

Special Issue on Knowledge Systems for Sustainable Development

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I. Introduction to special issue

Knowledge systems for sustainable development: The challenge of mobilizing R&D for sustainable development

Bill Clark

This paper introduces the idea of knowledge systems for sustainable development, including the broad framework for analysis we use in the KSSD project. It gives examples of knowledge systems from other fields, and suggests some of the general challenges that the literature, and our project, have emphasized. It provides a brief introduction to the KSSD project, its methodology, and an outline of the issue.

II. Empirical Case Studies

Global knowledge for local action: The CGIAR as a model knowledge system

Bill Clark, Nancy Dickson, Patti Kristjanson, David Nkedianye, Robin Reid, Tom Tomich

This paper explores the challenge of designing international R&D programs to facilitate the production of knowledge that is useful for “local” decision makers striving to achieve environment and development goals. Our “local” focus is intended to encompass farmers, resource managers and government ministries. We analyze the relative efficacy of different institutional arrangements for bringing local decision makers’ needs to shape the agendas of international R&D centers; for mobilizing global scientific resources to implement those agendas; for bringing the results of that R&D into widespread use in the field; and for providing feedback from the field to guide the subsequent agenda setting and research. The paper draws on experience from the Consultative Group on International Agricultural Research’s Alternatives to Slash and Burn Program and the International Livestock Research Institute.

Making short-term climate forecasts useful: Linking science and action

James Buizer, Kathy Jacobs, and David Cash

Climate variability has significant impact on decision-making for sustainability. Important advances have been made in the past two decades in understanding the drivers of climate, the most effective modes of communication of climate science, and specific applications of climate information within sectors. Interesting institutional approaches have developed to forge and support linkages between various types of knowledge, the actors who produce them and those that use them. This paper examines the components of the knowledge system and linkages between them, with particular focus on the boundary-spanning organizations that bridge between actors and their knowledge sources.

The role of knowledge innovative institutions: a case study of The Global Fund to fight AIDS, Tuberculosis and Malaria

Lorrae van Kerkhoff and Nicole Szlezak

Institutions for sustainable development are undergoing rapid change, with existing centralized international and state-based systems increasingly being complemented—and challenged—by new forms of collaboration, including public-private partnerships, multi-sectoral collaborations and flexible, demand-led funding. The effects of these changes on the ways in which scientific and technical knowledge is created, accessed, used, and revised are largely unknown. We report on a case study that examined the effects one large, innovative organization, The Global Fund to Fight AIDS, Tuberculosis and Malaria, is having on the knowledge dimensions of decision-making in global health. We show that governance arrangements that aim to foster national ownership of action programs by devolving decision-making power to recipient countries can be undermined by simultaneously insisting that these programs are based on scientific evidence and conform to international best practice. Politics and science are intimately connected throughout the Global Fund's application process, and that managerial and situational knowledge are also central to success. More generally, the study illustrates that institutional change that is not overtly concerned with linking knowledge with action can still significantly affect the dynamics of knowledge creation, access, distribution and use. Efforts to redistribute decision-making power or promote new forms of engagement need to consider the implications of these changes for knowledge if they are to contribute to long-term sustainable development.

Knowledge in development: Making ends meet in Omkoi, northern Thailand

Po Garden, Charunee Chirangworapot, Louis Lebel

This paper focuses on how development decisions could be made to better fit local values (tradition, culture, way of life) of the Karen farmers in Om Koi who engage in both traditional swidden agriculture and vegetable cash crops. The two types of production activities utilize different knowledge systems that are embedded in different social and governance structures.

Knowledge systems governance arrangement for sustainability: Lessons from agriculture development in the Argentine Pampas

David Manuel-Navarrete and Gilberto Gallopin

Sustainable agriculture is desirable at many levels for economic, food security and environmental reasons. Science faces the challenge of delivering knowledge for reducing the environmental impacts of modern agriculture while maintaining high crop yields. The development of practices such as no-tillage and precision agriculture may contribute to meet this challenge. However, the adoption of these, potentially more sustainable, practices by farmers is not always straightforward. This paper describes how governance arrangements for the generation and exchange of scientific knowledge and technology (K&T) are affecting the rate of adoption of sustainable agriculture in the Argentine Pampas. Sustainable agriculture K&T is mostly contingent on the agendas of farmers' organizations and the reform of public agriculture extension agencies. Our findings indicate that effective governance arrangements for sustainability K&T in the Pampas are those which: (1) promote public-private partnerships and enhance connectivity among actors including boundary organizations, (2) assign to the private sector a leading role in managing the K&T at the level of the farming unit, (3)

improve the public sector competence in regional scale research and socio-ecological knowledge, and (4) use research for assuring the adequacy of K&T packages to contextual conditions.

Know your shrimp, trust your friends: Sustainability and the knowledge system surrounding shrimp aquaculture production in Thailand and Mexico

Louis Lebel, Po Garden, Amy Luers, David Manuel-Navarette

This paper focuses on the role of knowledge systems in decisions about land use in areas with, or with a high potential of having, shrimp farms. We see this as requiring analysis at several institutional “scales” each with their own characteristics sets of messages and competing knowledge systems. At regional physical and administrative scale, information about industry impacts and benefit flows are critical to land-use policies regarding zoning, infrastructure development and subsidies to the industry. For individual farmers the most relevant issues may be more about developing knowledge to manage disease and water, keep down costs of inputs, and channels for good prices for harvested shrimp. At all scales we see the key as being identifying a handful of key components and problems in the system from the perspective of actors within system.

Using causal structures representation for producing sustainability knowledge and bridging the knowledge to action gap in the Argentine pampas

David Manuel Navarrete and Gilberto Gallopín

Causal Structures Representation (CSR) is explored as an integrative and synthetic method for producing sustainability knowledge that is easily communicable and readily usable in decision-making. The potential of this method is examined through participant observation in: the joint construction of a CSR of the process of agriculturization in the Argentine Pampas, and the use of this CSR in a workshop for policy integration with representatives from the Argentine government. A group of 15 experts with different viewpoints and interests worked together to construct a shared CSR depicting what is happening in the Pampas in relation to sustainability. A close examination of the conflicts, controversies, and disagreements emerging during and after the workshop is useful for learning about the barriers to knowledge integration. Overcoming these barriers is essential for the development of sustainability science. Once the diversity of viewpoints were identified and acknowledged, a compromised CSR was delivered. This CSR was evaluated within a political workshop from the perspective of its usefulness for policy action. In this workshop, the CSR was used as a template for: mapping the diverse strategies and policies which each ministry and government department is already implementing, and identifying four new areas for potential policy integration. This result constitutes a crucial step for increasing the effectiveness of the Pampas’ knowledge system for sustainable development by bridging: the sustainability knowledge production gap which lies in the departmentalization of different disciplines, the policy gap which emerges among the visions of different government sectors, and the knowledge to action gap which rests in the division between the scientific and policy arenas. SCR worked effectively as a boundary object because it was credible, salient, and legitimate due to the participation of experts with high reputation, its conception from the beginning as an object to be used in a political process, and the effective role of ECLAC as a boundary organization.

Linking knowledge with action in the pursuit of sustainable water resources management

Katharine Jacobs, Louis Lebel, James Buizer, Lee Addams, Pam Matson, Ellen McCullough, Po Garden, George Saliba, Timothy Finan

We highlight key aspects of the knowledge-to-action mechanisms by comparing the Yaqui Valley, Mexico, northeast Brazil, the Mae Nam Ping River Basin, Thailand and Arizona, USA, especially emphasizing the role of strategic planning management organizations in the water KS. These entities vary in the degree to which they function as true boundary organizations between decision-making bodies and research groups. Additionally, these groups often fill importance governance roles, also differing in the degree to which they influence agenda setting in both short-term and long-term planning situations.

Linking knowledge and action: Farmer innovation, decision-making, and risk management in the Yaqui Valley, Mexico

Ellen McCullough and Pam Matson

Decisions made by farm managers in the Yaqui Valley bear social, economic, and environmental implications for the entire Valley and beyond. This paper explores how and with what information farmers make decisions regarding production management and choice of enterprise. In particular, we explore farmers' utilization of knowledge for decision-making in the context of different types of risk and uncertainty, including biophysical, economic and political risks. Farmers who are eligible for membership have managed risk by associating with "Credit Unions." However, this strategy has influenced the ways in which farmers make their management decisions, including the adoption of innovations. Groups of innovative producers, organized through Credit Unions, have helped to fill an important technology transfer function left vacant in the wake of widespread reforms to Mexico's public institutions. As grain farmers struggle to remain competitive amidst decreasing prices, increasing production costs, and a rapidly evolving agricultural support system; they must adopt new strategies for dealing with market uncertainty associated with higher value crops.

III. Challenges

Linking knowledge with action for sustainability

Bill Clark, + KSSD team

How can knowledge systems be designed that reduce the "know-do" (knowledge-action) for sustainable development? This paper summarizes the findings of the KSSD project on how knowledge systems can be designed that better provide decision makers with the knowledge they most need (rather than with the knowledge that researchers most push), and how knowledge systems can induce and enable decision makers to make more effective and efficient use of the opportunities that S&T offers to advance their goals in the context of sustainable development. The paper focuses on three challenges confronting those trying to do a better job of designing institutions to link knowledge with action: the lack of effective supply / demand relationships; fragmentation of the knowledge system; and ignorance. It characterizes the institutional responses found in the KSSD cases to each of these challenges: boundary institutions that bring into alignment the demand for, and supply of, knowledge to support action; integration of knowledge production, and learning by doing.

Knowledge for sustainable development: The challenge of multiple epistemologies

Gilberto Gallopín, David Manuel-Navarrete, + KSSD team

The paper is built around the proposition that because of the complex nature of sustainable development issues, the incorporation, articulation, “hybridization”, combination, or integration of forms of knowledge with, or in addition to, scientific knowledge in the process of understanding and managing socio-ecological systems results in a better characterization of the problem/issue and thus in more effective solutions. Thus, KS and research institutions that embrace multiple knowledges are more effective for fostering a SD transition than those that do not. However, the articulation of different forms of K poses important methodological, epistemological and institutional challenges. Challenges, opportunities, and lessons learned are identified and discussed.

Governance challenges in knowledge systems: Institutional opportunities in the pursuit of sustainable development

Louis Lebel and Lorrae van Kerkhoff

In this paper we draw on the case studies presented in this volume to specifically examine the governance of knowledge systems. We present a framework for understanding the governance of knowledge systems that shapes our investigation. This is based on earlier work in which we proposed that efforts to understand the linkages between knowledge and action in the context of sustainability also required attention to the intervening issues of engagement and power (van Kerkhoff & Lebel 2006). We then review a range of efforts to bring research-based knowledge to bear on problems in sustainable development, focusing on evidence about the consequences of strategies of engagement for how power is shared and exercised. We address three questions in turn, that characterize the processes of governance that link research, action, power and engagement : (1) Who defines the problems important for research and action? (2)When is research-based knowledge acted upon? And, (3) How are the impacts of research assessed? Concisely these can be thought of as the challenges of agenda, authority and accountability.

IV. Conclusions

Research actors in a knowledge system for sustainable development: Perspectives from the inside

Pamela Matson, James Buizer, Louis Lebel

This paper collects, summarizes, and synthesizes the experiences of research scientists who are interested in making their science more useful and accessible to decision makers and who thus intentionally have inserted their research groups into knowledge systems. It describes how these research teams engaged, the greatest challenges that they faced, and the lessons learned in the process.

Designing effective systems to harness research-based knowledge in support of decisions bearing on the joint goals of human development and environmental stewardship

Bill Clark