World Academy of Science, Engineering and Technology
International Journal of Social and Business Sciences
Vol:17, No:8, 2023

Sustainability Assessment of Agriculture and Biodiversity Issues through an Innovative Knowledge Mediation System Using Deliberation Support Tools and INTEGRAAL Method Based on Stakeholder Involvement

Ashiquer Rahman

***Abstract*—**The cutting edge knowledge mediation system called 'ePLANETe' provides a framework for building knowledge, tools, and methods for education, research, and sustainable practices, as well as the deliberative assessment support for Higher Education, Research Institutions, and elsewhere e.g., the collaborative learning and research on sustainability and biodiversity issues of territorial development sectors. The paper is to present the analytical perspective of the 'ePLANETe' concept and functionalities as an experimental platform for contributing to sustainability assessment. Now the 'ePLANETe' can be seen as experimentation of the challenges of "ICT for Green". The digital technologies of 'ePLANETe' are exploited (i) to facilitate collaborative research, learning tools, and knowledge for sustainability challenges, and (ii) as deliberation support tools in pursuing of sustainability performance and practices in territorial governance, public policy, and business strategy, as well as in the higher education sectors itself. The paper investigates the dealing capacity of qualitative and quantitative assessment of agriculture sustainability through the stakeholder-based integrated assessment. Specifically, this paper focuses on integrating system methodologies with Deliberation Support Tools (DST) and INTEGRAAL method for collective assessment and decision-making in implementing regional plans. The report aims to identify the effective knowledge and tools to enable deliberations methodologies regarding practices on the sustainability of agriculture and biodiversity issues, societal responsibilities, and regional planning, concentrating on the question: "How to effectively mobilize resources (knowledge, tools, and methods) from different sources and at different scales regarding on agriculture and biodiversity issues to address sustainability challenges" that will create the scope for qualitative and quantitative assessments of sustainability as a new landmark of the agriculture sector

***Keywords*—**Biodiversity, Deliberation Support Tools, INTEGRAAL, stakeholder.

I. Introduction

IN order to implement a sustainable development approach, it is essential to build an act on knowledge integrated across social, cultural, economic, and environmental issues in space and time. There are a variety of sources for this knowledge as well as stakeholders involved in final decision making and the acceptability of conditions resulting from the sources of knowledge can be deliberated upon. From the point of view, many sustainable development projects fail not primarily because of a lack of knowledge about the threats or a lack of a viable conservation approach, but rather because of an inability to transfer the knowledge into the creation of effective measures. Therefore, an upsurge in knowledge interchange and collaboration between scheme and practice-oriented conservation actors (researcher, scientist), as well as between conservation actors, land user groups (labor, contactor, supervisor), and authorities (investor, territorial governance) may enhance the effectiveness of production and biodiversity conservation goals. By allowing for the interactions between conservation stakeholders as deliberation decision networks, deliberation decision analysis can help identify structural optimization potential in these deliberation decision networks. Our "ePLANETe platform" is such a type of networking hub that supports the stakeholders involved in the assessment of sustainability practices, and concentrates on the development of the deliberative process with the inclusion of system knowledge, tools, and methodologies to assist in problem definition identification and solution-desired goals-intervention. Moreover, it is a digital solution of Science, Technology, and Innovation (STI) for implementing sustainability and dynamic balance of the ecosystem through the members and stakeholders of the ePLANETe Blue Association. It is also a Multi-Faceted Digital Approach to innovation and sustainability for future challenges of knowledge society and economy through the practicing digital eco-system model through the several knowledge doorways. The multiple interfaces of ePLANETe as a communication and capacity-building resource are complementary by design and influence user behaviors and outcomes. Moreover, ePLANETe gateway is intended to accept the identification of best practices at specific levels of action, and to encourage knowledge exchanges in a "virtual community", and thus to improve sustainability performance through the engagement of collaborative activities of different sorts.

Dr. Ashiquer Rahman is with the School of Business, The Rajshahi Science and Technology University (RSTU), Bangladesh as an Adjunct Associate Professor, and Financial Operator, Tradelink, Paris. France (e-mail: ashiq_firoza@gmail.com).

II. Conceptual Framework

A robust agriculture sector is a fundamental pillar of the atmosphere, civilization, and rich economy; it provides a reliable source of sustainability indispensable to social existence. It likewise provides income and employment to people in rural communities and sideways the food supply chain. Despite growing agriculture efficiency being able to feedstuff an accumulative and increasingly affluent world inhabitant, conservational and social costs have mounted as a consequence. Due to the sophisticated combination of eco-friendly, societal, and commercial concerns of sustainable agriculture, its definition and measurement have been difficult. Moving forward, agriculture is still facing the challenge of increasing productivity to meet growing societal demands for food, fiber, and energy [1]. Therefore, developing a sustainable agricultural sector is imperative for countries and for the world to be not only productive but nutritionally adequate, compatible with agro-ecology ecosystem (e.g., biodiversity; synergies; efficiency; resilience; recycling; co-creation, and sharing of knowledge). They are consequently closely crosslinked with each other and interact on some key issues (e.g., Production and biodiversity conservation). More so than in any other sector of human activity, agriculture is indivisibly linked with biodiversity [2]. A new phase in the consideration of agriculture and its place in sustainable development and biodiversity began with the Rio Earth Summit (1992). Two main themes emerged from these reflections: one concerned agriculture and biodiversity, which resulted in the concept of agro-biodiversity, and the other the multi-functionality of agriculture [3].

To promote accountability for the nation's commitments to sustainable agriculture, consistent and transparent assessments (qualitative and quantitative) are essential. The fulfilment of these hopes for transparent assessment depends not only on effective and pragmatic systems analyses but also on the integration of systems science into collective learning. This is dependent on the sourcing of knowledge in many forms from a range of people and the acceptability of the resulting conditions deliberated by several affected stakeholders before final decisions are implemented [4]. This paper has moderated an assessment framework for developing a deliberative process to support agriculture as well as the biodiversity issues, and the development of a longitudinal decision support system to assist both the deliberation and agriculture sustainability process.

A. Social Choice for Participatory Sustainable Assessment

As argued in diverse contexts since the 1970s, better-integrated knowledge of coupled ecological-socio-economic systems can, in principle, assist policy development and planning in moving towards sustainable development by permitting the assessment of the viability and potentialities of those systems relative to the needs and performance goals (well beings) of current and future generations [4]**.** We adopt the view that for a wide variety of "stakeholders" in society — including decision makers in public administration and company management roles — learning about environmental governance challenges can effectively be achieved by participation in procedures (real or simulated) of selection and deployment of indicator systems for an evaluation activity **[**5]. Our chosen approach is grounded in participatory multi-criteria assessment methods that, in different ways, have been developed and deployed since the 1990s in a wide variety of policy fields. In particular we draw on work [7], combining methodological and empirical components, which has outlined operational procedures for indicator-based sustainability assessment procedures (henceforth SA). They argue for sustainability assessments to be organized in a parsimonious but multi-level way. Sustainability assessment information can be placed at three main levels, which are articulated by moving "upwards" and "downwards" relative to a deliberatively derived set of SQPMBLs (*Sustainability Quality-Performance Multiple Bottom Lines*). This multi-layered discursive approach considers sustainability goal specification and indicator development as a deeply social decision-making process for which a diversity of viewpoints must be brought together in a strongly schematically structured way. The objective is to produce, through a process of stakeholder dialogue with a spectrum of stakeholders and including tasks of identification and exploitation of a selection of indicators, an evaluation that responds transparently to the spectrum of performance issues (the multiple bottom lines) and stakeholder perspectives. Implementations of this procedure have been carried out by European research teams, notably at the former C3ED [7], and Ex- REEDS where, for the organization and communication of the evaluation, use is made of an online deliberation support tool kerDST [5]. The kerDST system permits a stakeholder community, working online or in proximity, to declare indicators as a function of perceived pertinence in a specific context. In methodological terms, the process consists of three main steps. The first phase is to "build the problem" by defining the 3-D array of (1) actor classes, (2) performance issues, and (3) options or situations to be evaluated. The second phase is for each class of stakeholder to declare a judgment for each option or scenario, relative to each criterion or performance issue. The third phase is to deepen the assessment by motivating each judgment by reference to indicators. Reflecting on the pattern of judgments built up, the user is encouraged to appreciate the pros & cons of each option (or the relative merits and deficiencies of each situation) and also, the cogency and limits of each category of information (or speculation) mobilized as an indicator. A vital question for the expansion and use of DST is: What emphasis to place on analytical resolutions and research procedures that support the demonstration of the situations, institutions, or scenarios under inspection, and what emphasis to place on procedural resolutions that may support structure the connections of "actors" and stakeholders of the assessment process and, one way or another that provide for the "reconciliation" or "arbitration" of conflicting visions and claims? Engaging in explicitly built deliberation about problems of "social choice" is defensible not only as an ethical and political choice but also as a scientific carriage that is in line with experimental 'social facts', particularly the

"impossibility" of analytical resolution of situations considered by high decision stakes, ex-ante indeterminacy and diversity of social values.

III. Methodological Framing

This paper has designed a strong action-research component, exploiting the collective action and collaborative project functionalities of the ePLANETe system for sustainability assessment on the agriculture sector through the case study of existing empirically investigated works.

A. The INTEGRAAL Procedure

INTEGRAAL is a framework for sustainability assessment that has developed by International Centre for Research in Ecological Economics, Eco-Innovation, and Tool Development for Sustainability (REEDS) and its predecessor C3ED. It consists of six steps that guiding the process of multi-criteria and multi-actor assessment and deliberation. Although presented here as a sequence of steps, INTEGRAAL is not to be conceived as a rigidly linear process. The six steps form an iterative process, which can be shown in the cycle. The attitude is to constitute a "deliberation forum" that offers opportunities to contributors to discover gradually, or in parallel, different facets of the settled problem. In the view of the REEDS team, deliberation exercises can be iterative, allowing participants to go deeper and to gain or exploit more detailed information (e.g., in the choice and mobilization of different indicators). It can be anticipated as shared learning continues that new policies for addressing the issue or sub-issues will be identified, stakeholder's values may be declared and new information, dot technology or analysis requirements may be highlighted requirements may be highlighted.

Step1. Identification by the stakeholder community of the social choice problem, or range of options: The objective of this task is to deliver the context, the scale, and the dynamics of the exercise. According to the level of participation, this step can be accomplished by the Research Community [6], or in a more participative way.

Step2. Organize the social choice problem in terms of the actors concerned, the situations or options being assessed, and the value criteria: This means developing in a pragmatic way, typologies or classifications [6] of:

(1) the stakeholders who are impacted by the problem or by the impact of the means of addressing it;

(2) the policies, strategy options, or scenarios to be appraised; and

(3) the issues against which the performance of the policies, options or scenarios will be appraised (for example: preservation of the environment, decent work, health, etc.)

Step3. Identify and mobilize information and tools for system representation (e.g., maps, models of processes and systems): This information and tools can help to 'ground' the deliberations in a robust knowledge base and, more particularly, this will assist in populating catalogues of indicators representing the stakeholders' reference points when working to evaluate situations and scenarios [6].

Step4. Mobilize the actors for tasks of deliberation: This step is dependent on the structure and information developed in steps 1-3. It produces results in the formal logic of a multi-actor multi-criteria evaluation. It also delivers insights and learning to contributors via the discussions that take place and remarks of the respective positions accepted and how these evolve through the collective learning that occurs.

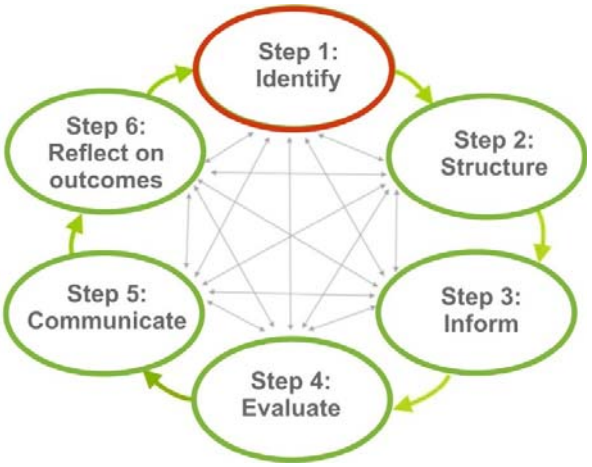


Fig. 1 INTEGRAAL Process

Step5. Communication of Results & Recommendations: This is the final reporting stage of an evaluation exercise, including all tasks "along the way" of information distribution relating to the design and arrangements of deliberations, documentation of discussions, and intermediate outcomes. Communication must take place around all features of the social learning process and its outcomes such as the framing of evaluation tasks, the range of indicators, the resolve of reference values (by whom, for whom?), and the reporting of outcomes of multi-criteria evaluations).

Step6. Reflection on the outcomes obtained and, in an iterative sense, coming back to Step1 of the progression in order to valuation the entire evaluation sequence to seem to be fit, to express new specific evaluation problems.

B. The KerBabel Deliberation Matrix and System kerDST

The methodological frame adopted to characterize evaluation methods along four major axes: (1) the objects of evaluation attention (e.g., institutions, sites, strategies, actions….); (2) the framing of the performance goals and challenges; (3) the identification and roles of the different "actors" or stakeholders in the evaluation process; and (4) the type of indicators or "signals" of performance. Attention to these four axes then allows us to characterize the procedures for indicator selection, mobilization, and synthesis into aggregate indices or scores. The logic of the 3-dimensional Deliberation Matrix as developed by the KerBabel research team, is to permit a didactic presentation of the process and

outcomes of *judgments* offered by *each* category of stakeholders, for *each* of the options or scenarios under evaluation, concerning a *spectrum* of governance or quality-performance issues [13]. The spectrum of quality-performance issues, the categories of stakeholders, and the list of objects to be evaluated and compared must be determined by a KerDST user who, as the designated *problem holder*, will "build the problem" within the online deliberation support tool [5]

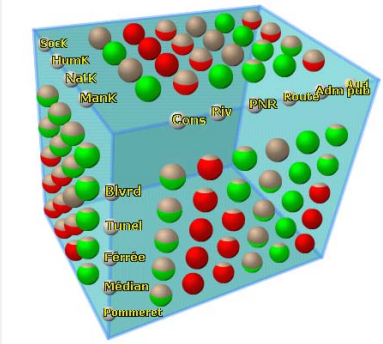
In the 2006 version of KerDST, it is essential to specify a *"small number"* of fundamentals along each of these three axes [5]. The limitation to a "small number" (typically between 3 and 8) is partly for ergonomic reasons of on-screen conception [6]. It is justified also on cognitive terms: individuals typically can "hold" up to 5 or 7 objects as separate items in their minds and building a deliberation with more than 8 elements along a single axis becomes unwieldy both on-screen and in cognitive terms is a constraint to "small numbers" along each of the structuring axes for "building the problem" can, in principle, be relaxed by introducing internal structure along each axis [6]. For instance, one strength offers a hierarchical construction of "top goals" and "subgoals" for categorizing the quality-performance criteria. We will return to the question of *interior construction* along each of the three constitutive axes, but focus here on the roles of the actors in the evaluation process and the mobilization of indicators to compose the evaluation [6].

The kerDST process provides three main phases or forms of participation by real persons as "actors" in the evaluation [6]: The first phase of stakeholder participation is to "build the problem", a process that, one way and another, culminates in the definition of a 3-D array: (1) the key stakeholder or social actor classes, (2) the relevant spectrum of performance issues and (3) the range of evaluation objects (e.g., higher education establishments, business strategies, industrial sites, projects, territorial development scenarios, technologies, investment options…) to be evaluated. Although one person will be empowered as a specific KerDST user to be the problem holder, many people can be involved in discussions before or during the real process of "building the problem" within the on-line deliberation support tool [6]. The second coat is for individuals who acting as legislatures of a class of stakeholders, declare a judgment for *each* evaluation option (e.g., site or scenario) and relative to *each* criterion or performance issue. By directing on each cell of the Deliberation Matrix, the value is that *each* stakeholder class should thus offer a judgement (*satisfactory, poor, intolerable*, etc.) of *each* option/scenario to *each* of the key supremacy or decision matters. One gets in this way, for each stakeholder (actor class), a rectangular array of cells, being a layer of the Matrix, within which each row represents the evaluations furnished by a given class of stakeholders for successive options/scenarios [6] The third form of stakeholder contribution is the opportunity for extending the assessment done motivating each cell-level judgment by reference to indicators [6]. This technique can have numerous surfaces including not only the range and weighting of indicators for the "basket" of indicators within a "cell" of the DM but also helps members of the user community to construct lists or banks of indicators measured as appropriate to the problem at hand [6].

KERDST — AN ON-LINE DELIBERATION SUPPORT TOOL FOR MULTI-STAKEHOLDER MULTI-CRITERIA EVALUATION

The evaluation exercises or tasks are organized with a "grid" or array *in three dimensions, built up by specifying, for a chosen problem:*

- *The Evaluation/Governance Issues:*
A small number of distinct Quality/Performance concerns
- *The Major Types of Actors or Stakeholders*
A pragmatic demarcation of "interests" and collective identities
- *The Policy Options or Possible Futures:*
A small number of Options for Action and/or Decision Scenarios



If the task is to evaluate a specific activity or to compare several situations,
then the user can specify a site or sites rather than scenarios.

Fig. 2 KerBabel DST [6]

From the above three facets of the KerBabel deliberation support procedure, we already got the answer of the question: how the forms of real stakeholder participation are inseparable from the procedures for mobilizing indicators and for *scoring* or *reporting* evaluation results at cell level and then at higher levels of aggregation? If we still take KerDST as our methodological case study, we need to more closely at the interaction of evaluation structure and actor contributions.

The kerDST online deliberation support tool integrated two major features within the basic multi-stakeholder multi-criteria comparative evaluation framework [10]. The first, already mentioned, is the mobilization of indicators as a basis for cell-by-cell judgements. These indicators are catalogued — in a corresponding "KerBabel™ Indicator Kiosk" (KIK) which can be accessed through online interfaces with the Deliberation Matrix. Users of the Deliberation Matrix can contribute to the definition of indicators, thus adding elements to the catalogue, in the course of a participatory evaluation.

The second is the accommodation of multiple participants as members of the online deliberation community, each participant being associated with one of the stakeholder categories defined in the Deliberation Matrix for the social choice problem being addressed, and contributing to the building up of composite judgments for the cells of the DM corresponding to that particular stakeholder category [6]. By the mixture of these two features, we recognize the four main types of taking advantage of the kerDST(2006) system's possibilities. The simplest procedure is that of "Colouring in the Cells" by single representatives of each stakeholder

category (or by a single expert acting "on behalf" of all stakeholder categories) for a qualitative multi-stakeholder multi-criteria assessment of a situation or of options for action (this is Variation 'A' in the schema). This opens up naturally [6]: Towards Variation 'B' where several participants contribute to a "composite" judgment per issue (that is, per cell). Besides, there is Variation 'C', where the individual representatives of each stakeholder category or a single expert acting on behalf of all stakeholder categories work separately. It produces a "non-participatory" evaluation supported by indicators.

KerDST© Typology of Deliberation Processes with the "kerDST" Deliberation Support Tool © KerBabel™ C3ED (2006)		Role of Indicators in the Evaluation	
		No indicators "Colouring in the Cells" (with or without commentary *For each Cell, a single judgement (by colour) is registered for each stakeholder category (via discussion or expertise)*	With Indicators The judgement for each Cell of the Matrix is informed by a "Basket of Indicators". *The colour of the Cell depends on the signification and relative weighting attributed to each indicator in the 'basket'*
User Community	CLOSED The deliberation is not open to an extended community. *A single (synthetic) judgement is registered for each actor/stakeholder category*	A. Qualitative Multi-Stakeholder Multi-Criteria Assessment	C. Non-Participatory Indicator-based Assessment
	OPEN An extended user community. *Multiple participants within each stakeholder category may contribute to the evaluation*	B. Qualitative Multi-actor Participatory Assessment (without indicators)	D. Multi-Actor Participatory Indicator-based Assessment

Fig. 3 On line kerDST Users Contribution [6]

IV. Case Studies

This section has analyzed case studies from existing research, collaborative learning activities, and evaluation activities. Using these case studies, we evaluated the conditions and possibilities for design and practice of building knowledge partnerships through ePLANETe platform as multi-stakeholder dialogues for sustainability of agriculture and biodiversity issues in Fig. 4.

These cases have incorporated agriculture sustainability and biodiversity issues in regional planning within small and large-scale assessment procedures, including stakeholders' involvement. Almost all of the project researchers were looking for feedback into how the DST and processes brought into the project might work in practice. In addition, they were looking for what added value this approach may be able to bring to regional sustainability policy. They used the ePLANATe system (knowledge, tools, and methods), and the projects were successfully completed.

Case 1: Creating Futures, led by the regional council Environment Waikato, has engaged a consortium of research partners with the overall aim of building experience with processes and tools that can assist in long-term integrated planning for actors of territorial development in the Waikato region [8], [9]. The project [9] had two specific objectives: (1) to develop, demonstrate and document deliberative processes to support territorial planning processes; and (2) development of a spatial decision support system to support the deliberation and planning processes.

Case 2: Pastoral 21, led by AgResearch and engaging a wide spectrum of research organizations [11], has a more specific agricultural sustainability objective, that of framing the multiple performance challenges of the New Zealand pastoral sector and, in particular, their concerns to remain profitable while mitigating the adverse impacts of their activities on the environment (notably, but not only, chemical runoff and nitrates from intensive animal production). The purpose of this research is to develop tools and processes for the evaluation of the impact of policies, directed at environmental management, across a range of social, economic, environmental, and cultural values held by agribusiness and others in the community [8], [11].

Case 3. Ker-ViViANE MM-DST [8], [10], funded by the European Commission and the problem situation presented in the *KerViViANE* virtual world is based on a real-life case of the commune of Montreuil-sur-Epte, in north-western France. A crisis had emerged, due to the cumulative contamination of local groundwater by chemicals deriving from agricultural fertilizer and pesticide applications, meaning that this water source could no longer be used for municipal supply. The **ViViANE**DST [10] focuses on the problem of chemical pollution of the environment caused by agricultural production.

Case 4: The **ALARM** Project [7], with more than 50 scientific partners, addressed the issue of biodiversity risks and losses in Europe. As described in the Ker-ALARM Brochure composed in 2005 by the KerBabel team at the C3ED, the creation ***Ker-ALARM Biodiversity Europe*** was *"an interactive online deliberation support tool (DST) for discovery and analysis of the biodiversity challenges facing public policymakers, the business world, scientists and civil society."* Ker-ALARM. In other words, using the French denomination, a SMMAAD (*Système Multi Media d'Apprentissage et d'Aide à la Délibération*) [8], [7].

Case 5. EJOLT project, in which this work has been led, addressed these socio-environmental conflicts and helped the Environmental Justice Organisations (EJOs) to map them in the Environmental Justice Atlas (EJatlas). To date, REEDS Researchers have sixteen conflicts from Madagascar reported on the EJatlas [8], [11]

Fig. 4 Remarkable Existing Projects Contribution of Online kerDST

V. Conclusion

The terms Agriculture, Sustainable development, and biodiversity have been closely inter-connected since the Rio Earth Summit (1992). Nonetheless, due to the features of different spatial and organizational scales, agriculture sustainability and biodiversity issues have sophisticated assessment processes. In the context of the knowledge mediation system "ePLANATe", a key benefit of the INTEGRAAL method using kerDST is that, it is designed to enable the progressive development of an evaluation problem in a way that is accessible to a broad spectrum of stakeholders

and experts, yet still accumulated over time. Besides it is a distinguishing feature of kerDST that the same methods can be used for framing any question, no matter the facets of the large question. In this way, the entire participant involved becomes familiar with common resources (e.g., knowledge, tools? and method) and more fundamentally a shared understanding of what "social choice" is as a multi-actor, multi-criteria decision situation involving synergies, trade-offs, and dilemmas.

There is a special feature to support stakeholders involved in the evolution of agricultural practices by designing resources (knowledge, tools, and methods). It is doubtless that this system has the capability of dealing with agriculture sustainability assessments via stakeholders-integrated evaluation. The only thing lacking in the kerDST system is a database inventory for applying quantitative analysis using econometrics models to estimate agricultural production functions (e.g.,Cobb-Douglas, quadratic, and square root). However, there is an urgent need to expand a consistent and transparent assessment framework such as Statistical Methodology for sustainable agriculture production, and biodiversity issues in order to meet the prerequisites for achieving the Sustainable Development Goal (SDG) of end hunger, fully recognizing the importance of agricultural production, and ensuring basic human needs for food and livelihood security. Likewise, advancement is needed for the scope and facilities of quantitative analysis with the setup of quantitative indicators for eliminating (weakness & threat), and enhancing (strength & opportunity) procedures, and identify the impacts of agricultural production on environmental, social, and economic dimensions of sustainability. Due to the lack of solid quantitative analysis on sustainable agriculture and biodiversity issues, there is a need for a classification "statistical approach" in the current research environment.

REFERENCES

[1] Zhang, X., Yao, G., Vishwakarma, S., Dalin, C., Komarek, A.M., Kanter, D.R., Davis, K.F., Pfeifer, K., Zhao, J., Zou, T., D'Odorico, P., Folberth, C., Rodriguez, F.G., Fanzo, J., Rosa, L., Dennison, W., Musumba, M., Heyman, A. and Davidson, E.A. (2021). Quantitative assessment of agricultural sustainability reveals divergent priorities among nations. One Earth

[2] Ryan, M.H., Graham, J.H., Morton, J.B. and Kirkegaard, J.A. (2019). Research must use a systems agronomy approach if management of the arbuscularmycorrhizal symbiosis is to contribute to sustainable intensification. The New Phytologist, (online) 222(3), pp.1176–1178. Available at: https://pubmed.ncbi.nlm.nih.gov/30657177/ (Accessed 5 Mar. 2022).

[3] X. Le Roux, Baudry, J. and Burel, F. (2009). Agriculture and biodiversity. Valuing synergies.

[4] Wedderburn, L., P. Blackett, E. Smith, Kelly S. (2009), Integrating Deliberative and System Dynamics: An evaluation of methods and process, unpublished report, AgResearch, Hamilton, December 2009, 49 p.

[5] O'connor, M., Small, B. and Wedderburn, E. (2010). Sustainable Agriculture in Aotearoa: Social Learning through Piecewise Deliberation. (online) Available at: https://hal.archives-ouvertes.fr/hal-00879693/document (Accessed 5 Mar. 2022).

[6] O'CONNOR M. (2006c), Deliberative Sustainability Assessment: Multiple Scales, Multiple Stakeholders, Multidisciplinarity and Multiple Bottom Lines, Methodological study for Work Package WP6 of the SRDTOOLS Project (Methods and tools for evaluating the impact of cohesion policies on sustainable regional development, EC 6th Framework Programme, Contract No.502485, 2005-2006), Rapport de Recherche du C3ED No.2006-01, Guyancourt, UVSQ, France, 2006.

[7] Maxim, L., Spangenberg, J.H. and O'Connor, M. (2009). An analysis of risks for biodiversity under the DPSIR framework. Ecological Economics, 69(1), pp.12–23.

[8] RAHMAN, Ashiquer (2019), Mobilizing ePLANETe. Blueknowledge mediation portal to deal with new challenges of sustainable development in Higher Education and Research Establishments (HERE) from a perspective of Knowledge Economy. Thèse de doctoraten sciences économiques (dir. Dr. Jean-Marc Douguet). Soutenance : Guyancourt, 17 septembre 2019, Université Paris Saclay, France.

[9] Huser, B., Rutledge, D. T., Van Delden, H., & Woods, R. A. (2009). Development of an integrated spatial decision support system (ISDSS) for Local Government in New Zealand.

[10] O'Connor, M. P. (2006). Building Knowledge Partnerships with ICT? Some lessons from GOUVERNe and VIRTUALIS

[11] Small, B. (2016). Sustainable Agriculture in Aotearoa: Social Learning throughPiecewiseDeliberation. Agresearch. https://www.academia.edu/28870758/Sustainable_Agriculture_in_Aotearoa_Social_Learning_through_Piecewise_Deliberation