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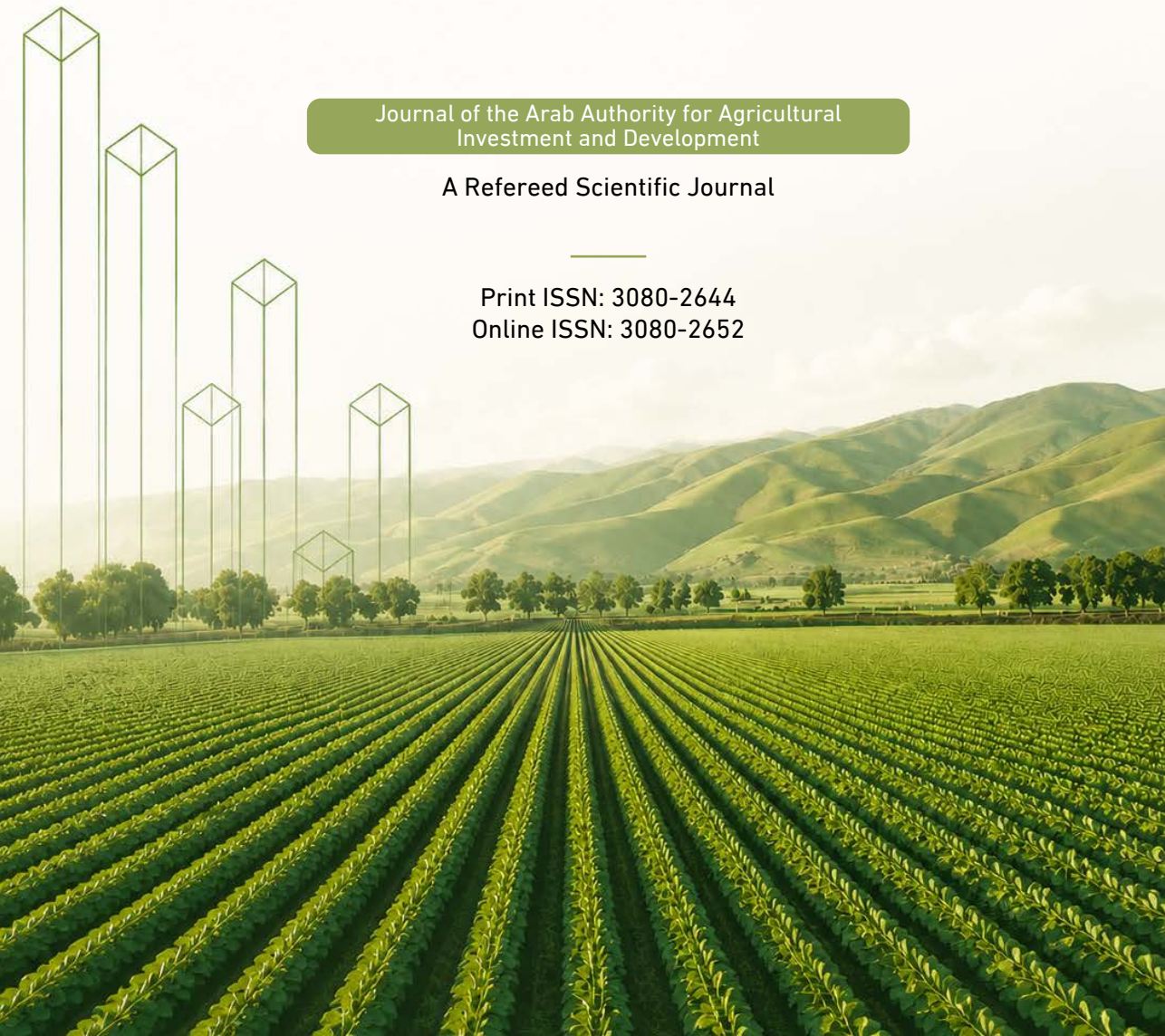
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Sustainability Assessment at Farm Level Using the RISE Method (Baghdad Governorate Case Study)

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Abstract:

The research aimed to evaluate farm-level sustainability because decisions made at the farm level—such as specialization, resource allocation, and production process management—are crucial and essential for achieving sustainability. Fostering strong communities requires a balance between economic, environmental, and social aspects. A survey was conducted on 72 farms in Baghdad province for the year 2023, in addition to other data obtained from relevant authorities. The RISE (Response-Inducing Sustainability Evaluation) tool was used, which is a comprehensive tool for assessing the sustainability of agricultural production at the farm level. Eight indicators were calculated, with each indicator comprising more than four criteria, covering economic, environmental, and social aspects. These indicators include: energy consumption, water consumption, soil care, biodiversity, emission potential, plant protection, waste and residue production, cash flow, farm income, investments, contribution to the local economy, social status of farm families and farm employees, and farm management. The water use indicator achieved 56 points, which is a critical sustainability indicator, influenced by water supply, which scored 27 points, indicating a difficult situation. Performance was weak for air use and environmental protection, achieving only 25 points due to poor material supplies and fertilization. Meanwhile, working conditions indicators were unsustainable through labor management and the wage and income level, which scored 27 points and was critical in terms of working hours and work safety indicators. The economic viability indicator achieved 57 points, which is critical in terms

of sustainability and was weak in terms of liquidity (only 6 points) and livelihood security (18 points). However, it was sustainable through the profitability indicator. The farm management criterion was critical at 48 points, influenced by risk management, which was unsustainable. Other indicators within the sustainability polygon were also critical: animal husbandry achieved only 50 points and soil use 54 points. Overall, it can be concluded that sustainability at the farm level in Baghdad province was unsustainable and failed to balance economic, environmental, and social indicators. Sustainable agriculture is a challenging and highly complex undertaking, requiring individualized, farm-specific solutions. Therefore, farm sustainability analysis should contribute to capacity building.

Keywords: Sustainability Polygon, Water Supply, Environmental Protection, RISE (This is an acronym, so it remains the same), Farm Management

Introduction:

Sustainable agriculture is a strategic issue within the Sustainable Development Goals. Continuous population growth exacerbates food demand, placing pressure on the supply side. This has led to an expansion of measures to boost food production. Sometimes, agricultural development is perceived as solely focusing on increasing output without considering its impact on ecosystems and soil quality. Consequently, this could lead to future food scarcity and food insecurity, threatening the sustainability of food production. A sustainable food system, in particular, is one that "provides food and nutritional security for all, in a way that does not compromise the economic, social, and environmental bases required for achieving food security and nutrition for future generations." Therefore, the ability of socially equitable and resilient food systems to provide nutritious food without exceeding Earth's environmental capacity lies at the heart of sustainable development and is closely linked to all Sustainable Development Goals. Given that agriculture drives many global environmental and social challenges, farm-level decisions—such as specialization, resource allocation, and production process management—are crucial in determining the food system's impacts on communities and the environment (Foley et al., 2011).

Therefore, "sustainable agriculture" involves developing agricultural systems focused on advancing agricultural techniques and projects that: (a) do not negatively affect the environment (as the environment is a vital resource for agriculture); (b) are accessible and effective for farmers; and (c) lead to increased food productivity and have a positive impact on environmental goods and services. Sustainability in agricultural systems integrates the concepts of resilience (the system's ability to withstand shocks

and pressures) and sustainability (the system's ability to persist over time), and broadly discusses its impact on the economy, society, and environment. This ensures the presence of sustainable food production systems and the application of flexible agricultural practices that enhance productivity and output, help preserve ecosystems, and boost adaptive capacity to climate change, extreme weather, droughts, floods, and other disasters, while gradually improving land and soil quality.

Measuring sustainable agriculture through various indicators is essential for monitoring goal achievement, especially to determine if the currently implemented agricultural system is sustainable. This allows for identifying whether current agricultural practices truly reflect sustainable agriculture or if further efforts are needed to promote it. These indicators can also empower policymakers to identify

necessary policies for achieving the goal. As rural communities evolve, it has become more crucial than ever for agricultural industries, governments, and researchers to possess effective frameworks for sustainability assessment. This determines the feasibility of applying farm-level sustainability indicators to measure and identify societal issues in an agricultural area. While agricultural sustainability indicators exist to standardize and guide assessment, not all can be easily applied at a regional scale. As development extends into rural communities, practical sustainability assessments to evaluate the social, environmental, and economic impacts of development on local communities become increasingly important each year. Agriculture has always been the cornerstone of rural communities, and a robust agricultural sector is essential for achieving sustainability.

Fostering strong communities requires a balance among environment, culture, and development. Sustainability assessment for agriculture should include accessible indicators that monitor the interactions between society, environment, and development. As development expands the boundaries between rural and urban communities, tracking change is paramount. However, the necessary tools to track these changes are currently insufficient.

For tracking developments and supporting evidence-based policymaking, accurate measurement is the cornerstone of transitioning to a sustainable food system. To monitor progress toward this transition, adequate measurement is a critical research and policy priority for both the private and public agricultural and food sectors. Consequently, sustainability indicators have gained importance across all scales. Indicators that embody, enable, and provide transparency regarding sustainability's key characteristics are particularly significant in a context where perspectives on this

concept vary among different stakeholders. Thus, the use of indicators to measure sustainability in agriculture has become common practice, with numerous literature reviews conducted on the topic (Foley et al., 2011).

Sustainability indicator frameworks showcase a wide variety of approaches. Regardless of the chosen approach, the specific framework and indicators selected to represent aspects of sustainability strongly influence the outcomes of sustainability assessments. However, the basis for indicator selection is rarely explicit in research. Even when indicator selection criteria are explicitly defined, significant limitations often exist in indicator construction, such as measurability and practical applicability, particularly regarding data availability. Specifically, data-driven sustainability assessments require readily available, relevant, and reliable data for indicator construction, and a lack of appropriate data severely limits analysis. In the literature on sustainability indicators in agriculture, little attention has previously been given to the potential consequences of this fundamental role of data availability for indicator construction and sustainability assessment results. Since the selection of sustainability assessment indicators is inevitably based on available data, the data sources for indicator construction and their implications for the explanatory power of the indicators warrant further research (Latruffe et al., 2016). Sustainability is a fundamental element toward a profitable future for agriculture. Therefore, there is growing recognition of the need to establish procedures for measuring sustainability within an integrated farm-level framework. Farm-level sustainability indicators have been developed here, encompassing the four aspects of sustainability: economic, environmental, social, and innovative, within an integrated framework to measure the current sustainability of agriculture. Indicators were chosen based on their general relevance within the socio-economic context.

Indicators are quantitative measures that allow for the assessment of farm sustainability performance. According to the European Commission, sustainability indicators should help evaluate the extent to which sustainability concerns are integrated into the Common Agricultural Policy, and thus should meet specific criteria. The limitations of the production-focused agricultural model, based on simplifying production systems and intensive use of non-renewable resources, are observable worldwide. These environmental, economic, and social limitations challenge this model and necessitate a transition to more sustainable agriculture. For transitions to be effective, they must be adapted to farmers' motivations and their diverse operational contexts. To improve the economic and environmental performance of agricultural systems, it is essential to understand and account for how farmers perceive their operating context and transform it to better achieve sustainable development

(Fairweather et al., 2011). However, only a few studies have explored farmers' perceptions of their farms' sustainability or how they translate these perceptions into productive strategies. Studies generally focus on specific topics, such as soil degradation, plant health risk management, biodiversity management, or groundwater management. The few studies that holistically explore how farmers perceive sustainability examine farmers' values concerning the concept of sustainability, the impact of the socio-economic context on their perceptions, or what motivates farmers to integrate the concept into their practices. These studies have been conducted in contexts where farmers are generally aware of the concept of sustainability. Given that the concept of "sustainability" and the word itself can mean many different things, there is a widening gap between the discourse and actions of individuals (farmers, extension services, politicians, scientists) involved in sustainability discussions, programs, and policies. Therefore, many authors have chosen to focus on how farmers design and implement farm-level sustainability strategies to ensure their income and the continuity of their farms across generations in a changing context (Suess-Reyes, 2016). Despite all this, currently developing agricultural sustainability measurement tools tend not to involve farmers in their interpretation, focusing more on measurement at spatial and temporal levels (Frater, Poppy & Jeremy Franks, 2013). Simultaneously, farmers/farm households are a crucial element in achieving a sustainable agricultural system. Therefore, measuring sustainable agriculture indicators at the farm household level is vital.

Various methods for measuring farm-level sustainability have been developed in recent decades. Among the methods developed by the Food and Agriculture Organization (FAO) is the Sustainability Assessment of Food and Agriculture systems (SAFA), which can measure sustainable agriculture based on three or four hierarchical levels. Here, "dimensions" represent the core pillar, while the highest and most general level describes sustainability. Furthermore, global sustainability goals are translated into "themes" (and in some cases, more clearly formulated into "sub-themes"). The lowest level of sustainability measurement is an indicator in the form of a measurable variable to assess the sustainability performance of the relevant theme or "sub-theme" (FAO, 2014). The SAFA method uses three main dimensions to measure sustainability at the smallest scale (farm households): the economic dimension, the social dimension, and the environmental dimension.

Another method developed to measure sustainable agriculture at the farm/household level is the Indicators of Sustainable Agricultural Exploitations (IDEA). The IDEA method defines the concept of sustainable agriculture by (a) incorporating viability, in the economic sense, i.e., the efficiency of the production system and the

securing of income sources in the agricultural production system in the face of market changes and unstable funding sources; (b) livability, focusing on analyzing whether agricultural activities provide a decent life for farmers and their families; and (c) the environmental reproducibility of agricultural ecosystems, which can be analyzed using agro-environmental indicators, especially those that characterize the impact of agricultural practices on the environment (Zahm, Frederic & Lionel Vilain, 2008). The IDEA method uses three scales, ten components, and 41 indicators to address 16 objectives describing farm-level sustainability. Other methods used to measure agricultural sustainability at both macro (country, spatial) and micro (farm/household) levels include the Public Goods (PG) tool developed by Gerrard et al. (2012), and the Response-Inducing Sustainability Evaluation (RISE 2.0) developed by Häni et al. (2003).
RISE, an instrument known as "Response-Inducing Sustainability Evaluation," is an indicator-based method for assessing the sustainable economic, social, and environmental performance of agricultural production at the farm level. The purpose of RISE is to contribute to promoting the sustainability of agricultural production by supporting knowledge-based processes based on voluntary, confidential participation and capacity building. The steps of RISE analysis include defining the objective and scope, selecting and contacting farmers, collecting and interpreting data, discussing farmers' feedback, and preparing reports. The use of the RISE methodology contributes to achieving more sustainable agriculture by translating the sustainability model to the farm level, making sustainability more measurable, communicable, and tangible. By identifying deficiencies and potential related to sustainability, economically oriented farm management is complemented by environmental and social dimensions. It is also noted that RISE is neither a control method nor a certification protocol; rather, it is designed to contribute to education and advisory schemes aimed at knowledge-based and self-motivated sustainable development of agricultural production at the farm level. The questionnaire-based interview with the farm manager is the primary source of information, and the model relies on the Microsoft Access database management program. This database, which grows with each farm assessment, will allow for...

RISE aims to conduct a comprehensive assessment of the sustainability of agricultural production at the farm level. Its vision is to contribute to more sustainable agricultural production by helping to disseminate the philosophy and practice of sustainable agriculture. This will be achieved by making sustainability more measurable and communicable at the farm level. By identifying sustainability potential and deficits, farm management focused on classical economics is complemented by the environmental and social dimensions. Our target group includes all stakeholders in agriculture, society, management, and business who share this vision. Previous versions

(RISE 0.x, RISE 1.x, and RISE 2.0) have been applied in diverse contexts. From 2000 to the end of 2010, 750 farms were analyzed in 22 countries, including dairy, vegetable, arable, and mixed farms, as well as coffee, cocoa, tea, and smallholder farms. Figure 3 illustrates the countries where the indicator was used, and with the 2025 update, Iraq will be added to the program family after the completion of our study. The RISE model is based on twelve indicators of economic, environmental, and social status: energy consumption, water consumption, soil care, biodiversity, emission potential, plant protection, waste and residue production, cash flow, farm income, investments, contribution to the local economy, and social status of farm families and farm employees. Spatial analysis is determined by farm area and temporally by a one-year period. A key feature of the model is the evaluation of both "state" (S) and "driving force" (D) for each indicator. This allows for a combination of systems and analytical approaches: the calculated "sustainability score" (D–S = DS) considers both the actual state (S) and the pressure (D) on the specific indicator. A high D is likely to lead to a low S over time. D allows for long-term trends and risks to be considered, which are crucial for the concept of operational sustainability, while S can serve as an analytical database for the actual situation; DS also includes systemic trends (see Vester, 1983). The tool allows for the identification of strong and weak aspects of the farm and can thus prompt steps to improve sustainability (a decision-oriented and response-inducing approach). The research aims to assess sustainability at the farm level in Baghdad province for the year 2024 using the RISE method and to measure the sustainability polygon.

Materials and Methods:

Response-Inducing Sustainability Evaluation (RISE) was utilized for this assessment, following communication and collaboration with Bern University of Applied Sciences, School of Agricultural, Forest and Food Sciences (HAFL). We obtained the RISE 3.0 program with a student account under the name RuaEsk2025. We were the first to use RISE in Iraq and the region, necessitating the creation of a new, previously non-existent regional designation within the program, and our inclusion in the RISE family. Our sample farm was assigned the number 33615. The program and the analysis process required a significant amount of data and calculations. Over 390 complex and diverse questions and items were entered, covering all environmental, economic, and social aspects. These included, for example, the nature and quality of water, soil details,

animal life and health, feed, lighting, grazing, various types of labor, consumption, living conditions, air quality, pollution, wages, income, irrigation, costs, revenues, and more.

The analysis required some data obtained from various sources. For instance, data related to humidity, temperature, and rainfall were acquired from Al-Raid station. Data concerning inflation and exchange rates were obtained from the Ministry of Planning. Information related to the nature of agriculture in the governorate and biodiversity was procured from the Ministry of Agriculture. Additionally, some technical data specific to cattle farming and methane emissions were added in consultation with the Animal Production Department at the College of Agricultural Engineering Sciences (Prof. Dr. Hussam Hussein Bananah, Dr. Huda Qasim Al-Hamdani). Some questions related to the security and political situation of the region were answered with estimations. It should be noted that some questions or items were not answered, either because they did not serve the objectives of our study or due to the difficulty of data availability. We strived to maintain a good balance between a set of universally applicable sustainability topics and indicators on one hand, and a sufficiently specific analysis on the other, which presented a significant challenge. A total of 72 survey forms were collected from farms in Baghdad province for the year 2024.

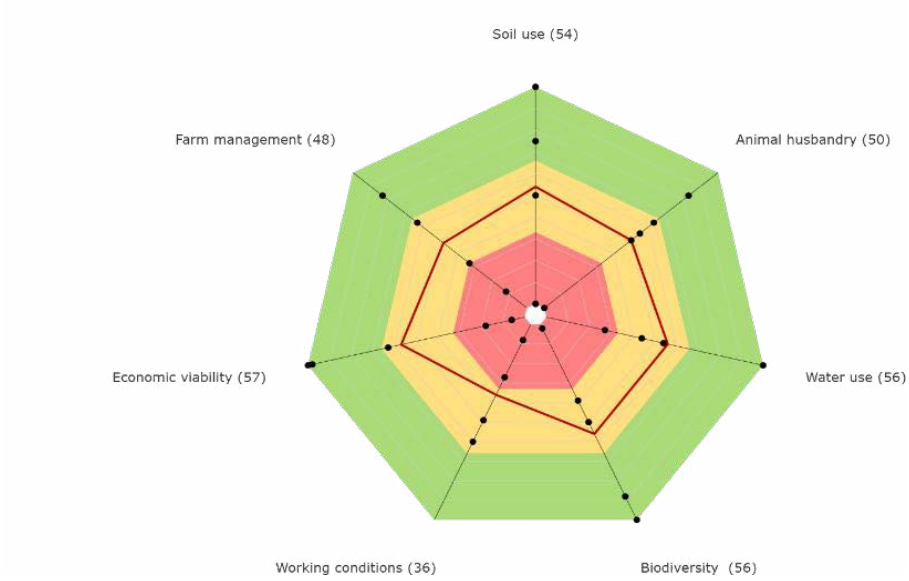
Results and Discussion:

After data input, sorting, and regional classification within the software, a Sustainability Polygon (as depicted in Figure 1) was generated. This polygon, illustrating ten sustainability indicators, presents the results of the sustainability assessment for the study sample. This evaluation reflects the current reality, and these findings may not be typical for many farms operating in Baghdad Governorate.

The overall sustainability index was low due to the low scores of all indicators calculated within the polygon. The economic status can be considered acceptable, achieving approximately 57 points, as the sample demonstrated good economic performance indicators. However, a critically severe issue was identified with the labor indicator, which scored a low 36. This weakness stems from poor working conditions, long working hours, low wages, and the presence of child and female labor, with some

aspects representing disguised unemployment. A significant number of the farms are small, with few cattle, relying heavily on family labor.

The water use indicator within the polygon achieved 56 points. While cattle farms generally don't require extensive water, the primary challenges identified were the year-round availability and the quality of the available water. The biodiversity indicator also scored 56 points. Although no specific measures or actions were taken to conserve biodiversity, agricultural projects inherently possess a certain degree of spontaneous



biodiversity. Furthermore, the animal indicator achieved 50 points, the soil indicator 54 points, while the farm management indicator scored 48 points.

Figure 1: Sustainability Polygon and Sustainability Score. Source: Developed by the researchers using RISE software.

Soil Use

Soil Management

Fertile soil is a finite and easily degradable resource, fundamental to life and production. This indicator reflects the soil's condition on the farm and how it is influenced by agricultural practices. The results of this topic answer the following questions for the farmer: How is their soil fertility assessed? And what is the impact of their agricultural practices on soil fertility?

Within this indicator, soil management is addressed, with the sustainability objective being the active application of knowledge and technology to facilitate productive and site-adapted soil use and conservation. An assessment is conducted to determine whether soil analyses, nutrient and organic matter balances, and changes in soil carbon content are calculated and considered, and if any agricultural land has been lost in the past ten years. A score of 100 points is awarded if all relevant analyses have been performed and no agricultural land has been lost. The score for this indicator was 25 points, which is very low. This indicates that not all analyses were performed, and carbon levels are high. Furthermore, due to climate change and inadequate soil management, agricultural areas have been lost in recent years.

Crop Productivity

The sustainability objective we aim to measure through this indicator is that, through appropriate yields per unit area, the farm contributes quantitatively and qualitatively to meeting the demand for agricultural products and ensures its economic competitiveness. The yield per unit area for all crops cultivated on the farm is compared against regional benchmarks for very high, medium, and very low productivity. Product quality is also assessed based on regional or farm-specific standards. The three benchmark yields correspond to 100 RISE points (very high yield), 67 RISE points (average regional yield), and 34 RISE points (low yield), with 0 RISE points awarded for no yield, with a +/- 20-point correction for product quality. Linear interpolation is used to bridge the gaps between the three defined points. Crop productivity scored 75 points, indicating medium productivity within the study sample.

Soil Organic Matter

The sustainability objective through this indicator is that arable soil on the farm is characterized by good organic matter supply, ensuring that the topsoil organic matter content remains at least stable. The organic matter content of arable soil is assessed directly, or a simple soil organic matter balance is calculated and evaluated based on rotation and agricultural practices. For simplification, the RISE model assumes a high and stable soil organic matter content for permanent pastures, permanent crops, and forests (Kuntze et al., 1994). There are two options for assessing the situation in arable land (mineral soils). If reliable analysis data are available, the organic matter content in the topsoil is assessed based on elevation and soil type. Reference data were obtained through a comprehensive analysis of Bavarian farms (Capriel, 2010), although they are not valid for peaty and black soils. If reliable data are not available, a simple soil organic matter balance is calculated and assessed, differentiating between organic and conventional farms. Soil organic matter balance coefficients are derived from the "site-adapted STAND method" (Kolbe, 2008). The goal is a stable soil organic matter content capable of ensuring an adequate nutrient supply while preventing nutrient inefficiency and high greenhouse gas emissions (Kolbe, 2012). The evaluation functions for both procedures used in RISE are only valid for the temperate climate zone. For areas outside this zone, RISE uses coefficients that have not yet been scientifically validated. This indicator scored 100 points, as the soil had good organic matter content capable of supplying nutrients to plants.

Soil Reaction

The sustainability objective here is that soil reaction falls within the optimal range for crop growth, and soil use does not lead to salinization or acidification outside this range. Soil pH is assessed in terms of crop requirements, and the risk of salinization or acidification is evaluated (Figure 11). Soil acidity and salinity are assessed using a single indicator in the RISE system, as both are related to soil pH. 100 points are awarded if the farm's soil pH ranges between 5.5 and 7.0. Points are deducted when the pH is too high or too low. Additional points are deducted when acidic fertilizers are used without proper soil treatment. 25 points are deducted if the amount of physiologically acidic fertilizers (e.g., urea, ammonium sulfate) exceeds 100 kg/ha annually. In dry climates, good soil

drainage is essential, and soil pH should not exceed 7.0. This criterion received 0 points because we were unable to measure soil acidity and crop requirements for acidic fertilizers.

Soil Erosion

The sustainability objective here is that the amount of soil lost due to water and wind erosion does not exceed tolerance levels, even in the most vulnerable areas. Details regarding the frequency and severity of all erosion events that occurred on the farm over the past five years are required. Additionally, climate, slopes, soil type, vegetation cover, and agricultural practices are used to calculate the risk of water and wind erosion in the most vulnerable areas. 100 points are awarded if no soil erosion was observed and the erosion risk does not exceed soil loss tolerance levels, even in the most vulnerable areas. This indicator scored 75 points, which is a good score and indicates no significant erosion, as most of the land in the study sample is cultivated and has vegetative cover.

Soil Compaction

The sustainability objective we aim to measure through this indicator is that crop growth and soil life are not negatively affected by excessive compaction of the topsoil layer. The risk of excessive soil compaction is assessed based on risk factors (wheel load, soil moisture, soil type, tillage) and protective factors (compaction reduction, improved soil stability). 100 points are awarded if no excessive compaction was observed, the soil is not susceptible to compaction or tillage, and the maximum wheel load is 2.5 tons or less. This indicator scored 50 points, which suggests that the soil in the study sample is exposed to excessive compaction and tillage, and in some instances, tillage was not optimal.

Animal Husbandry

Animal husbandry is an integral part of many agricultural production systems. Livestock must be raised in a manner that ensures their welfare and does not harm the environment. Animal welfare practices encompass the "Five Freedoms": freedom from hunger or thirst; freedom from discomfort; freedom from pain, injury, or disease; freedom to express normal behavior; and freedom from fear and distress (FAWC, 1979).

Simultaneously, high performance and resource use efficiency should be pursued. This topic addresses the following:

- Whether livestock performance is at a high level.
- Whether the animal husbandry system allows for species-appropriate behavior.
- Whether the physiological needs of the animals have been met.
- Whether the animals are in good health.

Herd Management

The sustainability objective of herd management is that livestock numbers on the farm are managed in a long-term, site-adapted manner to improve animal health, welfare, and sustainability. An assessment is conducted to determine whether information related to livestock is collected and utilized in a targeted manner for breeding and care to improve animal welfare. 100 points are awarded if there is systematic monitoring and documentation of animal husbandry (health and performance), and balanced criteria for selection and breeding. This indicator scored 50 points, confirming that cattle rearing is still largely traditional and family-based, with insufficient consideration of scientific methods in management and breeding to improve animal performance and health.

Livestock Productivity

The sustainability objective through this indicator is to achieve appropriate livestock performance on the farm. The annual performance of all livestock categories on the farm is compared against regional benchmarks for very high, medium, and very low performance. Product quality is also assessed based on regional or farm-specific standards. The three reference performance values are 100 RISE points (very high yield), 50 RISE points (average regional yield), and 0 RISE points (very low yield), with a +/- 20-point correction for product quality. Linear interpolation is used to bridge the gaps between the three defined points. This indicator scored only 18 points, indicating low productivity compared to regional or area productivity. This is attributed to reliance on

low-yielding local breeds, the absence of a systematic veterinary program, and the non-optimal use of feed in terms of quantity and quality.

Opportunity for Species-Appropriate Behavior

The RISE system, through this indicator, aims to achieve the sustainability objective of providing an animal husbandry system that ensures the freedom for animals to engage in their natural social behaviors, movement, rest and sleep, feeding, outdoor access, reproduction, and exploration. An assessment is conducted to determine whether animals enjoy sufficient time outside the enclosure and contact with conspecifics, and whether their environment allows them to behave as naturally as possible. 100 points are awarded if, based on current knowledge, the conditions in which animals are kept allow for species-appropriate behavior for all behavioral categories listed in RISE. The sample achieved 65 points, which is a good indicator, suggesting ample space in the enclosures, allowing animals to move and go outside comfortably. Furthermore, a good portion of their time is spent in pastures, facilitating contact and exposure to natural light.

Living Conditions

The sustainability objective here is to meet the physiological needs of the animals, where they live in a suitable environment. An assessment is conducted to determine whether temperature, lighting, air quality, noise level, and feeding arrangements meet the needs of the respective species. 100 points are awarded if all animals live under species-appropriate conditions. There was an increase in temperatures and also relative air quality pollution, though with improved lighting, which resulted in an indicator score of 55, indicating a relatively moderate degree of suitable environment for animal rearing.

Animal Health

The sustainability objective is for animals to live free from pain and disease, and for the number of unintended losses to be as minimal as possible. An assessment is conducted on the number of unintended losses, veterinary treatments, animal interventions, and the external condition of the animals. 100 points are awarded if no veterinary treatments are needed, no deaths due to disease, injury, or accidents, and no

deformed animals. A score of 63 points for this indicator means that veterinary treatments are needed, especially with the recent spread of diseases.

Materials Use & Environmental Protection

Sustainable agricultural production relies on natural nutrient cycles, maintaining a good nutrient balance even at high productivity levels while minimizing environmental pollution and material consumption. This section indicates: whether tight cycles and sustainable sourcing are considered when acquiring materials (fertilizers, feed, etc.); and whether environmental harm is avoided during the storage, use, and disposal of materials.

Material Flows

Our sustainability objective for material flows is to encourage the sustainable production of consumables, machinery, infrastructure, feed, and fertilizers through responsible sourcing. Targeted material selection and optimal resource utilization contribute to waste reduction. An assessment is conducted to determine: (a) whether priority is given to using nutrient sources (especially feed and fertilizers) that are either produced on the farm itself or at least sourced locally (within a region-specific radius); (b) whether the acquisition of materials and equipment considers sustainability criteria, especially circular economy principles; and (c) finally, whether unproductive losses are prevented. This indicator integrates information on the following components:

Feed self-sufficiency (calculated): N self-sufficiency, P self-sufficiency.

Fertilizer self-sufficiency (calculated): N self-sufficiency, P self-sufficiency.

Regionality of feed supply.

Regionality of fertilizer supply.

Losses from crop production ("food loss").

Degree of implementation of recycling potential.

100 points are awarded if all materials are sourced locally and sustainably, and unproductive losses are minimized. However, this indicator scored 29 points, clearly

indicating low performance. This suggests that feed, especially concentrated feed, is imported or purchased from outside the farm. Similarly, fertilizers are purchased from markets at high prices, and there is no self-sufficiency in feed, fertilizers, or food. Furthermore, there is waste in resource use, and sustainability and circular economy principles are not observed.

Fertilization

The sustainability objective we aim to measure through this indicator is to facilitate balanced crop nutrient supply and good productivity while preventing environmental harm and soil nutrient deficiencies. Available farm nutrients are optimally utilized, and external nutrient sources are only supplemented when necessary. Nitrogen and phosphorus balances are calculated at the farm level (supply and demand balance; reference values for the scoring function can be adjusted to regional data). Nutrient surpluses are evaluated more rigorously than deficits in surplus areas. The tolerance limit for surpluses is only raised in cases of poor phosphorus supply, but not for poor nitrogen supply. The extent to which fertilizer use is rationalized according to best practices is also assessed. This indicator integrates information on the following components:

Fertilization management.

Farm-level nitrogen balance.

Farm-level phosphorus balance.

100 points are awarded if fertilizers are used only when necessary, based on relevant analysis results. The farm has a stable nitrogen and phosphorus balance, meaning the difference between supply and demand does not exceed 10%. The precise details of the evaluation function can be regionally defined for both nitrogen and phosphorus. As a general rule, more points are deducted for surpluses compared to deficits of similar magnitude. Figure 14 illustrates some examples of evaluation functions. This indicator scored 21 points, indicating poor and unsustainable performance. This suggests that organic fertilizers from crop residues are not utilized, and nitrogenous and a considerable amount of phosphorus fertilizers are used at unrecommended dosages

and quantities, causing environmental harm, and there is no balance between supply and demand.

Plant Protection

The sustainability objective is that plant protection on the farm relies on integrated plant protection principles. Environmentally harmful hazardous substances are used only when absolutely necessary, and their environmental impact is minimized through careful selection and application. An assessment is conducted on (a) the extent to which plant protection problems are managed according to integrated plant protection principles, (b) the toxicity and persistence of any plant protection products used, and (c) whether measures are in place to reduce any unintended side effects from the use of genetically modified organisms (GMOs). This indicator integrates information on the following components:

Management of plant protection challenges according to integrated plant protection principles.

Due diligence in GMO cultivation.

100 points are awarded if plant protection practices are fully compliant with integrated principles, or if no plant protection products or GMOs are used. This indicator scored zero, indicating the absence of integrated plant protection management. It also suggests that site-adapted production systems, variety selection based on pest and disease resistance, reliable species identification before chemical treatments, application of damage thresholds, use of biological and mechanical means instead of chemical plant protection, and measures to maintain the effectiveness of the plant protection program (e.g., herbicide rotation) were not considered. Furthermore, farmers did not comply with relevant legislation, measures to prevent unwanted spread or gene flow, maintenance of specific GMO traits (e.g., herbicide tolerance, pest resistance), and the development of GMO product use since GMO adoption.

Air Pollution

RISE aims to achieve the sustainability objective that the storage, use, and disposal of materials do not lead to gaseous emissions that threaten or harm human or animal

health or the environment (air, soil, water, and natural ecosystems). This indicator addresses gaseous emissions that may harm human health or ecosystems. It integrates information on:

Ammonia: Risk of ammonia emissions from animal production.

Exhaust gases, smoke, and odor.

The future risk of such incidents is also assessed. The indicator scores 100 points in the absence of pollution incidents and risks. The indicator scored 21 points, indicating unsustainable use and low performance. This suggests a significant risk of ammonia emissions from animal production, as well as ammonia emissions from organic fertilizers, and smoke and odor emissions in the area, leading to soil and water pollution. Additionally, proper storage facilities for feed and fertilizers are lacking.

Soil and Water Pollution

The sustainability objective we aim to measure through this indicator is that the storage, use, and disposal of materials do not lead to liquid or solid emissions that threaten or harm human or animal health or the environment (air, soil, water, and natural ecosystems). This indicator addresses liquid and solid emissions that may harm human health or ecosystems. It integrates information on:

Nutrients (nitrogen and phosphorus).

Pollutants in fertilizers: Heavy metals, radioactive isotopes, organic substances.

Plant protection products.

Pollutants in waste, residues, and wastewater.

This indicator scores 100 points in the absence of pollution incidents and risks. It scored 56 points, which is a relatively low indicator due to the storage and disposal of problematic materials, risks from domestic and agricultural wastewater, the proportion of appropriately treated wastewater, pollution from livestock entering water bodies, and other risks related to soil and water pollution. This is also due to the improper disposal of toxic materials (plant protection products, veterinary medicines, dyes and paints, etc.),

as well as other materials that may be harmful to humans, animals, or the environment. Furthermore, the absence of buffer strips (a 6-meter-wide vegetative buffer strip, permanent vegetation along field margins, prevention of siltation, maintenance of high water retention capacity = prevention of runoff), drift prevention, and the lack of buffer strips for manure storage, silt, and temporary storage of organic fertilizers on bare soil.

Water Use

Clean fresh water is essential for human life and the production of crops and livestock. The farmer's production system affects the quantity and quality of water available to other users. This indicator addresses:

- The quality and quantity of the farm's water supply.
- The intensity and efficiency of water use in production.
- The sustainability of irrigation practices on the farm.

Water Management

The sustainability objective we aim to measure through this indicator is the active application of knowledge and technology to ensure efficient, site-adapted, and resource-conserving water use. This indicator is calculated only if "blue" water (sourced from aquifers or surface water bodies) is used on the farm (as opposed to only "green" water, i.e., rainwater naturally absorbed by plants). It scores 100 points if water consumption is monitored, and potential water-saving measures are identified and fully implemented. This indicator scored 56 points, which is a good score, meaning average performance. There is no major water problem, and water is available for many days a year. However, the main reason for the lower score is the reliance on blue water and inefficient water use.

Water Supply

The sustainability objective is that the quantity and quality of the farm's water supply are secure in the short and long term. The current situation, trends, and potential conflicts regarding water supply quantity and quality are assessed (Figure 17). 100 points are awarded if there are no problems on the farm. This indicator scored 27 points,

which is weak and indicates unsustainable water use. This may be attributed to farm problems such as the need to deepen wells, water-related conflicts, deterioration in water quality, reduced water availability, and declining groundwater levels. This is coupled with a low level of regional water stress as defined by the WBCSD Global Water Tool.

Water Use Intensity

Our objective with this indicator is that the quantity of water used in agricultural production is adapted to local conditions through crop selection and planting times. The farm does not rely on externally supplied water and minimizes its irrigation needs. The water demand for the farm's crops and livestock is calculated based on standard regional coefficients and compared to water supply determined by climatic conditions throughout the year. Water needs are estimated considering the timing and duration of crop cultivation. 100 points are awarded if the farm's total water needs are less than the annual rainfall on its land. The sample achieved a full score of 100 points, indicating sustainable water use intensity, as the cultivated areas are small and not cultivated year-round.

Irrigation

The sustainability objective for this indicator is that efficient irrigation methods enable high material and human returns. An assessment is conducted to determine (a) whether irrigation is targeted and efficient, (b) whether irrigation is financially viable, and (c) whether there are any irrigation-related problems. The indicator scores 100 points if irrigation is implemented in a targeted and efficient manner, is financially sensible, and is problem-free. The indicator scored 41 points, clearly indicating that irrigation in the study sample achieves low financial returns and is not efficient. This is due to the reliance on traditional irrigation methods, the deterioration of rivers and reduced water quantities, and the erosion of irrigation canals, leading to waste and inefficient water use.

Biodiversity

The diversity of living organisms is closely linked to the health of ecosystems. In fact, agricultural production and human life can only be achieved through the regulation of water, nutrient, and gas balances; pollination; soil formation; and other functions performed by ecosystems. This indicator addresses:

- What is being done to promote the diversity of species, varieties, and breeds on the farm.
- The extent to which natural ecosystems and their connectivity within the agricultural landscape are maintained.
- The quality of plant protection management.
- Whether substances toxic to humans and nature were used to protect crops and livestock.

Biodiversity Management

The objective here is that the farm has a biodiversity management system that includes a strategic and systematic approach to planning, decision-making, implementation, and monitoring of activities aimed at species protection and ecosystem conservation. The indicator scores 100 points for providing comprehensive biodiversity advice. The indicator scored 2 points, indicating unsustainable biodiversity management. This suggests that the farm does not receive comprehensive biodiversity advice or is not aware of the current situation. Farmers have not taken necessary measures to protect species or agricultural measures to promote biodiversity in the agricultural area.

Ecological Infrastructures

The sustainability objective we aim to measure through this indicator is that the farm includes many areas with high biodiversity potential that provide habitat for rare and specialized plants and animals. 100 points are awarded if 17% of the farm has high biodiversity potential. This figure is based on the UN Convention on Biological Diversity (Nagoya, Aichi), which states that 17% of terrestrial areas should be managed for nature. This threshold can be adjusted at the regional level. This indicator achieved a full score

of 100 points, indicating the presence of a high proportion of agricultural land with high ecological value (level, linear, and punctiform structures). This is because the sample consists of large agricultural areas with a significant proportion of pastures, among others, which allowed it to achieve this percentage.

Distribution of Ecological Infrastructures

The ecological landscape is well-connected, allowing mobile animal species to move from one ecological starting point to another. There is no "erosion" of ecological structures. 100 points are awarded if 100% of arable land has ecologically valuable features within or near it (less than 50 meters), and if the development of these features is moving in a positive direction (+/- 20 points). The optimal value for the ecological quality of landscapes can be adjusted at the regional level. This indicator scored 98 points, indicating the presence of arable land and nearby ecological facilities. This is also dependent on the preceding indicator.

Intensity of Agricultural Production

Production intensity is low enough to provide habitats for a variety of plants and animals. 100 points are awarded if there is no nitrogen fertilization (0 kg N/ha), no use of pesticide substances, and low stocking density (one large animal unit per hectare). These values can be adjusted at the regional level. Any sprays used should have low toxicity to non-target organisms (including beneficial insects and aquatic organisms) and low persistence (half-life less than one month). The indicator scored 50 points, which is half the maximum score, indicating intensive use of fertilizers, especially nitrogen, and the use of agricultural pesticides. It also suggests inadequate measures to promote biodiversity in the agricultural area.

Diversity of Agricultural Production

To achieve the objective which states: "Through the diversity of agricultural production and the use of genetically diverse crops and livestock on the farm, the farm contributes to the survival and development of plant and animal genetic resources. This helps ensure the availability of a wide variety of primary genetic material for future generations for breeding purposes. By cultivating different types of crops, the farm

contributes to creating a more diverse agricultural environment." This indicator, which scored 39 points, was calculated by assessing various aspects of production diversity: the number of different land use types, the number of arable and permanent crops cultivated, and the number of livestock breeds on the farm (with additional points awarded for old or endangered varieties and breeds); for permanent grasslands, the frequency of use and yields are assessed; and beekeeping is positively rated.

This indicator is assessed as follows: 100 points are awarded if there are 5 different land use types (this figure may be regionally adjusted), 6 different livestock breeds, 3 rare and/or old varieties and/or breeds, and bees kept on the farm. A high proportion of diverse permanent grasslands (assessment based on frequency of use and yield) and 10 different arable and permanent crops (for more than 10 hectares of arable and permanent crops, a maximum of 10 crops; for less than 10 hectares of arable and permanent crops, one crop per hectare).

Working Conditions

A committed and productive workforce is a prerequisite for the success of any farm. These two characteristics are strongly influenced by working conditions on the farm. This indicator assesses the objective working conditions of farm employees and self-employed workers. It addresses the following aspects:

- Occupational health and safety / physical working conditions.
- Work organization.
- Respect for fundamental rights.
- Wages.
- Fairness.

Personnel Management

The sustainability objective for this indicator is that good personnel management ensures the farm has sufficient staff in the short, medium, and long term, who are satisfied, motivated, and adequately trained. Transparent and fair employment terms and conditions also reduce the likelihood of disputes. An assessment is conducted to

determine whether the farm has a professional personnel management system and whether working conditions comply with decent work standards stipulated in relevant human rights conventions and agreements. This indicator scored only 6 points, which is very low and indicates unsustainable low performance. This is because employee requirements are unknown, arrangements for replacing workers leaving the farm due to age are absent, there is no professional training program, employment contracts are not written, there are no payrolls, no work permits for all employees, and no measures have been taken to motivate the workforce (e.g., incentive systems and praise) / protection against unfair dismissal / adequate income protection in case of accidents, illness, or maternity, etc., and child labor is present.

Working Hours

The sustainability objective here is that everyone working on the farm has sufficient free time to recover physically and mentally, so they can remain healthy and productive in the long term. Daily, weekly, and annual working hours, and annual leave were recorded and assessed according to regional standards. 100 points are awarded for 5 days a week, 40 hours a week, 6 weeks of paid annual leave, and paid overtime. These values are regionally adjustable. The indicator scored 60 points, indicating a good and acceptable level given the production conditions, and that the work is not inherently arduous, with the understanding that family labor is not directly paid.

Safety at Work

The sustainability objective we aim to measure through this indicator is: "Appropriate measures are taken to ensure that work-related accidents and illnesses on the farm are minimized. Children are not harmed by any work they perform on the farm." An assessment was conducted on the frequency of work-related accidents and illnesses on the farm, the measures taken to prevent them, and whether there is a risk of illegal child labor. The indicator in the study sample scored 40 points, indicating low performance, meaning a lack of safety at work due to child and female labor without safety measures, leading to work-related accidents or illnesses. Additionally, direct handling of some highly toxic pesticides occurs.

Wage and Income Level

The sustainability objective aims for individuals working on the farm to earn an hourly wage that allows them to live comfortably above the poverty line when working normal hours. The indicator scored only 27 points. This means that workers earn wages that place them below the poverty line, as workers need to earn at least 34 points to live at the poverty line. 100 points are awarded if the hourly wage is twice the poverty line wage for an average family. For self-employed workers (unpaid family labor working on the farm), the same calculation was based on the figure derived by dividing private consumption plus all non-cash benefits enjoyed by the family by the total number of working hours of all self-employed workers. Relevant threshold values (poverty line, 100-point factor, family size, normal working hours) can be regionally adjusted. Additional points are awarded or deducted (+/- 50) based on the farm's financial results.

Economic Viability

A farm is, first and foremost, a business venture that seeks to achieve economic objectives while considering relevant environmental and social constraints. The goal is to ensure the project's profitability in the short and long term, and to maintain or even improve productivity, ensuring its stable and self-directed growth, thereby securing the farmer's family livelihood and the income of its workers. This criterion addresses the following aspects of the farm's economic sustainability: liquidity and stability, profitability, indebtedness, and livelihood security.

Liquidity

The sustainability objective here is: "The farm's liquid assets are sufficient to meet its financial obligations at all times." An assessment was conducted on the ratio of cash reserves (liquid assets plus available credit lines) to average weekly expenditure (annual expenses divided by 52 weeks), i.e., the number of weeks the farm can sustain itself from its cash reserves. The farm's reserves are considered sufficient if, at any point in its production cycles, it can pay wages and salaries, accounts payable to suppliers, loan installments, and interest payments from its own reserves. 100 points are awarded if it can cover 40 weeks from cash reserves. However, for the sample, the indicator scored only 6 points, meaning the sample can cover only 2.4 weeks. This is attributed to

weak performance and low liquid assets, and sometimes farmers are forced to purchase inputs on credit, incurring higher costs.

Profitability

The sustainability objective is that the farm achieves financial profit in both the short and long term. In other words, its profits enable it to meet its financial obligations, invest, and achieve a return equivalent to the capital invested in the project. The operating cash flow to sales ratio was assessed. The return on equity, i.e., the ratio of profits (cash flow minus depreciation) to invested capital, was also assessed. The judgment was based on the following rule: if the cash flow to sales ratio is 20%, 100 points are awarded; if it is 10%, 67 points are awarded. As for the return on equity, if its ratio is 5%, 100 points are awarded / 0% = 0 points. For the sample, the cash flow ratio was 20%, and thus the indicator scored 100 points, meaning the sample generates profits and has the ability to meet its financial obligations. This is consistent with what was stated in the first section of this chapter.

Stability

The sustainability objective we can ascertain through this indicator is that the farm enjoys financial stability, meaning its ability to regularly achieve financial break-even over several years with a normal level of family consumption, and that the future of farm production is secure in the long term. It scores 100 points if the farm's infrastructure is in good condition, the farm has many customers in all its main activity areas, its primary source of income represents less than 20% of total business revenue (no risk), access to all land is guaranteed in the long term, and it has a high equity ratio. The sample scored 67 points on this indicator, meaning the sample has diverse expertise, maintains modern infrastructure, and thus does not rely entirely on market price trends or individual customers. Access to land ensures planning capability and long-term production continuity, while a high capital ratio allows farmers to make their own decisions on how the business develops.

Indebtedness

The sustainability objective we aim to understand through this indicator is that the farm's level of indebtedness is not problematic and is proportionate to its financial resources. There is room to incur more debt when needed, for example, to overcome a period of funding shortfall. The financing ratio was calculated as a ratio between net debt and operating cash flow. This allows calculating the number of years required to fully repay the farm's debts using its current cash flows. The judgment was based on the following rule:

- Debt-to-Equity Ratio: 100 points if the farm would need 5 years to repay its debts using its operating cash flows / 0 points for 20 years.
- Debt Service Coverage Ratio: 100 points for a debt service coverage ratio of 0% / 67 points for 50% / 0 points if 100% of cash flow is used for debt service.

The sample scored 98% on this indicator, meaning it needs 5 years to cover its debts using its operating cash flows. In reality, debt was not a significant figure, and it was zero in some categories of the sample, which is consistent with what was stated in the RC indicator in the first section of this chapter.

Livelihood Security

The sustainability objective we aim to understand through this indicator is that the farm's income is sufficient to secure the economic livelihood of the family (unpaid family members). An assessment was conducted on the ratio of private expenditure to the adjusted minimum subsistence level. The minimum subsistence level is adjusted proportionally to the size of the farmer's family, and any in-kind payments received by the farm are deducted. The private expenditure of unpaid family members (farmer's family) should clearly exceed the minimum subsistence level. The indicator was judged based on the following rule:

Between 34 and 66 points maximum are awarded for household expenditure ranging between 100% and 200% of the poverty line (yellow, critical). If the household income is twice or up to three times the poverty line, the farm is awarded between 67 and 100 points maximum (green, sustainable). The sample achieved a low livelihood

security level, less than critical, as it scored only 18 points, indicating that the farm's income is insufficient and does not secure a decent economic life.

Farm Management

It may be entirely worthwhile to manage a farm using traditional methods, even in the long term. However, changes will be necessary if poorly designed management coincides with clear unresolved challenges. In this case, it is essential to adjust the farm's strategy by implementing:

- Measures that integrate sustainability into management systems, operations, and culture.
- Sustainable farm management.
- Achievement of goals and strategies that align with stakeholders' personal values and consider the natural, human, animal, environmental, financial, and societal constraints.
- Access to necessary knowledge for informed decision-making.
- Regular assessment of internal and external risks so that proactive measures can be taken and resources used productively, safely, and profitably.
- Promotion of sustainable relationships, ensuring that interactions with people and stakeholders inside and outside the farm are characterized by respect and fairness.

Business Goals, Strategy, Implementation

The sustainability objective we aim to measure through this indicator is whether those responsible for farm management consciously set goals, develop strategies to achieve them, and implement the necessary actions. In this context, "conscious" means alignment with individuals' personal values and the farm's surrounding conditions. The chosen strategy should have a positive impact on economic, social, and environmental sustainability. The sample scored 63 points for this indicator, which indicates a critical situation. This relatively means that the farmer does not have well-considered goals and

an appropriate strategy for the farm, and has not implemented them regularly. Furthermore, social and environmental aspects were not considered, and their work goals were not consistent with sustainability goals.

Availability of Information

Here, we aim to achieve the following sustainability objective: When necessary, those responsible for farm management have access to sufficient information and reliable planning tools so they can manage the farm systematically and professionally. An assessment was conducted to determine whether the farm has access to sufficient information and reliable planning tools necessary for systematic farm management, and whether these tools are actually used if necessary. The indicator scored 33 points, indicating unsustainable and low performance. This means that the farmer does not have access to all necessary information and reliable planning tools, or does not use them as needed to facilitate sustainable farm management.

Risk Management

Through this indicator, we try to achieve the sustainability objective that states: Those responsible for farm management are aware of the risks and impacts that may threaten the farm's livelihood and do their utmost to mitigate them. This indicator assesses how those responsible for farm management deal with risks that threaten their livelihoods. An assessment was conducted on the freedom of action available to farm management internally, especially regarding risk prevention, as well as minimizing the negative impacts of any adverse events. The application of quality assurance measures is essential to ensure healthy and marketable production. The sample's performance was unsatisfactory, unsustainable, and low, as it scored only 13 points, indicating the farm's inability to confront and manage risks. This is especially relevant given the high and inherent risk and uncertainty in agricultural production.

Resilient Relationships

Sustainability objective: The farm's internal and external relationships are managed in a way that provides a solid foundation for its long-term success. The farm cooperates with colleagues and neighbors whenever appropriate. Disputes are resolved

by consensus, not by coercion. The indicator scored 83 points, indicating sustainable and acceptable performance. This confirms the existence of stable relationships successfully built within and outside the farm, forming a solid foundation for its success. The farm engages in wise and productive cooperation with other farms and individuals. Disputes within or related to the farm are resolved by consensus rather than coercion. This aligns with the social environment of rural areas and their adherence to social values and principles within an ethical framework.

Table 2: Indicators, Standards, and Points Achieved

2	Animal husbandry	50
2.1	Herd management	50
2.2	Livestock productivity	18
2.3	Opportunity for species-appropriate behavior	65
2.4	Living conditions	55
2.5	Animal health	63

1	Soil use	54
1.1	Soil management	25
1.2	Crop productivity	75
1.3	Soil organic matter	100
1.4	Soil reaction	0
1.5	Soil erosion	75
1.6	Soil compaction	50

4	Water use	56
4.1	Water management	54
4.2	Water supply	27
4.3	Water use intensity	100
4.4	Irrigation	44

3	Materials use & environmental protection	25
3.1	Material flows	29
3.2	Fertilization	21
3.3	Plant protection	0
3.4	Air pollution	24
3.5	Soil and water pollution	56

6	Working conditions	36
6.1	Personnel management	8
6.2	Working hours	60
6.3	Safety at work	49
6.4	Wage and income level	27

5	Biodiversity	56
5.1	Biodiversity management	2
5.2	Ecological infrastructures	100
5.3	Distribution of ecological infrastructures	88
5.4	Intensity of agricultural production	50
5.5	Diversity of agricultural production	39

8	Farm management	48
8.1	Business goals, strategy, implementation	63
8.2	Availability of information	33
8.3	Risk management	12
8.4	Resilient relationships	83

7	Economic viability	57
7.1	Liquidity	6
7.2	Profitability	100
7.3	Stability	63
7.4	Indebtedness	98
7.5	Livelihood security	18

Source: The researchers' work, based on RISE3.

Conclusion

Sustainability at the farm level is crucial; it's the bedrock for achieving sustainability across the entire agricultural sector. Balancing economic, social, and environmental goals is paramount for farmers to ensure their practices and decisions are sustainable. It's important for sustainability indicators to be more than just target numbers. They should be adaptable over time and across different scales to reflect changing conditions. Ultimately, ensuring the sustainability of the agricultural community depends on effectively measuring and adapting to change as needed.

It's essential to determine whether sustainability commitments, from farm to national levels, translate into tangible results. Local communities act as the link between these levels. Without robust and accessible evaluation mechanisms, accountability might be lost, or tracking efforts could become impossible. A lack of accountability doesn't necessarily imply ill intent; it might simply stem from a shortage of the necessary tools for verification.

RISE can be a valuable tool for assessing farm sustainability. It provides a solid foundation for further verifying farm-level sustainability by calculating economic, social, environmental, and energy indicators. These include metrics for water, soil, biodiversity, emission potential, plant protection, waste and residues, cash flow, farm income, investments, local economy, and the social status of each farm.

The sustainability standing of the study sample was critical in terms of the seven polygon indicators and low in terms of sustainability degree. This was influenced by farm management points, which shifted the situation from critical to low. The farmers were not sustainable in their practices and did not balance economic, social, and environmental goals.

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تقييم الاستدامة على مستوى المزرعة باستخدام منهجية RISE: دراسة حالة محافظة بغداد

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الخلاصة:

هدف البحث إلى تقييم الاستدامة على مستوى المزرعة؛ لأن القرارات المتخذة على مستوى المزرعة، مثل التخصص وتخصيص الموارد وإدارة عمليات الإنتاج، تُعدّ حاسمة وأمرًا ضروريًا لتحقيق الاستدامة. يتطلب تعزيز مجتمعات قوية توازنًا بين الاقتصاد والبيئة والاجتماع. تم استبيان 72 مزرعة في محافظة بغداد للعام 2023 فضلًا عن بيانات أخرى تم الحصول عليها من الجهات المختصة. استُخدم تحليل RISE وهي أداة تُستخدم للتقييم الشامل لاستدامة الإنتاج الزراعي على مستوى المزرعة. تم حساب ثمانية مؤشرات، في كل مؤشر أكثر من أربعة معايير للوضع الاقتصادي والبيئي والاجتماعي: استهلاك الطاقة، واستهلاك المياه، ورعاية التربة، والتنوع البيولوجي، وإمكانية الانبعاث، وحماية النبات، وإنتاج النفايات والمخلفات، والتدفق النقدي، ودخل المزرعة، والاستثمارات، والمساهمة في الاقتصاد المحلي، والوضع الاجتماعي لأسر المزارع وموظفي المزرعة، وإدارة المزارع، مؤشر استخدام المياه حقق 56 نقطة وهو مؤشر حرج للاستدامة متأثرًا بإمدادات المياه التي حصلت على 27 نقطة، وهي تشير إلى وضع صعب. أما استخدام الهواء وحماية البيئة، فكان الأداء ضعيفًا إذ حقق 25 نقطة بسبب ضعف إمدادات المواد والتسميد، بينما مؤشرات ظروف العمل كانت غير مستدامة من خلال إدارة العمال ومستوى الأجر والدخل الذي حقق 27 نقطة، وكان حرجًا بمؤشرات ساعات العمل وسلامة العمل، أما مؤشر الجدوى الاقتصادية، فحقق 57 نقطة وهو حرج من حيث الاستدامة، وكان ضعيفًا من حيث السيولة (6 نقاط فقط) وأمن سبل العيش (18 نقطة)، بينما كان مستدامًا من خلال مؤشر الربحية، معيار إدارة المزارع كان حرجًا بـ48 درجة متأثرًا بإدارة المخاطر التي كانت غير مستدامة، المؤشرات الأخرى ضمن مضلع الاستدامة كانت حرجة أيضًا إذ تربية الحيوان حققت فقط 50 نقطة واستخدام التربة 54 نقطة، بشكل عام يمكن القول إن الاستدامة على مستوى مزارع محافظة بغداد كانت غير مستدامة، ولم تستطع الموازنة بين المؤشرات الاقتصادية والبيئية والاجتماعية. وإن الزراعة المستدامة مهمة شاقة ومعقدة للغاية، وتتطلب حلولًا فردية خاصة بالمزرعة. لذلك ينبغي أن يساهم تحليل استدامة المزرعة في تنمية القدرات.

الكلمات المفتاحية: مضلع الاستدامة، إمدادات المياه، حماية البيئة، RISE، إدارة المزارع.