fig. 8. The KAANIB PCA model farm in xx was analysed with RISE.

2.4.4 Irrigated rice farms

The three farms in this group participated in the BRIA[1] program during the last years. However, they do not grow hybrid rice but inbred varieties. The major crop is rice and – less important - as a second crop coconut. One farm established a pig production as a way of intensifying production.

Fig. 9 The irrigated rice farms analysed with RISE grow inbred rice varieties, and coconut. One farm has livestock production with pigs.

[1] Better Rice Initiative Asia (http://www.better-rice-initiative-asia.org/)

Tab. 1. Key figures of crop production of the farms analysed in Leyte and Southern Leyte in March 2018. All figures refer to the period from January to December 2017. SCG stands for “SC global coconut farm”, KAA for “KAANIB PCA model farm”

Farm type	**SCG**	**ATI learning sites**					**KAA**	**Irrigated rice farms**				**AVG**	**Regional standard yield**
Farm no.	**01**	**03**	**04**	**07**	**08**	**AVG**	**05**	**02**	**09**	**10**	**AVG**		
Agricultural areas	**2.2**	**1**	**1**	**9**	**2.5**	**3.4**	**7**	**5**	**1**	**2**	**2.7**	3.4	
Crop	Yields (dt/ha/y) *Crop areas (ha)*												dt/ha/y
Coconut palm *Cocos nucifera*	0.02 *2*	0.1 *0.1*		0.3 *0.5*		**0.2** ***0.3***	0.2 *5*	2 *4*	2 *0.5*	0.9 *0.8*	**1.6** ***5.3***	**1** ***1.8***	**4.2**
Rice, wet *Oryza sativa*		4.2 *0.3*		5.3 *8.4*		**4.8** ***4.35***		9.5 *1*	4.1 *0.6*	4 *1.3*	**5.8** ***2.9***	**5.4** ***2.3***	**4.5**
Rice, rain feed *Oryza sativa*							0.5 *0.2*						
Pumpkin *Cucurbita ficifolia*		1 *0.1*	0 *0.2*			**0.5** ***0.15***	0.1 *0.03*					**0.4** ***0.1***	**50**
Banana *Musa × paradisiaca*	18 *0.1*				27 *0.2*							**22.5** ***0.15***	**30.2**
Corn, sweet *Zea mays*			9 *0.25*		5 *0.6*	**7** ***0.43***						**7** ***0.43***	**2**
Ginger *Zingiber officinale*				4 *0.01*	0 *0.1*	**2** ***0.05***						**2** ***0.05***	**7.1**
Okra *Abelmoschus escul.*			1.4 *0.05*				0.4 *0.03*					**0.9** ***0.04***	**4.5**
Sweet pepper *Capsicum*				0.5 *0.1*	10 *0.5*	**4.75** ***0.3***						**4.75** ***0.3***	**8**
Water melon *Citrullus lanatus*		1 *0.02*	6.2 *0.5*			**3.6** ***0.25***						**3.6** ***0.25***	**40**
Cassava *Manihot esculenta*			5 *0.01*										
Chili pepper *Capsicum baccatum*		3 *0.8*											**1.4**
Citrus fruits *Citrus*							3 *0.02*						**9.4**
Coffee *Coffea*							0 *1*						**0.9**
Eggplant *Solanum melongena*							0.8 *0.03*						**9.6**
Papaya *Carica papaya*					0 *0.04*								**27**
Pickling cucumbers *Cucumis sativus*		0.1 *0.4*											**6**
Savoy cabbage *Brassica oleracea*		0 *0.2*											**22**
Small mixed vegetable garden			5.4 *0.02*										**8**
Sweet potato *Ipomoea batatas*					0 *0.2*								**4.8**
Tomatoes *Solanum lycop.*	50 *0.02*												**10**

Tab. 2. Key figures of livestock production of the farms analysed in Leyte and Southern Leyte in March 2018. All figures refer to the period from January to December 2017. SCG stands for "SC global coconut farm", KAA for "KAANIB PCA model farm"

Farm type	**SCG**	**ATI learning sites**					**KAA**	**Irrigated rice farms**				**AVG**	**Regional standard performance**
Farm no.	**01**	**03**	**04**	**07**	**08**	**AVG**	**05**	**02**	**09**	**10**	**AVG**		
Number of Large Livestock Units (LAU)	**0**	**0**	**1**	**1.4**	**0**	**0.6**	**2**	**0**	**10.7**	**0.8**	**3.8**	**1.8**	
Livestock categroy performance criteria/unit	**Performance** ***number of units***												
Carabao No performance criteria/animals							3			1			
Chicken fattening g DGR/places			7 *50*				5.5 *8*		5.7 *18*	5.4 *3*	**5.55** ***10.5***	**5.9** ***19.8***	**13.8**
Leying hens Eggs/places			120 *5*										
Turkeys g DGR/places									28.6 *9*				**37**
Breeding pigs Piglets/places				9 *2*					10 *10*			**9.5** ***6***	**9**
Breeding boar No performance criterias/places				1									
Pork fattening (extensive, local breed) g DGR/places							333 *3*						**150**
Pigs fattening kept in barns g DGR/places			400 *4.5*						708 *20*			**554** ***12.3***	**700**
Goats fattening g DGR/animals							6.3 *6*						**100**

Tab. 3. Key figures of financial performance of the farms analysed in Leyte and Southern Leyte in March 2018. All figures refer to the period from January to December 2017. SCG stands for "SC global coconut farm", KAA for "KAANIB PCA model farm"

Farm type	**SCG**	**ATI learning sites**					**KAA**	**Irrigated rice farms**				**AVG**
Farm no.	**01**	**03**	**04**	**07**	**08**	**AVG**	**05**	**02**	**09**	**10**	**AVG**	
Number of working persons												
Avg wage per hour PHP/h (employees)	-	37	89	43	23	**48**	-	57	68	39	**55**	**51**
Cash flow before household PHP	**38'956**	308'526	202'466	4'235'745	414'201	**1'290'234**	**229'930**	22'701	261'643	-18'748	**111'867**	638'100
Working hours family members	**2052**	2592	2073	3011	972	**2162**	**2964**	3240	1197	2688	**2375**	**2310**
Cash flow per working hour PH	**19**	119	98	1126	426	**499**	**78**	7	218	-7	**47**	**237**
Household exp-penditures PHP	**56'600**	240'000	169'200	854'100	1'229'560	**623'215**	**132'750**	159'660	290'940	105'840	**185'480**	**359'850**
Operational cash flow PHP[2]	**-17'526**	68'526	33'266	3'381'645	-815'359	**667'019**	**74'651**	-36'959	-29'297	-124'588	**-96'948**	179'197
Declared off-farm income PHP	**0**	8000	0	854'000	0	**431'000**	**6000**	0	928'800	14'600	**471'700**	**362'280**

[2] Definition Operational cash flow: Income – Expenditures – Household consumption

3 Results and recommendations – Summary

3.1 Results

In the following section a summary results of the nine farms and four farm groups, respectively, are described. The participants of the training course produced detailed reports of each farm with description of the results, interpretations and recommendations. These reports and further tables with analysis data are submitted separately.

Generally, the following **positive aspects** could be observed at the analysed farms

- Good performance in some crops (e.g. rice)
- Partly good performance in animal production (good growth rates for fattening pigs)
- Many farmers have knowledge about producing vermi-compost
- Good availability of water
- Low dependency on fossile energy
- Good and flexible availability of labour
- Innovative farmers; eager to learn and improve skill and knowledge
- Mostly richly structured farms (mix of permanent crops, seasonal crops, wild species)
- Openness to try new crops and techniques
- Mixed picture of economic performance: generally tense liquidity situation, and low profitability. But low level of debts giving financial independence. Some farmers reach positive cash flow giving opportunity to invest, or to pay back debts. Level of household livelihood is mostly positive.
- Often, farm households have further income sources, beside agriculture. This helps spreading risks.

The most important **issues** requiring further considerations were

- In some crops, poor performance compared to the yield potential (e.g. coconut, vegetables)
- Many farms produce crops with low market value (coconut, rice). However, production of own stable food (food security)
- Partly inefficient use of nutrients due to poor manure management with high emissions to the soil, groundwater and the air
- Unbalanced nutrient supply (deficient or excessive): lack of conscious fertilization planning
- Animal health: partly high mortality rates at poultry
- Animal welfare: for pigs frequently lack of lying comfort and manipulable materials, partly permanently fixation of saws in small crates, and permanent tethering of grazing animals
- Requirement of agricultural extension service
- Partly low salary level compared to regional subsistence level
- Liquidity challenges: there is need for thorough liquidity planning

Tab. 4. Values of the RISE sustainability themes and indicators of nine farms of four groups analysed with RISE in Leyte and Southern Leyte province in March 2018. SC stands for a farm delivering to SC global; ATI for ATI learning site; KA for KAANIB PCA model farm; Rice for Irrigated rice farms. In the column AVG the average of the farms is calculated.

Group	SC	ATI					KA	Rice				All
Farm no.	**1**	3	4	7	8	**AVG**	**5**	2	9	10	**AVG**	**AVG**
Soil use	**76**	67	63	73	55	**65**	**65**	67	83	90	**80**	**71**
Soil management	50	100	50	100	67	79	50	50	50	100	67	69
Crop productivity	8	75	44	81	73	68	1	52	56	55	54	49
Soil organic matter	99	22	17	53	39	33	91	98	94	86	93	67
Soil reaction	100	5	100	100	0	51	50	0	100	100	67	62
Soil erosion	100	100	67	67	100	84	100	100	100	100	100	93
Soil compaction	100	100	100	35	50	71	100	100	100	100	100	87
Animal husbandry			76	71		**74**	**64**		83	45	**64**	**68**
Herd management			83	67		75	25		67	17	42	52
Livestock productivity			54	67		61	70		97	0	49	58
Opportunity for species-appropriate behaviour			100	50		75	64		97	54	76	73
Living conditions			100	71		86	100		93	79	86	89
Animal health			42	100		71	63		60	75	68	68
Materials use & environmental protection	**62**	76	71	73	77	**74**	**52**	66	65	59	**63**	**67**
Material flows	75	80	65	70	53	67	47	50	93	76	73	68
Fertilization	27	44	32	65	78	55	39	33	23	43	33	43
Plant protection	50	83	92	83	67	81	42	83	83	58	75	71
Air pollution	75	78	75	89	95	84	61	82	38	72	64	74
Soil and water pollution	85	93	92	60	92	84	72	81	89	45	72	79
Water use	**69**	70	61	67	51	**62**	**63**	73	76	64	**71**	**66**
Water management	78	51	33	61	42	47	42	50	75	50	58	54
Water supply	80	90	90	80	60	80	80	100	90	80	90	83
Water use intensity	50	50	50	50	50	50	50	50	50	50	50	50
Irrigation		88	69	75	50	71	81	92	88	75	85	77
Energy & Climate	**100**	72	72	81	46	**68**	**67**	86	66	100	**84**	**77**
Energy management	100	70	40	65	41	54	0	60	100	100	87	64
Energy intensity of agricultural production	100	99	77	99	98	93	100	99	99	100	99	97
Greenhouse gas balance	100	48	100	80	0	57	100	100	0	100	67	70
Biodiversity	**80**	76	73	79	57	**71**	**69**	63	44	65	**57**	**67**
Biodiversity management	44	82	20	75	75	63	24	33	24	25	27	45
Ecological infrastructures	100	100	100	100	0	75	100	100	100	100	100	89
Distribution of ecological infrastructures	100	100	100	100	70	93	100	100	10	100	70	87
Intensity of agricultural production	100	51	84	67	74	69	86	55	18	51	41	65
Diversity of agricultural production	55	48	62	54	65	57	37	28	68	49	48	52
Working conditions	**58**	63	70	58	55	**62**	**59**	58	61	44	**54**	**58**
Personnel management	65	62	65	65	62	64	65	50	51	24	42	57
Working hours	67	43	50	20	40	38	42	80	42	38	53	47
Safety at work	75	84	73	83	73	78	62	64	70	52	62	71

Wage and income level	23	62	91	62	45	65	65	37	80	63	60	59
Quality of life	**61**	84	77	81	94	**84**	**73**	77	79	68	**75**	**77**
Occupation & Training	67	79	83	88	100	88	67	75	75	75	75	79
Financial situation	25	75	75	69	88	77	75	75	75	63	71	69
Social relations	88	100	88	94	100	96	75	75	88	75	79	87
Personal freedom & values	50	88	75	79	92	84	75	83	83	50	72	75
Health	75	76	63	75	88	76	75	75	75	75	75	75
Economic viability	**25**	76	67	77	68	**72**	**76**	35	65	38	**50**	**60**
Liquidity	0	16	4	15	100	34	63	8	100	0	36	34
Profitability	0	81	65	100	0	62	100	0	0	0	0	38
Stability	56	81	94	75	88	85	69	81	75	50	69	74
Indebtedness	50	100	100	93	50	86	97	50	50	50	50	71
Livelihood security	17	100	73	100	100	93	50	100	100	92	97	81
Farm management	**59**	72	78	87	78	**79**	**69**	79	87	68	**78**	**75**
Business goals, strategy, implementation	77	77	73	88	77	79	63	75	88	56	73	75
Availability of information	38	68	45	86	58	64	25	50	68	25	48	51
Risk management	28	69	100	100	100	92	100	100	100	100	100	89
Resilient relationships	92	75	92	75	75	79	88	92	92	92	92	86

3.1.1 SC Global coconut farm

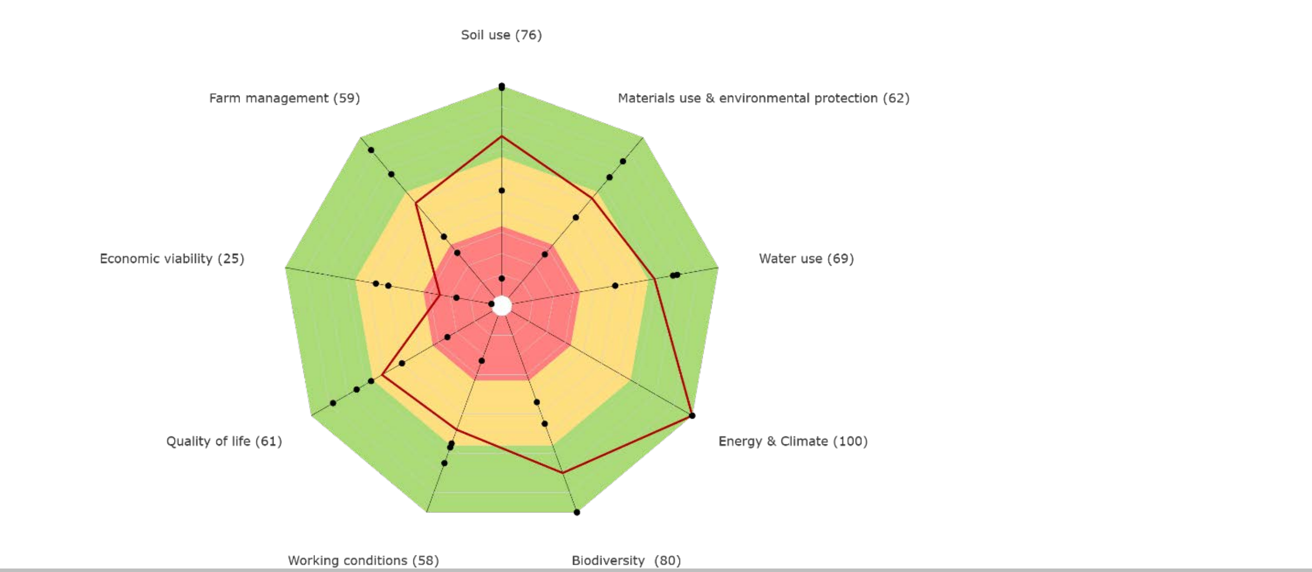

Fig. 10. Sustainability polygon of the RISE analysis of the farm delivering to SC Global. The different axes represent the sustainability themes. The farm has no livestock and therefore this theme is not assessed (totally nine themes). The black dots represent the indicator scores. The average of these indicators results represents the theme score (intersection points of the red line). Theme and indicator scores located in the red zone indicate a problematic situation, in the green zone a good performance, and in the yellow zone a moderate result.

The sustainability polygon of the farm is characterized by mainly positive (4) and average (4) theme scores, and one negative score at *Economic viability* (Fig. 10).

Besides coconuts the farm is quite diversified and produces a variety of crops for the local market but also for own consumption. The farmers produce crops at a low intensity level without any mineral fertilizers (0 kgN/ha) and chemicals (0 applications of PPP/ha). For fertilization they are using some compost instead. Low nutrient supply and mixed cropping may keep pest and pathogens at an acceptable level. Due to the low inputs level, the farm achieves good sustainability scores in the environmental dimension. Particularly positive are the indicators Soil organic matter (use of compost, permanent soil cover), Soil reaction (no acidifying fertilizers), Soil erosion (permanent soil cover, suitable topography), Soil compaction (no (heavy) machinery), Material flows (local sourcing), Air pollution (no machinery), Soil and water pollution (no runoff of fertilizers and chemical), *Energy and climate* (no energy use for agricultural production), and for wild and domesticated *Biodiversity* in general.

Fig. 11. Mixed coconut stand, intercropped with mainly banana and tomatoes. Crop residues are mainly burned. Some residues are used to produce compost.

Due to the low intensity level the farm achieves low yields for coconut (0.02 dt/ha) and bananas (18 dt/ha) (Tab. 1). Both yield levels are far below regional standard yields (coconut 4.2 dt/ha, banana 30.2 dt/ha). A main reason for low crop yields may be the insufficient replacement of nutrients (indicator Fertilization). For coconuts, another reason may be the renewal of the stands (indispensable to remain productive on the long run).

However, low yields on the one hand and low product prices on the other one impose a severe threat for the financial sustainability of the farm. Despite low production costs and modest standard of living, the cash flow is in the negative zone. Therefore, three of five economic indicators are in the red zone and two in the middle zone (Tab. 4). For the farmer, this means that farming alone does not provide a livelihood for the family and that they depend on alternative income sources (Tab. 3).

RISE training participants developed the following recommendations for this farm

- Capacity building in various domains of production and record keeping (e.g. fertilization, composting and mulching);
- Focus on increasing production of more profitable crops (e.g. vegetables, fruits). However, to increase stability and resilience, need to increase production of other crops to reduce dependency.
- Diversify farm to increase resilience;
- Make use of improved varieties for increased production – but bear in mind resistance/stability of traditional varieties. High yielding varieties interspersed with resilient varieties would be optimal. However, to replant a plantation to achieve this would take several years, when replacing max 10% of the trees each year.
- Cease burning of crop residues and organic wastes and practice mulching;
- Planting of leguminous plans between crop cycles;
- Make use of free fertilisers available from PCA (but clarify whether organic fertilisers are available);
- Replace P loss through importation of manures, establishment of small chicken house;
- Consider additional income potential from by-products – e.g. rope and coir from coconut husks;
- Sort, reuse and recycle waste where possible; sell bottles/cans rather than dumping on farm;
- Assess availability of governent crop insurance programmes (and use them).

3.1.2 ATI learning sites

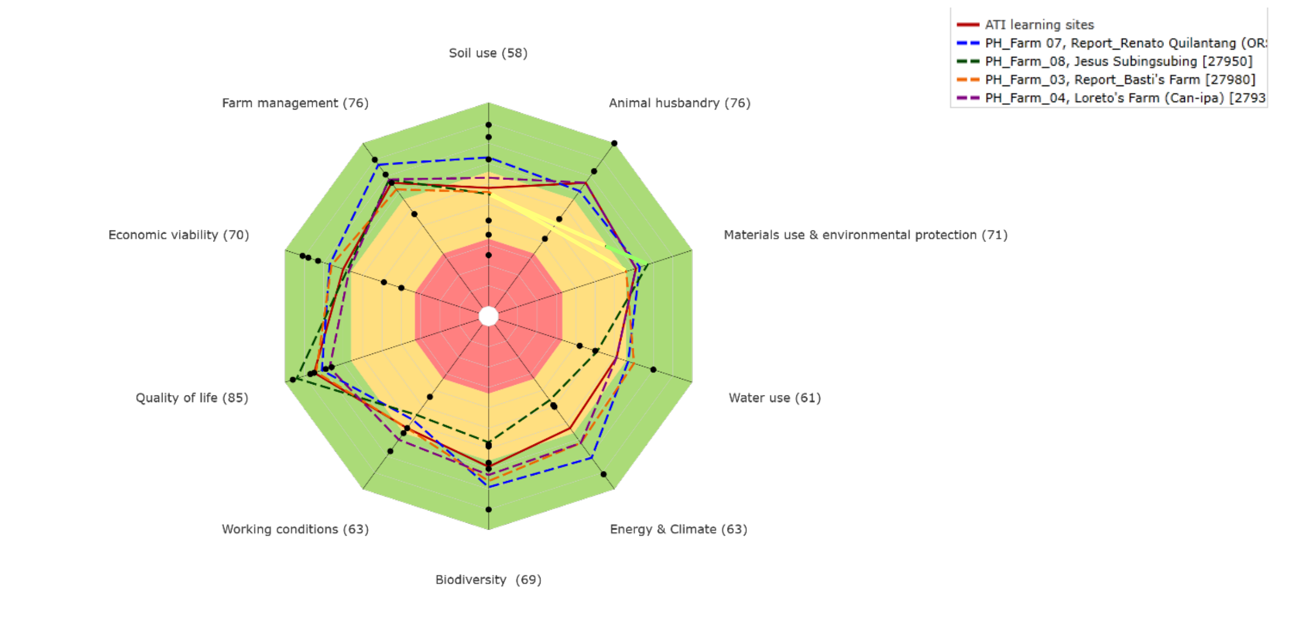

Fig. 12. Sustainability polygon of the RISE analysis of the 4 farms serving as ATI learning sites. Two of the four farms have livestock, displayed in the theme *Animal husbandry*. The two farms without animal production recieve no scores for this theme (masked lines).

The sustainability polygons of the four farms of this group are quite large and mostly regular. Looking at the average farm score, there were seven sustainability themes in the positive zone: *Animal husbandry* (positive performance and animal welfare), *Materails use & environmental protection* (with some important exceptions), *Energy & climate* (low consumption), *Biodiversity* (diverse crops), *Quality of life*, *Economic viability*, and *Farm management* (professional management). The other themes are in the higher middle zone.

These farms have in common that they are quite diverse with many different crops. Two of them do not grow coconut and rice, but instead, concentrate on higher value-adding crops like vegetables. The intensity level of agricultural production varied considerably between the farms. Regarding nutrients, two farms show well balanced nitrogen supply and one a balanced phosphorous supply. The others either have a nutrient supply that is too high (188% nitrogen; 620% phosphorous) or too low (3% nitrogen; 3% resp. 17% phosphorous) compared to the calculated nutrient demand of crops.

The intensity level of plant protection varies considerably between farms as well. Whereas one farm produces vegetables without any chemical PPP, two other farms are very intensive in this respect (10.6 and 62.4 applications/ha). These extremely high values must be verified.

Farms serving as a model for other farmers should have exemplary practices. For the analysed ATI farms, special attention should be paid to the proper storage of PPP. At some farms, storage is quite messy with a mix of old and new products and empty containers. Two farmers reported about resistance problems with some products, indicating inproper resistance management, either by the farmers themselves or by the other farmers in the region.

The farms generally achieve good crop yields above regional standard (Tab. 1). For example, one farm produced 5.2 dt rice per ha and year.

Economic performance is positive for the analysed farms. With one exception, all farms have a positive cashflow and all farms have household consumptions clearly above susistance level. The farm with a negative cashflow has to finance this consumption level by cross-subsidies from other business activities. The level of indebtedness is low for all farms, providing financial independence.

Fig. 13. Rice field and and coconut stands at Farm 03. Intensive vegetable production. Vermi-composter. Storage sheds with many unused items. Rather wild storage of PPP. Common pictures at the farms with garbage lying around.

Fig. 14. Innovative farming at Farm 04 with fishponds connected to vegetable and seedling production. Manure and other organic wastes are composted. During farrowing saws are kept in farrowing crates. Non-lactating saws are kept in small groups. Different poultry are kept in cages or free-range. Problematic keeping of wild animals (asian palm civet kittens, monkey). Coconut and banana stands. Bags with vegetables at the farm.

Fig. 15. Rice seedlings at Farm 07. The major crop is rice (8 ha), where also modern machinery is used. Besides rice the farm grows a variety of other crops, mainly for self-subsistence. The farm buildings are also used for farmers' trainings. Saws are mostly kept in small groups, whereas the boar is kept in a separated compartment. The effluents of the stable are not collected but percolate to the soil.

Fig. 16. Intensive crop production at Farm 08. Compost production.

RISE training participants developed the following recommendations for these farms

- Improving crop yields and nutrient management
    - Carry out soil analysis to assess basic soil parameters like pH and nutrient status. Possible agencies that could assist are DA and ATI/VSU;
    - Rectify soil pH through timing application of liming materials i.e Dolomite and addition of organic matter;
    - Increase production of vermicasts for soil application to enhance soil fertility;
    - Make sure soil is always covered, with crops, green manures or organic (straw) mulch to protect from erosion and water loss;
    - Plant leguminous crops (i.e., mung beans, peanut, pole sitaw);
    - Consider growing green manures;
    - Establish/reconsider proper crop rotation;
    - Create planting calendar;
    - May also plant trees in some peripheries of the farm for additional protection against strong winds;
    - Do not remove plant residues in the area because it has more nutrients compared to the vermicast; if possible, have other sources for your vermicast production; apply more organic fertilizers;
    - Lessen the use of heavy machines or if possible, avoid using it.
- Capacity building
    - Attend training to further enhance knowledge and skills;
    - Ask assistance from technical experts prior to livestock production, biodiversity, water management and energy saving;
    - Attend trainings related to biodiversity management and conservation.
- Plant protection
    - Learn strategies how to reduce PPP; replace toxic products by less toxic ones;
    - Poisoning birds and other animals to protect the crop is not a good practice. Apply alternative techniques (e.g. lines with cloths) to minimize damage from birds in rice;
    - Store the PPPs in proper places in a way that children cannot reach;
    - Have some 6 m wide vegetated buffer strips when applying PPPs to close to bodies of water.
- Animal husbandry

- Do not keep wild animals. Their basic needs cannot be satisfied, and animals are suffering;
- Check suitability of silage. Ask technical assistance from the Department of Animal Science prior to the preparation of silage (free of charge) and some planting materials as source of nutrients for the livestock;
- Preventive measure should be considered (i.e., vaccine). Have regular vet/technician to conduct check-up of the livestock and poultry;
- Provide soft bed to the pigs; don't let them lie on concrete floors; allow them to be in open fields sometimes (pasture, open waters); give them something to play with (drinking throughs).

- Management and Working conditions
  - Provide an employment contract; pay slip and insurance also, if possible;
  - If possible, increase the wage of the farm workers, even just a little;
  - Shorten the working days per week or working hours per day;
  - Keep farm records on inputs (water, fertilizer, labor, seedlings) and outputs (harvests and other outputs).

3.1.3 KAANIB PCA model farm

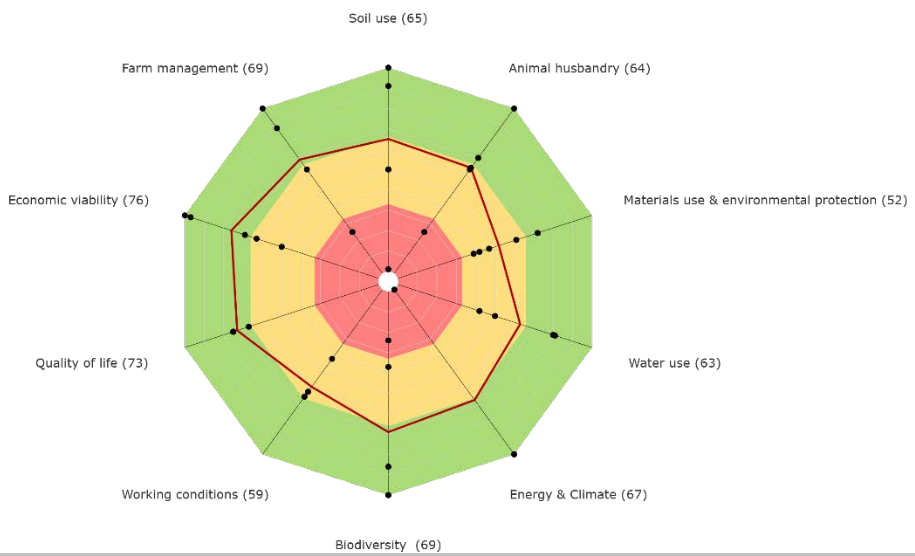

Fig. 17. Sustainability polygon of the RISE analysis of the KAANIB PCA model farm.

The shape of the sustainability polygon of the KAANIB PCA model farm is regular, with scores at quite a high level. Five themes are in the lower positive zone and five in the higher middle zone. Some negative indicator scores could be explained by the lack of active management, e.g. regarding Herd management (no preventive measures, no conscious breeding, no documentations), Biodiversity management (low awareness, no planning) and Availability of information (need for more information). Low performance in Energy management is because of low relevance to the farm, as it uses only little electicity.

The farm is comparibly large (7 ha), with a diverse set of crops and some livestock (carabaos, chicken, pigs, goats). The main crop is coconut palm (5 ha), intercropped with different fruit trees (citrus and jackfruit) and vegetables. There are also 1 ha of coffee and 0.2 ha of rice. The intensity of agricultural production is low with low inputs of mineral fertilizers (26.1 kg N/ha) and chemical fertilizers (one product at 0.01 ha). Manure application can be neglected. Accordingly, the achieved crop yields were clearly below regional standard yields (Tab. 1). Bringing nutrient inputs and crop yields into relation (indicator Fertilization), it shows that nutrients (mineral fertilizers and manure) are only partly converted into yields (nitrogen balance: 172%

(demand from yields vs. supply); phosphorus balance: 366%). This reveals an inefficient use of fertilizers and is an indication for further yield limiting factors. With respect to environmental protection nutrient inefficiencies are negative because of uncontrolled losses into the environment.

Fig. 18. Rice field with mixed coconut stands in the background. Coffee trees. For grazing, goats are permanently tied.

Despite comparably low yields, the economic performance of the farm is quite positive (three indicators in the positive zone (Profitability, Stability, Indebtedness) and two in the middle zone (Liquidity, Livelyhood security) with a reasonable operational cash flow of 75’000 PHP (Tab. 3). The large size of the farm, its diversification and also the farmer’s modest but decent livestyle may have contributed to this positive result. Looking at the different crops, coconut was of highest importance for the farm (200’000 PHP profit[3]), followed by different vegetables (21’000 PHP profit) and rice (1’900 PHP profit).

At *Animal husbandry* there were deductions in scores for the indicator Opportunity for species-appropriate behaviour because of permanent tethering goats when pasturing.

These findings are very much in line with the farmer’s perception who was asking for more training and information in the domains of fertilization management, pest management, livestock integration, post harvest and marketing. Lack of training and materials on the one hand and lack of financial means on the other one were mentioned by the farmer to be the main problems for farm development.

RISE training participants developed the following recommendations for this farm

- Improving crop yields and nutrient management
  - plant more legumes to add nitrogen in the soil
  - check whether better varieties would be available
  - rice: carry out soil analysis and ask for technical assistance; search for nutrients limiting productivity
- Animal husbandry
  - make fence or live fence (e.g. kakawate, ipil-ipil) and pen instead of tethering
  - when animals get sick involve vet for treatments
- Environmental protection: Do not burn plastics
- Water use: Close the water when not in use
- Check suitability of new farm businesses and farm branches
  - E.g. cassava, sweet potato
  - fishpond
- Attend trainings in agricultural practices and farm business (e.g. identification of profitable crops). Seek advice from local technicians.
- Learn how to store plant protection products securly and apply them safely

[3] For this calculation personal costs of the owner’s family are not considered.

- Check availability of public life and health insurance

3.1.4 Irrigated rice farms

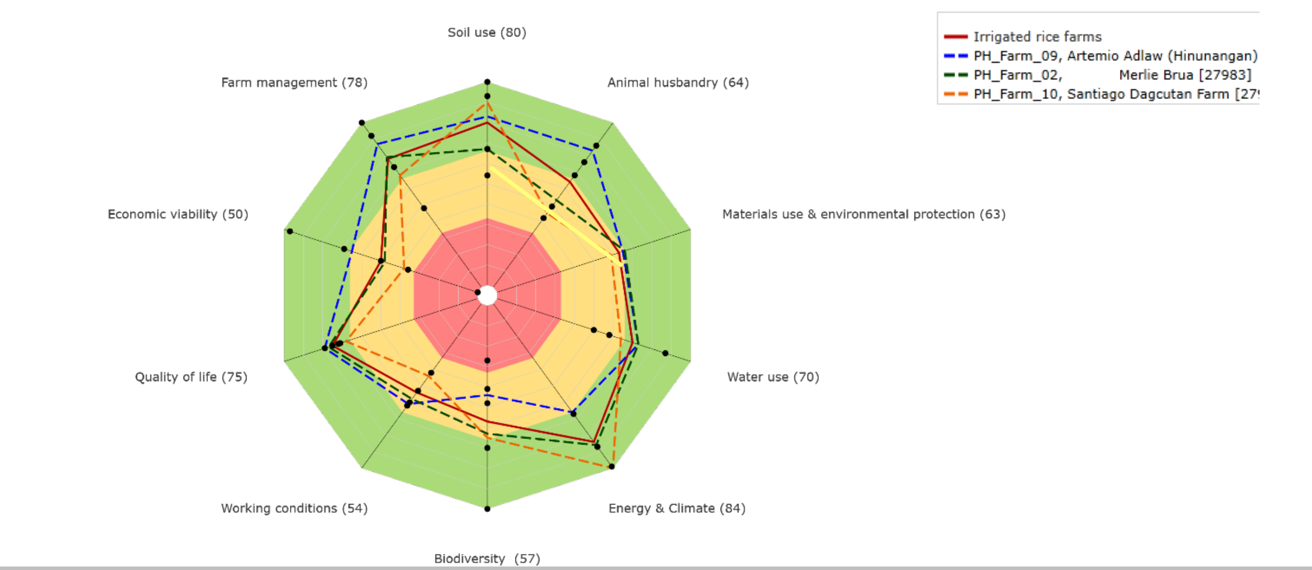

Fig. 19. Sustainability polygon of the RISE analysis of the rice farms in Southern Leyte province. Two of the three farms have livestock (one farm has pigs and poulty, one farm only poultry), displayed at the theme *Animal husbandry*. The farm without animal production recieves no scores for this theme (masked line).

The shape of the sustainability polygons vary considerably between the three farms of this group. Scores in the positive zone are achieved for the themes *Soil use* (no Soil erosion, no Soil compaction, good Soil organic matter supply, positive Soil reaction), *Water use* (sufficient Water supply, good Irrigation practices), *Energy and climate* (low Energy intensity, mostly low Greenhouse gas emissions (pig farm has elevated emissions)), *Quality of life* (high satisfaction level with most areas of live), and for *Farm management* (appropriate Risk management, Resilient relationships, mostly adequate Business goals, strategy and implementation). Scores in the middle zone are achieved for *Biodiversity* (sufficient Ecological infrastructures but high Intensity of production), *Working conditions* (partly problematic Safety at work, partly low Wage and income level, partly long Working hours) and for *Economic viability* (positive Livelihood security and business Stability, but low Profitability, and partly problematic Liquidity). In crop production, the farms are quite monotonous with a focus on rice and coconut. Consequently, the farms perform quite low regarding *Biodiversity*. Therefore, the main reason for the high variability of scores can be found in differencies in livestock production. One farm is a pure crop farm, one produces some poultry but of minor importance, and one farm has a considerable pig and poulty production. At that farm, the animal density is very high (10 LAU/ha). Accordingly, the amount of nutrients is very high (455 kgN/ha), as well. High nutrient availablity and average rice yields (5.6 dt/ha/y) result in an imbalanced nitrogen balance of 1558% and 2571% in phosphorous! According to the interview data vast amounts of nutrients are lost and disposed to the environment. It is strongly recommended to veryfy the situation, as the farm is in close proximity to the coast. Via rivers nutrients may quickly reach the sea and may harm susceptable marine ecosystems. Interestingly, also the farm without livestock shows an excessive supply of fertilizers compared to the realized yields (443% in nitrogen (supply of 563 kg of N compared to demand of 127 kg from crops) and 1428% in phosphorus (supply of 400 kg of P compared to demand of 28 kg from crops)). Intensity of chemical use is rather low to medium with application rates of 0.5 to 5 applications per ha.

From the perspective of animal welfare, the husbandry of the pig farm gives a mixed picture. Comparably good performance (e.g. 10 piglets/saw place, 708 gDGR fattening pigs), non-fixation of lactating saws and low mortality rates positively stand out. However, some husbandry conditions are poor, keeping animals from satisfying their basic needs. For example, non-lactating saws are kept separated in narrow busket crates inhibiting natural needs of free moving and social interactions. Alternatively, systems could be established where saws are kept in small groups. All saws and weaner pigs are kept on bare soil without any litter and without manipulable materials (e.g. pieces of wood, hanging chains). It is recommended to use rice husks and rice straw for better lying comfort and distraction. A burlap fixed at the farrowing crates allows saws to satisfy their instinct of building a nest for their piglets. It is no secret that happy animals perform better than suffering or bored animals.

Both animal farms show high mortaltiy in poultry, at one farm caused by extreme weather conditions . It is recommended to verify this and to check mortality factors with veterinarians.

First, the pig farm appeared to be more profitable than the other two rice farms. However, data verification revealed inconsistencies at the recorded feedstuff. Therefore, fodder costs were estimated according to the costs of other farms in the sample. Doing so, all three farms of this group showed tense *Economic viability* with poor Liquidity (at two farms) and a negative operational cash flow resulting in low Profitability. At all three farms Livelihood security was positive, indicating a decent standard of living. This again indicates dependency of the farms on off-farm income: With income only from agriculture this standard of living would not be possible. Further, the negative cash flow makes maintenance and investments in farm development very difficult.

Fig. 20. Rice fields with inbred rice variety at farm 9. Composting of solid manure and other organic material in vermicasts. Separated non-lactating saws with no possibility of moving freely. Saws are kept in farrowing crates to reduce piglet mortality. Weaners are kept on concrete floor with no litter or manipulable materials. Fattening pigs are kept in groups and on deep litter rice husks.

Fig. 21. Harvested rice field at farm 10. The farmer is planting an inbred rice variety.

RISE training participants developed the following recommendations for this farm

- Improving crop yields and nutrient management
    - Planting legumenous crop/veg. along rice paddy pathways if possible;
    - Container gardening of veg. is also suggested within the house vicinity;

    - Soil analysis and plant nutrient requirement can be the basis to optimize the use and application of fertilizer;
    - Check availability for other water sources in the local area which can contribute to farm survival;
    - Learn how to make proper fertilization planning. Farms with livestock should learn how to apply manure according to the crop requirements. Enivronmental pollution from slurry and effluents must be eliminated.
- Animal Husbandry
    - Concerning high mortality in poultry, seek advice of the vet. and report the incidence to the Local Municipal Agriculture Office;
    - Improve animal welfare situation at the pig farm (see text);
- Business development
    - If possible, construction of fishpond to utilze excess water in the farm;
    - Increase diversity of crops and livestocks in the farm. Implement more diversed farming in the upland area (coconut) like intercropping some banana and other high value adding crops to host other beneficial organism existence. Increase farm productivity by farming diversification. Very limited or no diversed agricultural production and genetic resources maintenance. Should implement diversified farming by planting various crops and use of genetically diversed crops and livestock to promote survival and development of plant and animal genetic resources.
- Capacity building
    - Attend more trainings about biodiversity and agricultural practise if possible;
    - Regular update to DA technicians regarding new technologies to enhance farm management and productivity.
- Working conditions
    - If possible, ask the association to enroll the workers or all members to health ensurance;
    - Proper Protective Equipment (PPE) is recommended in applying any chemicals. Workers should wear protective gears when spraying using poisonous chemical; should also observe safety even during the preparation of the chemical spray by wearing gloves and masks.

3.2 Recommendations – Summary

The aim of this study "Sustainability assessment of farming systems in the Philippines with the RISE tool" was to

a) evaluate different production systems, and
b) identify sustainability issues to be integrated in the extension service.

The evaluation of the different system was elaborated in the previous chapter, as well as system-specific recommendation to improve sustainability. The following overview of recommendations regarding sustainability issues could be integrated in the extension service. For the specific information, please refer to the detailed text in the chapter above and the individual farm reports.

- **Improving crop yields and nutrient management**
    - Carry out soil analysis to assess basic soil parameters like pH, and nutrient status. Possible agencies that could assist are DA and ATI/VSU.
    - Rectify soil pH through timing application of liming materials i.e Dolomite and addition of organic matter.
    - Increase production of vermicasts for soil application to enhance soil fertility.

  - Make sure soil is always covered – with crops, green manures or organic (straw) mulch to protect from erosion and water loss.
  - Make use of free fertilisers available from PCA (but clarify whether organic fertilisers are available).
  - Check availability for other water source in the local area which can contribute to farm survival.
- **Diversification of production to increase resilience**
  - Establish/reconsider proper crop rotation; Create planting calendar.
  - Make use of improved varieties for increased production – but bear in mind resistance/stability of traditional varieties. Optimal would be high yielding varieties interspersed with resilient varieties, however to replant a plantation to achieve this would take several years, replacing max 10% of the trees each year.
  - Plant leguminous crops (i.e., mung beans, peanut, pole sitaw). Along rice paddy pathways if possible.
  - Consider growing green manures.
  - May also plant trees in some peripheries of the farm for additional protection against strong winds.
  - Container gardening of veg. is also suggested within the house vicinity.
  - Do not remove plant residues in the area because it has more nutrients compared to the vermicast; if possible, have other sources for your vermicast production; apply more organic fertilizers; cease burning of crop residues and organic wastes.
  - Lessen the use of heavy machines or if possible, avoid using it.
- **Capacity building**
  - Attend training to further enhance knowledge and skills in various domains
    - Crop production and manure management: fertilization planning, composting and mulching, plant protection;
    - Record keeping;
    - Biodiversity management and conservation.
  - Ask assistance from technical experts where available: livestock production, biodiversity, water management and energy saving.
- **Plant protection**
  - Learn strategies how to reduce PPP; replace toxic products by less toxic ones.
  - Poisoning birds and other animals to protect the crop is not a good practice. Apply alternative techniques (e.g. lines with cloths) to minimize damage from birds in rice.
  - Store the PPPs in proper places in a way that children cannot reach.
  - Have some 6 m wide vegetated buffer strips when applying PPPs to close to bodies of water.
- **Animal husbandry**
  - Do not keep wild animals. Their basic needs cannot be satisfied and animals are suffering.
  - Preventive measure should be considered (i.e., vaccine). Have regular vet/technician to conduct check-up of the livestock and poultry.
  - Concerning high mortality in poultry, seek advice of the vet. and report the incidence to the Local Municipal Agriculture Office.
  - Provide soft bed to the pigs; don’t let them lie on concrete floors; allow them to be in open fields sometimes (pasture, open waters); give them something to play with (drinking throughs) .

- Check suitability of silage. Ask technical assistance from the Department of Animal Science prior to the preparation of silage (free of charge) and some planting materials as source of nutrients for the livestock.

- **Management and Working conditions**
  - Provide an employment contract; pay slip and health insurance also, if possible.
  - If possible, increase the wage of the farm workers, even just a little.
  - Shorten the working days per week or working hours per day.
  - Keep farm records – inputs (water, fertilizer, labor, seedlings) and outputs (harvests and other outputs).
  - Proper Protective Equipment (PPE) is recommended in applying any chemicals. Workers should wear protective gears when spraying using poisonous chemical; Should also observe safety even during the preparation of the chemical spray by wearing gloves and masks.

Many of the above-mentioned recommendations require thorough knowledge and planning of measures. Official organizations like ATI, or PCI play an important role in providing unbiased information. However, also private processors – like SC Global – could have a very own interest in the development of sustainable producers of raw materials. Doing so, they would be strong partners of “theirs” farms, by providing additional benefits (e.g. knowledge, skills and empowerment) to the farms going beyond product price. In this sense, it could be a good opportunity to develop a curriculum and integrate the most urgent measures identified.

Further support by HAFL[4] could be provided by agricultural experts who can provide technical support in different agricultural domains, and support planning and implementing research projects, including projects with master students[5].

[4] HAFL (School of Agricultural, Forest and Food Sciences) is a department of the BFH (Bern University of Applied Sciences)

[5] E.g. animal welfare and health, breeding, manure management, fertilization, natural resource managment, machinery, accountings, curricula development.https://www.hafl.bfh.ch/en/research-consulting-services.html

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Appendix1

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