Assessment tool for assessing sustainability literacy and knowledge of all students of ICAR-NDRI, Karnal

Introduction

The ICAR-National Dairy Research Institute (NDRI), Karnal, recognizes sustainability as a fundamental component of its academic, research, and extension mandate, particularly in the context of climate change, resource constraints, and the need for resilient agricultural systems. As a premier institution in dairy science and livestock research, NDRI places strong emphasis on developing sustainability literacy among its students to prepare them for addressing complex environmental and socio-economic challenges.

Sustainability literacy extends beyond basic awareness and encompasses a comprehensive understanding of environmental, social, and economic dimensions of sustainability, along with the ability to apply this knowledge in real-world contexts. In the domain of dairy and livestock systems, this includes critical issues such as greenhouse gas emissions, heat stress management, resource-use efficiency, and sustainable rural livelihoods.

In this context, NDRI has adopted a structured and evolving approach to assess sustainability literacy and knowledge among students. The assessment framework is designed to evaluate not only theoretical understanding but also practical application of sustainability principles through academic learning, research activities, and field-based engagement. This approach ensures that students are equipped with the necessary competencies to contribute effectively to sustainable development and climate-resilient dairy systems.

Conceptual framework and institutional approach

The sustainability literacy assessment framework at ICAR-National Dairy Research Institute (NDRI) is guided by internationally recognized models such as the Sustainability Tracking, Assessment & Rating System (STARS) and the Sustainability Literacy Test (Sulitest), which emphasize objective evaluation of sustainability knowledge, critical thinking, and application-oriented learning. These frameworks define sustainability literacy as the capacity to understand key environmental challenges, appreciate their social and economic dimensions, and make informed decisions in professional and societal contexts. Building upon these global benchmarks, NDRI has developed a context-specific and sector-oriented framework tailored to its core domain of dairy science and livestock systems. The Institute integrates universal sustainability principles

with specialized knowledge related to climate-resilient dairy farming, greenhouse gas emissions (particularly enteric methane), resource-use efficiency, and circular bio-economy approaches in livestock production.

The institutional approach adopts a holistic and interdisciplinary perspective, encompassing environmental sustainability (climate change, biodiversity, natural resource management), social sustainability (farmer welfare, gender equity, rural livelihoods), and economic sustainability (productivity, efficiency, and sustainable value chains). This integrated framework ensures that sustainability is not treated as a standalone concept but is embedded across teaching, research, and extension activities. Furthermore, the assessment system is designed as a continuous improvement mechanism, enabling the Institute to identify knowledge gaps, strengthen curriculum design, and enhance student competencies over time. By aligning global standards with national priorities and institutional strengths, NDRI ensures that its sustainability literacy framework remains both academically rigorous and practically relevant.

Assessment Methodology

The ICAR-National Dairy Research Institute (NDRI) adopts a structured, multi-dimensional methodology to assess sustainability literacy among students, combining standardized tools with experiential and application-based evaluation approaches. A standardized assessment tool is employed, consisting of multiple-choice questions (MCQs), case-based scenarios, and problem-solving exercises. These are designed to evaluate both foundational understanding of sustainability concepts and the ability to apply these concepts in real-world dairy and agricultural contexts. The assessment framework incorporates domain-specific elements such as climate-resilient livestock systems, greenhouse gas emissions, and resource-use efficiency.

To evaluate learning outcomes and effectiveness of academic interventions, NDRI follows a pre- and post-assessment approach. Baseline assessments are conducted at the beginning of courses or training programmes to gauge initial levels of sustainability literacy, while follow-up assessments are conducted after course completion, workshops, or field exposure to measure improvement in knowledge and understanding. In addition to formal assessments, sustainability literacy is evaluated through experiential learning components, including student research projects, dissertations, field visits, and participation in extension activities. These components provide qualitative insights into students' ability to apply sustainability principles in practical settings, particularly in the context of dairy farming and rural systems.

Dimensions of Sustainability Literacy

ICAR-National Dairy Research Institute (NDRI) assesses multiple dimensions to ensure a holistic understanding of sustainability among students.

i. **Environmental dimension:** Includes climate change, greenhouse gas emissions, renewable energy, biodiversity, and natural resource management.

ii. **Dairy and livestock systems dimension:** Sector-specific knowledge such as enteric methane emissions, heat stress management, sustainable feeding, manure management, and climate-resilient dairy practices.

iii. **Social and economic dimensions**: Cover rural livelihoods, farmer welfare, equity, and sustainable value chains.

Coverage and Inclusivity

The sustainability literacy assessment framework at ICAR-National Dairy Research Institute is designed to be inclusive and institution-wide. It covers undergraduate, postgraduate, and doctoral students, ensuring broad participation across academic levels. The framework is applicable across disciplines of production, processing, and social science and management group, while maintaining a common sustainability foundation.

Continuous improvement and future directions

The institute adopts a dynamic approach to sustainability literacy assessment, ensuring that the framework evolves with emerging challenges and scientific advancements. Assessment tools are periodically reviewed and updated to incorporate new themes such as climate extremes, carbon management, and circular bio-economy. The Institute is also working towards **greater alignment with global standards** such as STARS and Sulitest, while adapting them to the dairy and livestock sector. Future efforts include development of a C**omprehensive Sustainability Literacy Index**, integration of advanced assessment methods, and strengthening interdisciplinary learning. Continuous feedback from students and faculty is used to refine the framework and improve effectiveness.