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Co-Producing Sustainability Knowledge: Assessing SANDEE's Role as a Research Network in South Asia

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The South Asian Network for Development and Environmental Economics

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Abstract

In South Asia, as local and regional environment problems have grown, societal demand for new knowledge has outpaced the ability of traditional institutions to respond. In this context, we examine the experience of the South Asian Network for Development and Environmental Economics (SANDEE) as a regional research network engaged in the task of co-production of knowledge. We argue that research networks contribute to the growth of sustainability knowledge through (a) knowledge creation, (b) knowledge transfer and (c) knowledge deepening. We use data drawn from participants in training programs to quantitatively evaluate four research outcomes and find that research support from SANDEE is associated with increased international peer-reviewed publications. We supplement the quantitative analyses with a qualitative discussion on what has sustained and made a geographic network such as SANDEE feasible. We also discuss the challenges posed by the need for inter-disciplinary approaches and the reasons why there is a lag between knowledge development and governance reforms. This institutional paper, which was developed as a response to a panel discussion on knowledge networks in 2012, offers 'insider' insights gleaned through long-term association with SANDEE.

Key words

sustainability knowledge, research networks, environment and economics, South Asia

Co-Producing Sustainability Knowledge: Assessing SANDEE's Role as a Research Network in South Asia

1. Introduction

Given the global economic system's profound impact on the sustainability of the earth systems (Griggs et al. 2013, IPCC 2013), there is clearly a need for new knowledge that will both allow us identify thresholds, where our current management of the earth is failing, and find novel ways to secure the future (Mooney et al. 2009). Particularly in the developing world, where the biggest priority is poverty reduction, it is all the more important to understand how changes in the environment may compromise the ability to meet economic development and poverty reduction goals (MA 2005, Carpenter et al. 2009). The additional, even bigger challenge is to link this understanding to policy processes that can advance positive changes at local to global scales (Steffen 2009).

There is a large and growing literature on sustainability science (IPCC 2007, UNDP 2011), which underlines the importance of interactions between natural and social knowledge frameworks (Cash et al. 2003, Mooney et al. 2009). Increasingly, there is also emphasis on the creation of knowledge-action networks that connect producers and consumers of knowledge (NRC 2007). Understanding the linkages between the supply and demand for knowledge is essential for '*use-inspired science*' to be adopted for policy decision-making (NRC 2007, McNie et al. 2007).

In the developing world, the multiple gaps in knowledge production and use are wider than ever. Let us consider, for example, the body of literature that demonstrates that destruction of mangrove ecosystems increases the risks to coastal populations from storms (Das and Vincent 2009). In countries such as India, where road and dike building through the national rural employment guarantee schemes is a critical way out of starvation, mangroves in lieu of coastal dikes become a hard option to promote unless it provides equivalent livelihood possibilities. There is clearly a need for good science that can measure and identify the consequences of changes in ecosystem services (Mäler et al. 2008). To ensure that this science is acceptable, we will need to show why conservation makes sense in the context of local economies (Polasky et al. 2011, Wittmer and Gundimeda 2011). Further, there is the additional requirement that decision-makers use policy-relevant information (McNie et al. 2007). Connecting the knowledge chain of production, diffusion and use is particularly important as we begin to adapt to climatic changes with differential geographic impacts (IPCC 2007, NRC 2010).

In this paper, we concentrate on one specific mechanism, regional or geographic research networks, for addressing sustainability knowledge gaps in the developing world. Our geographic focus is on South Asia. In the rest of the paper, we first identify environmental policy challenges that require attention in South Asia. We briefly discuss the knowledge generation architecture in the region, mainly using Indian organisations as examples. We follow this with an analysis of the contributions of SANDEE – the South Asian Network for Development and Environmental Economics – and its role in building skills for sustainable development. We evaluate SANDEE's activities related to research and training and to policy dissemination. We conclude by drawing lessons from a decade long experience of knowledge co-production, which, in this paper, refers to the joint production of a public good (knowledge) through the participation of numerous individuals and organizations at multiple levels.

2. Growth and Sustainability in South Asia

The South Asian sub-continent has made tremendous economic progress in the last decade or so (Figure 1). One important success story is Bangladesh, whose per capita income grew sluggishly at 0.4% per year during 1970-90 but accelerated to 3.4% during 1990-2009. Another success story is India, which more than doubled its annual

per capita income growth rate from 2.1% to 4.8% in the same period. Political turmoil has, however, taken its toll in the region. Pakistan, for instance, saw a decline in per capita annual growth from 3% to 1.7% during the reference period (UNDP 2011).

South Asia still houses a quarter of the world's population and half the world's poor. But growth in income has led to a decline in the population proportion under poverty by about 20 percentage points (US $2 international dollars PPP) and increased the literate population (see Figure 1). Conservation efforts have also had some success. Forest cover in South Asia, for example, has increased from 7.9 to 8.2 million square km in the two decades following 1990.

Despite some successes, in general, economic and population growth has put tremendous pressure on the environment. South Asia's per capita CO2 emissions, though one of the lowest in the world (at 1.5 tons per capita), is growing at 3.4% per annum (UNDP 2011 p. 149). There is evidence of a decline in very dense forests and bio-diversity (see Parikh et al. 2012). Air pollution has deteriorated significantly, particularly in urban areas, and the quality of forests is deteriorating. Given the many negative indicators of environmental change, it is important to ask whether economic growth in South Asia is sustainable (Mukhopadhyay and Shyamsundar, 2012).

One way to ensure sustainability is to move away for income measures of well-being and instead track changes in comprehensive wealth. Comprehensive wealth is broadly defined to include different forms of capital assets, i.e. physical capital, human capital, social capital and natural capital valued at their shadow prices (Arrow et al. 2004, 2012, World Bank 2011). Improvements in per capita wealth arguably capture improvements in human inter-generational well-being, while simultaneously taking account of critical changes in the natural world (Barbier et al. 2009).

Figure 2 and Figure 3 present evidence of changes in comprehensive wealth and natural capital in South Asia as estimated by the World Bank. As Figure 2 shows, per capita comprehensive wealth has been increasing in the South Asia region over this decade, which is good news. However, Figure 3 suggests that this increase may be at the cost of a declining per capita natural wealth (World Bank 2011). Evidence of the decline in natural capital is further reinforced for India by Arrow et al. (2012). Overall, the contemporary picture from South Asia suggests that economic development is taking a toll on the environment.

Clearly there is a need to strengthen knowledge organisations that can evaluate and address the linkages between economic development and environmental change in South Asia. Traditional knowledge producing organizations, such as universities and research institutes, are constrained in the short run because of pre-existing norms. Universities often do not prioritize research due to their heavy focus on teaching and lack of resources for conducting research, let alone multi-disciplinary work. In India, for example, until recently, journal publications and research projects were not a binding constraint for appointments and promotions up to a certain level.[1]

Furthermore, multi-disciplinary degrees in sustainable development or environmental management, which could bring different scientific faculty together, are still quite uncommon in universities. Even in research institutes with faculty from different disciplines, multi-disciplinary research is limited. This is partly because funding sources are specialized and partly because the academic culture does not yet encourage cross-disciplinary work. In the domain of technology, for instance, India has a strong presence in the form of a number of highly acclaimed Indian Institutes of Technology (IIT). Almost all the IITs have a Department or School of Humanities and Social Sciences. However, the number of joint papers or teaching programs among social science, natural sciences/technology departments is limited. The lack of interaction among social, and natural sciences, and engineering is also reflected in the annual meetings of subject-related associations and the weak linkages to the natural sciences among social-science driven think-tanks.

There is, however, growing evidence of multi-disciplinary research and policy emphasis among a new variety of organisations. This is reflected in the emergence of associations such as the Indian Society for Ecological Economics and organizations like the Energy and Resources Institute (TERI), which was recently ranked as one of the top 150 think tanks in the world (McGann 2013). Such organizations have emerged because of government

[1] The entry level requirements for a University or college position were "good academic record at Master's level" and the passing of a written eligibility test (see the regulatory body in India for higher education – the University Grants Commission's website http://www.ugc.ac.in for recruitment rules).

and international funding and because resource and environmental concerns have become a part of national policy discussions.

India's large academic infrastructure has made it a forerunner in the South Asia region (ICSSR 2007, GoI 2009, Chattopadhyay 2009, Tilak 2012). There are, of course, many good organisations in the other South Asian countries as well, but there is also significant variation in quality. Given the urgent need for sustainability solutions and heterogeneity in existing institutions, knowledge networks have an important role to play.

3. Capacity Building and KNOWLEDGE PRODUCTION — SANDEE's experience

Over the years, numerous knowledge networks have evolved around the globe, focusing on geographic, scientific or policy concerns (consider, for example, Inter-Governmental Panel on Climate Change, Third World Network, Global Development Network, and very recently Climate and Development Knowledge Network, etc.). These networks not only provide a platform for multi-disciplinary and multi-stakeholder work, they also allow expertise to be pooled and enable communication and sharing of information (Creech and Ramji 2004, Creech et al. 2012). SANDEE is one such network, with a mandate to build the capacity of individuals and organisations in South Asia to understand the inter-connections among economic development, poverty and environmental change.

There are many definitions and forms of knowledge networks. Broadly speaking, these are collaborative efforts among organisations or individuals around a specific theme or shared interest. Our specific focus is on networks that co-produce public knowledge. Typically, co-production is the result of participation by individuals who are not in the same organization, but contribute to output as individual citizens might in generating public goods (Ostrom 1996).[2] In this paper, we discuss co-production of sustainability knowledge that is mediated by SANDEE and occurs through interactions among multiple individuals and organisations.

3.1 Evolution

SANDEE evolved as an explicit response to geo-political circumstances in South Asia. First, it was clear that the countries in South Asia faced many similar problems, but there was hardly any exchange of academic information across national borders (for anecdotal reports see Pattanaik, 2012 and Hoodbhoy, undated). Countries in South Asia face regional environmental problems and management opportunities related to water-sharing, atmospheric brown clouds, floods mitigation, energy trade, etc. However, geo-political tensions constrain the ability of scientists and academics to meet and exchange views (Ali 2013). The limited platforms for scientific discussions hinder trust-building among professional scholars, a pre-requisite if solutions are to be shared (Hussain 2010). Also, given the diversity of skills and institutions available, there were possible economies of scale in training and knowledge development at a regional scale, which were relatively un-exploited because of the dearth of regional institutions.

SANDEE's history can also be traced to international interest in environment-development economics and to teaching workshops organized around the globe by the Beijer Institute of Ecological Economics, Stockholm, under the guidance of Karl Goran Maler and Sir Partha Dasgupta (Dasgupta 1998). However, the first institutionalized environmental economics regional network emerged in 1993 in East Asia in the form of the Economy and Environment Programme for Southeast Asia (EEPSEA). SANDEE followed in 1999 and thereafter three more networks, RANESA (Resource Accounting Network for Eastern and Southern Africa) and CEEPA (Center for Environmental Economics and Policy in Africa) in Africa and LACEEP (Latin American and Caribbean Environmental Economics Program) in Latin America (SANDEE, 2010). The primary focus of all of these networks has been to build research skills on the inter-linkages between economic development and environmental change.

3.2 Network Characteristics

SANDEE is a flexible and semi-virtual organization devoted to enhancing research and teaching capacity among South Asian scholars. Its research mandate covers local, regional and global sustainability concerns. Research

[2] Co-production can also occur when experts involve communities to bridge the "relevance" gap between expert comprehension and "experiential" understanding (Fischer 2000).

topics have changed over the years, and the current focus is on ecosystems management, the economics of climate change and policies and programs for greener development. The network draws in regional and international talent to help local researchers address questions identified by them.

Co-production of knowledge and governance solutions is channeled through four different activities. **Research** is supported through a competitive grants program, complemented by careful mentoring of researchers on research design and analyses. Peer learning and sharing occurs because researchers meet bi-annually to present on-going research (see SANDEE Arc in SANDEE, 2012 (back-cover)). Some 200 researchers apply each year for a research grant, with an approximate success rate of 10%. Thus far, some 150 research studies have been funded. **Training and Education** occurs through multiple workshops that run from a few days to several weeks and build skills related to research, analyses and stakeholder engagement. During 2002-2013, about 1200 teachers, policy makers and researchers participated in over 60 different workshops. This training has facilitated teaching, development of new curriculum and built research capacity in many South Asian universities (SANDEE 2010). An **Underserved Areas Program** acknowledges South Asia's large heterogeneity in knowledge infrastructure and research capacity. Regional and country- specific training is offered to build expertise and equal the playing field across countries. **Dissemination and dialogue** happens through policy workshops, scientific publications, conference participation, as well as contributions to policy-oriented government committees. The four programmatic activities have resulted in two edited volumes (Ghate et al. 2008, Haque et al. 2011), 85 working papers (and accompanying policy briefs), nearly 100 peer reviewed publications during the decade 2003-13 and various stakeholder discussions and management changes.

Institutionally, the network is governed by a management and advisory committee (MAC) composed of policy makers, donors and experts, and, coordinated by a small Secretariat in Kathmandu, Nepal (see the Organogram in Annex 1). In addition, SANDEE's support structure includes a group of international long-term 'faculty' advisors, who act as mentors to each research project, a pool of regional and global scholars, who contribute as peer reviewers and trainers, and SANDEE Fellows, who are researchers from the region who provide need-based training, mentoring and research support. SANDEE's presence has been sustained because of interest in environment-development issues among multiple international donors. Three important agencies, the Swedish International Development Cooperation Agency (SIDA), International Development Research Center (IDRC) and Norwegian Agency for Development Cooperation (NORAD), in particular, have been willing to extend long-term support.

4. Examining Impacts

Experience with SANDEE suggests that knowledge networks contribute to the development of sustainability science by enabling: (a) knowledge creation, (b) knowledge transfer and (c) knowledge deepening. We discuss below evidence of research, training and policy outcomes from SANDEE's activities and how these are deepening skills and being disseminated across the region.

4.1 Methodology

In order to assess the impacts of regional networks on research and policy we rely on both qualitative and quantitative data. Qualitative information comes from the direct involvement of the authors in research and training activities for over a decade and from discussions with network researchers about their professional growth and research-policy linkages. Some of this information is reported in SANDEE's annual reports and in documents to donors.

For the last several years, SANDEE researchers have been routinely surveyed twice a year to obtain data on research and policy outcomes. In addition, a specially designed survey was undertaken during December 2013-February 2014 to evaluate outcomes. This survey was sent out through Survey Monkey to 275 professionals who participated in SANDEE's three-week annual Summer School in Resource and Environmental Economics during the years 2002 to 2013. One hundred (37%) completed the online survey, while 13% of the emails bounced back.[3] The survey covered a variety of questions related to respondents' research activities, whether they had received a

[3] The response rate is reasonable given that an international meta-analysis of response rates to email surveys places the average response at 33% (Shih and Fan, 2009 p. 31).

SANDEE research grant, their publications and success in generating other research funding. We rely on this survey data to evaluate the effect of SANDEE's training and research activities on co-production and sharing of knowledge in the region.

4.2 Training and Research Outcomes

The 2013-14 survey allows us to quantify the impacts of SANDEE grants on four outcomes: new research projects undertaken by the respondents, publications in national journals, international journals, and book chapters. The results provide some evidence of professional development and changes in sustainability information occurring in the region, at least partly, through SANDEE's efforts.

Survey results show that 75% of the respondents use the knowledge gained from the Summer School for teaching, 54% use the material distributed for curriculum development and 46% use it for research. This evidence of knowledge transfer is reinforced by the fact that SANDEE research was being used as part of teaching activities in at least 19 university programs across South Asia in 2013 alone (SANDEE 2013, p 5).

Summary data on Summer School survey respondents in Table 1 shows that participants in the Summer School increased their involvement in research projects, on average, by 54%. The post-training publication rate is higher by 51% and researchers who completed a SANDEE research grant exhibit a better international publication record. However, since a simple comparison of mean values can be misleading, we undertook multivariate regression analysis to further examine the impact of SANDEE's research grants on different professional outcomes. We estimated the following linear equation to test whether Summer School trainees who received a SANDEE grant performed differently from those who attended the summer school but did not get the SANDEE research grant.

$$Y_{it} = \alpha_i + \alpha_2 Training_t + \alpha_3 Grant_i + \alpha_4 Training_t \times Grant_i + \varepsilon_{it} \quad (1)$$

where Y_{it} represents one of four different observable outcomes – the number of projects completed, the number of articles in national journals, articles in international journals and the number of published books chapters.

In equation (1), *Training* is a dummy variable equal to 1 if outcomes were achieved after participating in SANDEE's Summer School and 0 otherwise. *Grant* is also a dummy variable equal to 1 if the respondent received SANDEE research grant post-training and 0 otherwise. Thus, α_2 measures the difference in outcomes due to training and α_3 measures the difference in outcomes due to the SANDEE research grant. However, we want to measure the net effect of *Training* and the *Grant* on outcomes. Therefore, we estimate a Difference-in-Difference (DiD) estimator (Card and Krueger 1993), α_4, which measures the net effect of post-training SANDEE grants (*Training* X *Grant*) on the outcome variable Y_{it}. The DiD approach requires a parallel trend assumption that without the SANDEE grant both groups of respondents would perform similarly in terms of research and publications. Hence, α_4 represents the extent to which outcomes change when a researcher who has received training obtains a SANDEE research grant as well.

A potential limitation of this analysis is that grant allocation is not random within the sample; rather, researchers receive grants based on their motivation and the quality of research proposals. However, this bias is minimized because our sample includes only those applicants who participated in SANDEE training. This makes the grant recipients somewhat comparable to the other respondents in the dataset.

Table 2 presents two sets of regression results. The first four columns report the Ordinary Least Squares estimates and the last four columns report corresponding fixed effect model, which takes advantage of the fact that we have panel data. We use individual fixed effects to take care of some of the unobservable personal traits that may affect participation in the training as well as research outcomes (Hausman and Taylor 1981).

Table 2 indicates that participants in the Summer School undertake more research projects post-training compared to the pre-training scenario. Further, respondents who receive research grants undertake 2.5 projects more (either before or after the training) than comparable respondents who didn't receive a research grant. These results reflect the direct and separate effects of training and grant support.

The DiD estimates presented in Table 2 show that the only outcome that is better among the candidates who participated in training and received a SANDEE research grant compared to those who did not receive a research grant is publications in international journals. Grantees are publishing about one additional article compared to trainees who did not get a SANDEE grant. Given that the average number of publications in international journals in the sample dataset is 1.10 articles, this jump by one additional article is a significant improvement.

The result on international publications reinforces a finding from an independent evaluation that suggests that SANDEE researchers publish at the same rate as U.S. Ph.D. students, but at a fraction of the cost (Whittington 2010, processed). SANDEE has always had a strong focus on publications. All researchers receive technical advice from expert 'mentors' and working papers are peer reviewed. SANDEE's stringent review and dedicated mentoring process apparently results in increasing the publication record.

5. Policy Links

Our examination of outcomes would be incomplete without asking whether research and training translate to policy outcomes. SANDEE was not initially designed with policy influence as a main objective. Given its focus on capacity building, the network attracts researchers who are not yet leaders in their own fields and may not have the 'gravitas' to engage policy makers. Also research is often project-based and rarely at the scale where it can directly impact national or regional policy. Researchers are, however, supported with funding, training, and technical support to disseminate research results and dialogue with key stakeholders.

Research projects have impacts mainly at the management and institutional levels. Discussions with researchers suggest that their research has partially contributed to diverse outcomes such as improvements in farmer training in pesticide management (in Nepal and India), changes in resource user fees (India), alterations in harbor development plans (Maldives) and changes in university curriculum (multiple universities). The research-policy link, however, is rarely immediate. Researchers invariably continue to improve on their scholarship and get drawn into advisory roles, either at the state level or through national committees (SANDEE 2010). For example, just recently, researcher Indira Devi was the named the head of a new Center for Excellence created by the Government of Kerala, India, to examine the effects of climate change and other environmental challenges (SANDEE 2013). Policy changes will likely occur over time through such centers.

A recent example of a broader policy impact is a report that was released in 2013 by India's then Prime Minister Manmohan Singh on greening India's national accounts (GoI 2013). This was the result of a two-year dialogue among a 13 member high-level expert group constituted by the Government of India. Some 40% of the members in this group were associated with SANDEE (see GoI 2013 and SANDEE 2013). Thus, our experience suggests that while projects are not always immediately impactful, built up human capital and knowledge can be influential over time.

McNie et al. (2007) discuss how the Regional Integrated Sciences and Assessment programs in the US, despite significant effort to engage the policy community and produce policy relevant information, were not particularly successful in influencing climate science policies. Thus, it is not surprising that knowledge networks in developing countries, which are focused on building rigorous research skills, do not have as strong a policy footprint relative to research impacts.

6. Discussion

It is useful to qualitatively think about what may be contributing to both scientific outcomes and sustainability of SANDEE's network activities. First, as previously noted, while there are clearly regional environmental problems to be tackled and possibilities for cross-border learning from neighbors that are at different development stages, there are huge geo-political hindrances to interaction among professionals in South Asia. For example, even today, it is very difficult for a Pakistani researcher to get a visa to come to India and vice versa. This makes SANDEE one among a handful of organisations that is able to exploit economies of scale in developing sustainability knowledge by working cross-regionally.

Another reason why the network has been successful is because of its local-international linkages. Initially, the network grew because it was initiated with the help of two stalwarts in the field of economics (Sir Partha Dasgupta and Karl-Goran Maler). Championship of a research initiative by intellectual international celebrities helped bring regional researchers and experts into the SANDEE arena. Researchers are also mentored by an excellent group of international academics who have stayed with the network for many years (committing at least two weeks of time every year). Knowledge deepening and sharing is enhanced by these linkages, which enable local knowledge to reach the international arena and vice versa.

Third, research support is continuously backed by skill-building through training, repeat interactions and mentoring. Every researcher has a chance to participate in multiple training opportunities, focused often on his/her identified needs. It is also the case that some researchers compete and obtain a grant only after they undertake training that helps strengthen research design. Once a study is funded, research quality is boosted through careful peer feedback and monitoring in biannual research workshops. Finally, after research completion, researchers continue to stay engaged with the network because of new opportunities for further professional development.

At least three donors have been steady supporters, enabling the Secretariat to focus on helping researchers. It has also been helpful that the Secretariat has stayed small, stable and dedicated to supporting research from the region (Whittington 2010, processed). In general, strong mentoring, need-based periodic training, repeated interactions, careful monitoring, post-project opportunities and a stable Secretariat appear to be important in sustainability knowledge creation, deepening and sharing.

7. Research Networks - Opportunities and Challenges

South Asia is the least integrated region in the world (Ahmed and Ghani, 2007) – far less integrated than Africa or any other regional block. In this context, SANDEE's effort to share sustainability information across the region opens up possibilities for better cooperation in the future.

When individual countries are limited in their productive capacity for addressing sustainability problems, geographic networks offer an opportunity for pooling information and bridging knowledge gaps. Networks also act as quick mechanisms for knowledge transfer because they are able to create space for interactions among researchers and experts from around the world. For instance, anecdotally, we know that many SANDEE researchers go back to their own countries and draw on internal domestic funding to do research on issues that they have learnt about from their cross-border peers. Moreover, knowledge deepening occurs because of repeated interactions and discussions among researchers fostered by network meetings and improvements in communication technology. The cross-border implications are that solutions can be traded.

Geographic knowledge networks, however, face many challenges in their ability to co-produce sustainability knowledge and governance reforms. Three questions merit further discussion. First, do networks enable the development of multi-disciplinary approaches required for sustainability research? Second, do regional networks in particular enable the generation of knowledge on regional challenges? Third, to what extent do networks contribute to governance changes?

Networks can foster multi-disciplinary learning. For example, some 21% of SANDEE research grants between 2010 and 2012 supported environmental scientists in examining economic and institutional issues related to conservation. In other grants, social scientists have had to learn more about other disciplines or work with other environmental scientists. However, disciplinary barriers persist and the economics discipline dominates the network's research questions and methods. Our conclusion is that for research networks to be truly multi-disciplinary, they need to be better resourced and led by multi-disciplinary teams.

Regional networks are certainly useful when nation-states find it difficult to communicate across national borders on shared environmental problems. For instance, SANDEE has supported a set of case studies across South Asia on farmers' burning of crop residue, which provides a more nuanced understanding of what it will take to address the regional challenge posed by atmospheric brown clouds (Ahmed and Ahmad, 2013, Gupta, 2011, Haider 2013, Pant 2013). But, transboundary issues that are steeped in conflict are difficult to study even in the context of networks.

Water sharing is a highly sensitive issue in South Asia and it has been difficult to make a dent in this area. It is easier to work on regional issues where either data are available or the topic itself is less politically charged. However, as trust amongst professionals across countries grows, this will potentially increase opportunities to examine the more knotty transboundary challenges (Ali 213).

Knowledge networks complement and cannot substitute for traditional 'brick and mortar' organisations. The strength of research networks comes from their flexibility, making them different from traditional funding agencies and also knowledge organizations. However, the flow of researchers and their primary training is entirely dependent on the knowledge organisations within different countries. Certainly, without sound fundamental training from traditional organisations, research skills cannot easily be raised to international standards despite all the training provided through knowledge networks. Furthermore, on the financial side, it is important to note that networks do not generate funds from their own activities. In the case of geographic networks in regions with territorial tensions, funding from national governments will be difficult. In this sense, the research network is not a substitute to government funded academic organizations.

Research from networks such as SANDEE is generally focused on practical environmental challenges, i.e. they are problem driven and seek to offer policy or management solutions. However, regional networks, unlike national think tanks, do not "belong" to any one country while most policy decisions are nation-specific. This makes it difficult to feed research into national governance reform. Policy makers also, often, want quick results, while research networks are more amenable to carefully answering questions, rather than producing prescriptions in short order. Individual researchers, however, as they grow professionally and provide leadership in their own subject-areas, are able to dialogue on policy and management issues and there are numerous such examples (Glover 2010, 49). Also, because of the breadth of knowledge generated, networks are in a position to raise broader governance questions and influence the dialogue on longer-term governance reforms.

A recent report commissioned by the New America Foundation argues that the greatest economic damages and life losses in recent years in South Asia are not from terrorism and civil conflict but related to natural disasters. The report proposes that these stresses can be reduced only through "*regional approaches to ecological cooperation*". Broadening knowledge networks, as a mechanism for building trust and making progress on sustainable development, is one of the six recommendations made in this report (Ali, 2013). In some parts of the world, sustainability science and peace-building go hand in hand; but these are both long term enterprises that may not show high returns in the short run.

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SANDEE is a regional network that facilitates the co-production of knowledge on environment-development issues. Its outcomes and impacts are a result of the efforts of multiple researchers, a group of committed and talented expert advisors, teachers who have transferred their own knowledge to researchers and practitioners at various workshops and many colleagues who have either worked in the SANDEE secretariat, served on the SANDEE Board or have sponsored SANDEE activities. Our gratitude goes to all of these individuals and the institutions that have supported SANDEE and its activities. We wrote this paper, which is part historical analyses, part quantitative evaluation and part process description because we were invited as 'insiders' to document the role knowledge networks can play in creating sustainability knowledge and policy reforms by a group of international researchers. While we attempt to be as objective as possible in writing this paper, we want to underscore the fact that all three authors have been a core part of the SANDEE team.

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Tables

Table 1: Comparison of different cohorts of training participants (2003-2012)

Variable	Obs	Before training	After training	Difference	Percentage Change	t-stat
Number of projects conducted	82	1.04	1.6	0.56	54%	3.12***
Publications in peer reviewed international journals	94	0.89	1.34	0.45	51%	2.13**

Note: **, and *** indicate significant at 5% and 1% respectively.

Table 2: Effect of SANDEE research and training on different outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Ordinary Least Squares Estimates				Individual Fixed Effect Estimates			
VARIABLES	Projects	National_Jrnl	Int'l_Jrnl	Books	Project	National_Jrnl	Int'l_Jrnl	Books
Training	0.29	-0.41	0.16	0.12	0.45**	-0.42	0.18	0.15
	(0.27)	(0.36)	(0.29)	(0.32)	(0.20)	(0.27)	(0.25)	(0.26)
Grants	0.58*	0.13	-0.03	1.04***	2.45*	-0.42	0.18	2.15
	(0.32)	(0.42)	(0.33)	(0.37)	(1.46)	(2.10)	(1.99)	(2.01)
DiD Impact	0.39	0.24	0.86*	-0.23	0.26	0.27	0.76*	-0.30
	(0.46)	(0.60)	(0.48)	(0.53)	(0.34)	(0.45)	(0.43)	(0.43)
Constant	0.87***	2.37***	0.89***	1.41***	0.17	2.57***	0.82	1.01
	(0.19)	(0.25)	(0.20)	(0.22)	(0.52)	(0.77)	(0.73)	(0.74)
Fixed Effect					Yes	Yes	Yes	Yes
Observations	178	194	194	194	178	194	194	194
R-squared	0.08	0.01	0.05	0.06	0.15	0.03	0.08	0.02

Note: *, **, and *** indicate significant at 10%, 5% and 1% respectively. Standard errors in parentheses.

Figures

Figure 1: Snap-Shot of South Asia: Carbon Emissions, Fishery Production, Forest Area, National Income, Literacy Rate, Population and Poverty

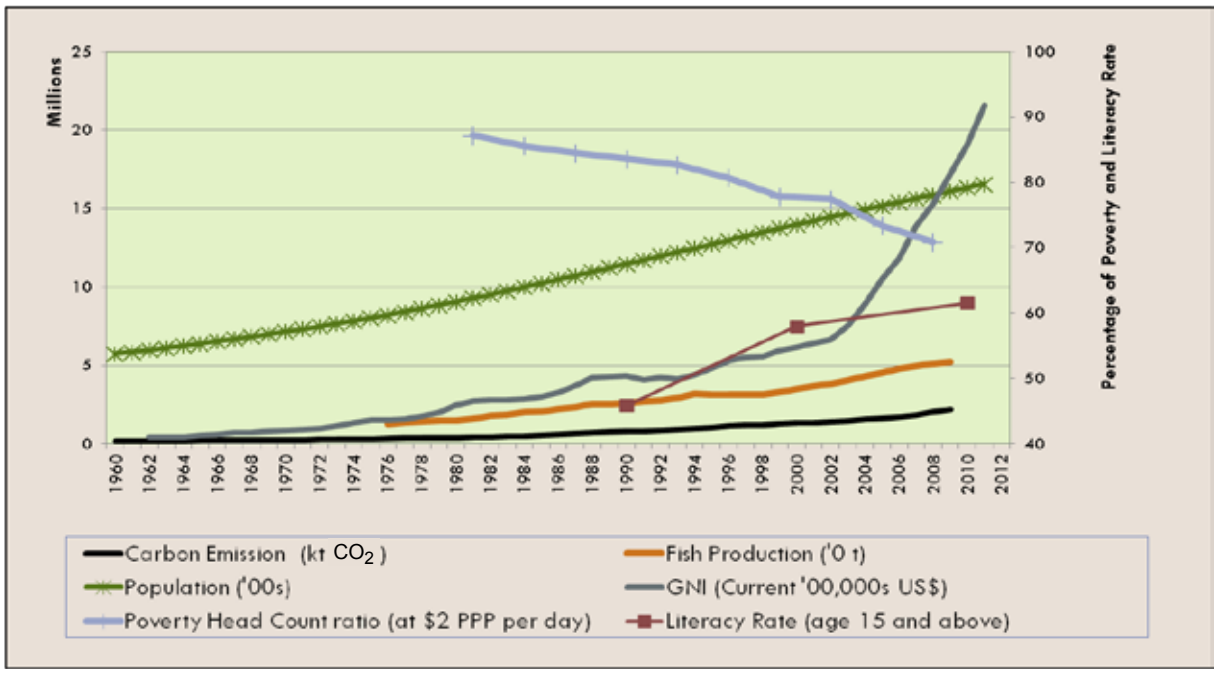
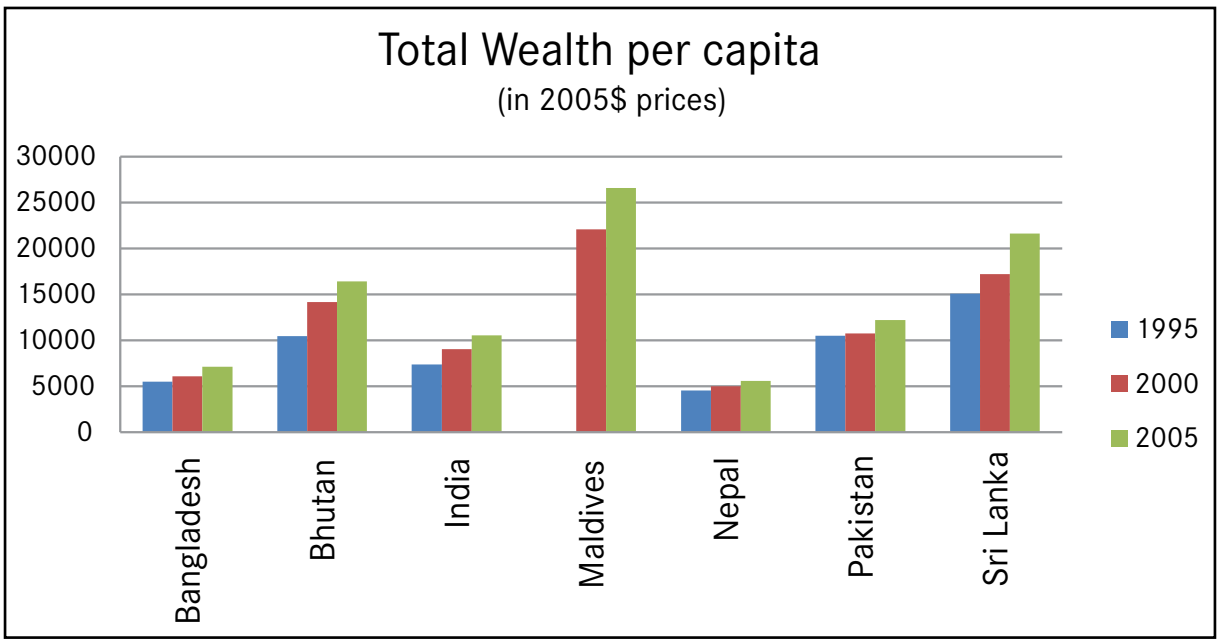
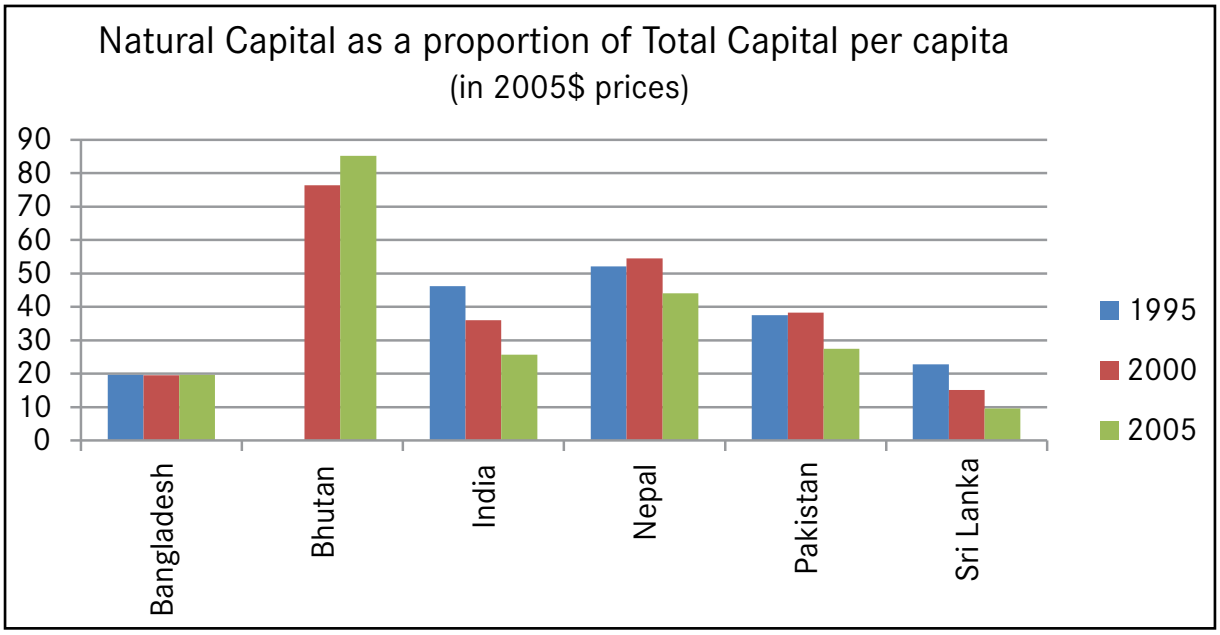


Figure 2: Per Capita Comprehensive Wealth (In 2005 $ USD)



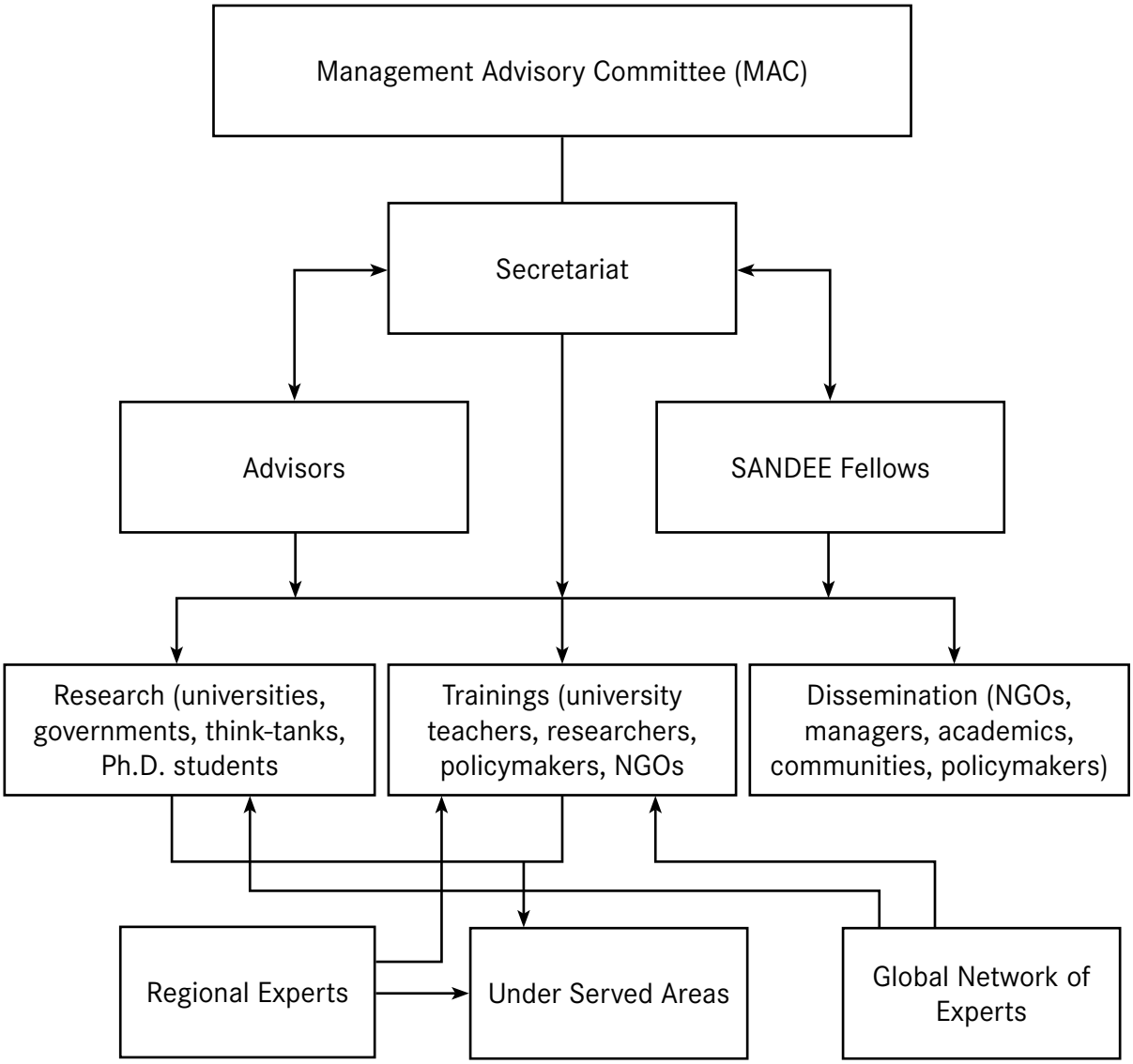
Source: World Bank (various years)

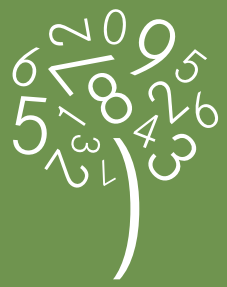
Figure 3: Natural Capital as a Proportion of Total Capital Stock in South Asia



Source: World Bank (various years)

Annex 1: SANDEE Organogram





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