# Global Partnerships in Science and Technology: The European Union as a Model of International Cooperation

Josephine Anne Stein
University of East London, UK
Allam Ahmed
University of Sussex, UK

**Abstract**

Sustainable development (SD) is a key objective for European science and technology (S&T) cooperation, both within Europe and in European partnerships with countries and international organisations around the world. This paper examines how SD concepts are embedded within European policies on S&T partnership, both explicitly and implicitly, and pertaining both to intra-European partnerships and those between the European Union (EU) and the rest of the world. The authors suggest how the European model for S&T cooperation might be adapted to develop global partnerships in a balanced, long-term and sustainable way.

**Keywords**

Partnership; cooperation; S&T; EU; DCs and SD.

## THE RISE OF EUROPEAN S&T RESEARCH PRACTICE AND CULTURE

Implicit in the organisation of European S&T partnerships are a set of practices that reflect the structures and institutions of the EU itself. Transnationality and inclusivity are essential elements which both complement and reinforce the scientific and technological objectives of cooperative research; mutual recognition and distributed leadership and responsibility are used to reinforce European cohesion as knowledge and technology are collectively advanced. A combination of stability, balance and dynamism underpins the European model of international cooperation, exemplifying an approach to sustainable development that we believe has wider applicability in the world at large.

While the institutions of the European Union, most notably the European Commission in the case of S&T, provide opportunities to bring representatives of the Member States, knowledge-based disciplines, institutions and industry together in common purpose, one defining structural feature is the absence of entrenched hierarchies. The European Presidency changes hands periodically, and with it the chairship of the Research Council (the body ultimately responsible for research policy on behalf of the Member States). One could argue that there was a period of history in which there was Italian prominence or even dominance in European Community research policymaking, but the Research portfolio has since passed to a French, a Belgian and now a Slovenian Commissioner. In a similar way, leadership of European research consortia tends to get passed like an Olympic torch. It may start with a scientist from a well-established research organisation in a highly developed, core European country and then, as

knowledge, competence and confidence diffuse to other people, institutions and countries, others step in.

Research policymaking on the Framework Programme, the principle vehicle for European S&T cooperation in Europe, is painstakingly negotiated in a way that recognises the legitimacy and importance of inclusivity. Responsibility is distributed amongst the many institutions and actors involved, and the process is characterised by extensive consultation and consensus building. Similarly, the negotiation of a research proposal, particularly the large-scale instruments of the 6th Framework Programme (Integrated Projects and Networks of Excellence), and the distribution of responsibility for project management as well as for the research itself, is a uniquely European approach to S&T partnership.

We would argue that a European "style" of research cooperation has emerged and become established over the past half century that embodies the concept of sustainable development applied to Europe as a whole. The balance that has been achieved in the "democratisation" of research policy and practice, through consultation, negotiation, mutual respect and the dynamic distribution of responsibility, is one aspect of sustainability through social cohesion. But the European approach to S&T partnership also embodies more classical understandings of sustainable development.

Initially tied to "industrial competitiveness" (this made the ultimate objective of European research cooperation under Article 130f of the Single European Act of 1986), European research after the Maastricht Treaty was targeted towards supporting *all* European policy objectives. "Sustainable development" as it is normally understood, as an ecologically responsible approach to production and management of the economy, entered into the domain of European research as an explicit policy objective.

"Subsidiarity" has been a defining feature of European S&T cooperation; research and technological development (RTD) supported by the European Community (EC) needs to complement and supplement other research undertaken at the institutional, regional and national levels, and by the private sector. Thus, inter-institutional and international partnerships form the very basis for European S&T cooperation. Furthermore, the inclusion of academic, governmental and private sector participants is encouraged, as is the inclusion of small and medium enterprises (SMEs) and partners from less well-developed regions of Europe.

Initially, this European style of research cooperation aroused suspicion amongst those accustomed to traditional structures and mechanisms for selecting research proposals for public funding, based on peer review and according to purely scientific and technological criteria such as achievability and novelty. Some researchers expressed resentment at being "forced" to cooperate with colleagues from regions, countries, academic institutions and industrial firms who did not have well-equipped laboratory facilities or enjoy high professional recognition in established circles. However, those who did venture into such partnerships generally evaluated the quality of the research as comparable to or better than research funded at the national level (Georghiou et al, 1993). Furthermore, those new to international S&T cooperation discovered that the cross-fertilisation of ideas from different scientific and cultural approaches was highly beneficial, outweighing whatever real limitations were presented by material deficiencies, linguistic differences or the costs of collaboration in terms of travel, complex communication processes and administrative burdens.

## THE ACHIEVEMENTS OF THE EUROPEAN MODEL

How did the European Community manage to enlist, engage and satisfy participants in S&T partnerships? One was purely and simply by the opportunity to do research that was not, by virtue of subsidiarity, possible to do otherwise. This included opportunities to pool similar resources and knowledge, or to get access to complementary knowledge, facilities, data or locations for field research. New methodologies and intercomparative insights enriched the value of the research; economies of scale made it possible to achieve results more quickly or in a more scientifically robust way, and attracted both competition from large research teams elsewhere in the world and interest in collaboration on a larger scale. Having tried international cooperation in S&T for the first time, British researchers were inclined to collaborate further, not only within Europe but with partners anywhere in the world (Stein et al, 1993).

How does European Community research manage to satisfy the legal, financial, and organisational aspects of successful intra-European S&T partnerships? The legal framework for European S&T partnerships was largely established through existing national law, with a few additional, simple principles governing or guiding practice. For one thing, contracts are placed with organisations rather than with individuals. In some parts of Europe, this created huge numbers of "consultancies" consisting of "independent" researchers, until the universities employing these researchers were able to emplace systems for administering externally-funded projects in a fair and accountable way.

And rather than getting involved in the nitty gritties of negotiating intellectual property rights, the European Commission required only evidence by bidding consortia of commitment to disseminate, commercialise or otherwise "valorise" the results of research. A plausible plan as part of the proposal, rather than an enforceable requirement, could be evaluated and provide the framework for exploitation. A model contract was devised and refined as a service to consortia, but with the details of the negotiations left to the partnership.

Eligibility rules for participation were kept simple. Organisations established in Europe and spending the money received from RTD contracts within Europe could participate, even if ownership of the company was wholly non-European. This did cause some controversy in the late 1980s, particularly over Japanese-owned electronics firms, but the fuss died down when people recognised the subtlety and complexity of how Europe would benefit from participation by foreign-owned companies. Locally-established companies contribute to the local economy and to national systems of innovation, whatever their ownership. Furthermore, non-European partners could participate, typically on a self-financing basis, allowing European researchers to get access to data, facilities and expertise from outside of Europe on a mutually-beneficial, reciprocal basis.

Financially, the European model stresses cost sharing. For shared-cost actions, companies were made eligible to receive up to 50% of the costs of the research, while non-profit organisations may receive up to 100% of the marginal costs. Other types of projects, such as concerted actions, receive funding only towards the costs of collaboration, including workshops, project meetings and international conferences, joint publication, and short-term researcher mobility. Funding for the research itself would come primarily from national sources. This type of funding is highly leveraged in that a small European-level investment allows scope for synergies and coordination on a very large scale.

The organisational aspects of European S&T partnerships are very diverse and flexible. Shared-cost projects can have both formal partners and associate partners, or subcontractors, and

can call upon additional experts to participate in conferences, workshops, working groups, publications and exchanges. Concerted actions can similarly include associates on an informal basis. The new instruments of the European Community's 6th Framework Programme, Networks of Excellence and Integrated Projects, provide considerable flexibility and devolved management. But organisations also emerge autopoeitically, for example as professional societies (Stein, 2004), trans-national publications and the less-well-defined groupings such as epistemic communities (Knorr-Cetina, 1999) and virtual laboratories, which provide some continuity but are formalised to different degrees. The Joint Research Centre (JRC -- actually a set of research institutes dotted around Europe) were originally set up for cooperation in nuclear S&T, but have since diversified to encompass many other areas of common interest. The JRC is orientated primarily towards S&T cooperation in support of setting European health and safety standards, or supporting other policy objectives through strategic research.

How does European partnership accommodate the differing needs of scientific and technological research? Until the Maastricht Treaty came into force, European Community cooperation in S&T was in effect an instrument of industrial policy, stressing the more applied, technological end of the spectrum. Cooperation on science was dominated by large facilities, often outside the remit of the European Community, typefied by high energy physics (CERN) and astronomy (ESO -- European Southern Observatory). Nuclear fusion was a special case, implemented as a fully-coordinated activity under the 1957 Euratom Treaty. However, two important mechanisms provided support for the full range of basic scientific research: researcher mobility and concerted actions, often through dedicated programmes such as COST (European Cooperation in Science and Technology). Thus, disciplines such as chemistry, oceanography and meteorology flourished outside the mainstream content of the Framework Programme, as well as specialised domains such as forestry, medical research, transport, and civil engineering and emerging fields of international interest such as neuroscience and archeology. And the JRC's emphasis on regulatory standards and support for policy provides yet another avenue for European S&T cooperation.

Thus, European S&T partnerships have a great variety of organisational structures and practical models available for cooperation, reinforced not only by specific policies and programmes, but increasingly by the institutionalisation of cooperation (Stein, 2004). It is not only the research community who are gaining experience in working internationally through collaboration. A growing body of S&T policymakers and civil servants have experience of negotiating priorities for European research, monitoring and evaluating programmes, and participating in dedicated policy fora (Edler, 2003). And a scientific advisory system in Europe is emerging to support the full range of objectives for European research: priorities for knowledge generation and diffusion; policies to promote industrial competitiveness; regulatory development for consumer, public health and environmental protection, etc.

By funding research through the multi-annual Framework Programme, the European Community periodically reviews its priorities for science and technology, and adjusts its budgets, policies and programme accordingly. This allows for both evolutionary development and dynamism, a formula for continuity and change that addresses the need for stability in some research areas and accommodates the need to support emerging areas of science and technology or areas of emerging societal need.

Ancillary factors reinforce European S&T partnerships, from the introduction of an internal labour market to practical measures such mutual access to healthcare and education that eases the mobility of researchers and their families. As European integration tackles one issue

after another, from taxation of researchers' salaries to the transferability of insurance and pensions, mobility is no longer reserved for the pioneers. The more Europeans have experienced educational exchanges and cooperative R&D, to say nothing of the maturation of the "Inter-rail generation", the easier S&T partnership becomes on a practical and on a human level. The introduction of the euro may have been one of the most important contributors to stabilising the economic risks of exchange rate fluctuation (still a problem in the UK and in Denmark and Sweden, and in the ten accession countries in Eastern Europe who joined the EU on 1 May 2004). Similarly, the application of European competition law has opened markets within the European Union, further encouraging the Europeanization of business operations. Political and economic integration processes have gone hand in hand with European S&T cooperation since the post-World War II period (Stein, 2002b).

By and large, European S&T partnerships work well. There are certainly costs associated with collaboration, but these are often the very costs that are met by sources of joint European funding: travel for exchange visits, joint field research, and project management meetings; international workshops, conferences and publications, etc. Good working relationships cannot be taken for granted; contractual and interpersonal factors require time and careful attention. However, advice and support are available from the European Commission and colleagues, and both individual and collective experience helps to build up robust and productive partnerships.

English is increasingly acceptable as a common language, with scientists learning how to avoid colloquialisms and to seek to convey and to understand meaning rather than to expect linguistic sophistication. In "return" for having the easiest time working in English, those who are proficient in the language tend to be asked to take on report writing and related tasks on behalf of the partnership. It all balances out.

Electronic communication has become so much more affordable, and group work software more sophisticated, that distributed collaboration is getting to be easier all the time. Electronic discussions and "e-meetings" between face-to-face contacts are increasingly available to researchers, who are gradually developing the associated skills and "netiquette" to work productively in this way. One of us (Stein) participated in a "virtual meeting" in which collaborators from six countries arranged to sit at our computers for a two-hour period. Using the relatively primitive technology of a simple listserv, we "chatted" and resolved five out of six items on the meeting agenda, complete with good-natured banter and the occasional contribution in French. We did need an extra hour, but this was so much more efficient than physical mobility that no one objected. Prior acquaintanceship and good pre-existing working relations were important to the success of this experiment.

How do European S&T partnership arrangements satisfy standards for quality and relevance? In shared-cost actions, the scientific and technological content of a proposed project are separated from budgetary information and from justifications according to other evaluation criteria such as meeting European policy objectives and exploitation plans. The portion of the proposal that is peer reviewed contains no reference to the identities or even the nationalities of those in the consortia. Each partner is identified by a code number, and even bibliographic references to partners' prior work are encoded and listed separately in another part of the proposal. Failure to comply with anonymity invalidates the proposal. Each proposal is evaluated on a set of criteria, and must exceed a threshold on each criterion as well as an overall threshold that is "more than the sum of its parts". Thus a proposal must first satisfy stringent quality standards by peer review, before being evaluated on non-scientific objectives such as arrangements for project management, exploitation of research results, and contribution towards

specific European objectives identified as part of the Call for Proposals. Those proposals that succeed in this stage of the evaluation may be selected for negotiating contracts.

The European Commission has used various interventions to construct partnerships, from combining similar proposals into a single project, to asking for partners to be added in order to achieve geographical, intellectual or other types of balance (by gender, type of organisation, etc.). This has not necessarily been welcomed by those who painstakingly constructed the project and then have to redesign and renegotiate the work programme. However, the end result can be vastly improved and once the project is under way such birth pangs can quickly recede into memory.

As Europe has grown, so has the complexity of the S&T cooperation scene, to the extent where consolidation and devolution of project management became essential. Thus, in the European Research Area and in the 6th Framework Programme, coordination and large-scale, devolved-management structures for shared-cost funding are being implemented. Teething problems have been evident, but corrective mechanisms are available and consultation is already at an advanced stage for the 7th Framework Programme.

For concerted actions, the principle of mutual recognition avoids the need for complex international evaluation of scientific or technological merit; national peer review is accepted as setting an appropriate standard by all other participants. Thus, a Portuguese or a Polish scientist who receives funding through their own national systems is accepted as demonstrating equal merit to colleagues funded by Belgian or British research councils or other funding bodies.

The European model has thus successfully dealt with organisational, scientific, legal, disciplinary, management, commercial, geographical, intellectual property, financial and human aspects of S&T partnership. It has achieved an overall penetration into S&T systems of all kinds within Europe such that scarcely any serious research organization is uninvolved in European partnership. It has demonstrated the efficacy of pooling capacity along with a commitment to both scientific and non-scientific objectives of European research, and has emplaced a distinctive working style based on collective decision-making and the distribution of research responsibility. Over time, the growing extent of shared experience and the emergence of European norms of collaboration have created a sustainable system for S&T partnership within the European ambit.

## CHALLENGES FROM THE PERSPECTIVE OF THE DEVELOPING WORLD

UNESCO's 32nd General Conference in 2003 focused on "Building Knowledge Societies", and the UN Millennium Project includes as one of ten task forces one on "Science, Technology and Innovation", as integral to its strategy to achieve the Millennium Development Goals. The advancement of knowledge-based practices has become an essential component of globalisation and sustainable economic growth, developing countries (DCs) cannot afford to ignore technological developments if they are to stay competitive.

The transfer of information and knowledge from developed to developing countries is one important source of support for sustainable development under current conditions. Imperfect as the prevailing model of "donor" and "recipient" countries may be, most of DCs in practice rely on literature produced in developed countries for up-to-date S&T-related information. Around 60% of the total world output relating to S&T was produced by only 11 industrially developed countries (UNESCO, 1992).

The scarcity of literature in educational institutions is a serious problem in most of the DCs, where there is a real need for better access to information. Whether international organisations and Western institutions can help poor nations use advanced technological tools such as the Internet for economic and social development is a question that is receiving serious attention (see Ahmed, 2004). However, there are often mismatches between what "donor" countries can reasonably offer and what the developing countries can implement. Knowledge generated in the developed world may have little relevance to pressing needs in food production, health care, clean water and education in the developing world.

Today, countries are increasingly judged by whether they are *information-rich or information-poor*. The developing countries recognize that much of their economic future will depend upon the understanding of the global technological forces at work and their long-term implications. However, the evidence also shows that the benefits accrued from the utilisation of ICTs over the recent years have been inequitably distributed with the developing countries facing the prospect of being marginalized. This has created a new form of poverty, *information poverty*, within these countries. The world is beginning to divide between the information rich and the information poor nations. The developing countries are posed with the challenge of either becoming an integral part of the knowledge-based global culture or face the very real danger of finding themselves on the wrong side of the digital divide. The risks for the DCs are greater simply because they are less developed and are faced with the prospect of having to integrate advanced technologies while their economic development and infrastructure is not yet mature. The workers in these countries are susceptible to greater vulnerability as a result. Focusing in particular on impacts of ICTs on work and employment, the following changes and trends are significant for formulation of policy and strategic framework.

Technological infrastructures, particularly IT infrastructures, differ in developed and developing countries, requiring not only innovation in knowledge management systems in the DCs but in achieving compatibility between systems in the DCs and in the developed world.

The development of IT is an essential prerequisite not only for knowledge acquisition, but for the development of the knowledge-based economy. It is estimated that over the next decade, 30% of the world's economic growth and 40% of all new jobs will be IT driven (Vinay and Saran 1998). Technological progress is shifting the nature of skills from physical effort and repetitive process towards the skills of innovation, decision making and organisation. In the new knowledge-driven global economy, the emphasis is on the use of workers as change agents in organizations. As a result, entirely new set of personal competencies are emerging. For developing countries, keeping up with these changes, and involvement in research, are both vital. There is no doubt that some developing countries are rich in traditional knowledge while some others are doing very well even in the technologically most advanced fields. Both are claiming today to be part of the process which generates knowledge as equal members in a partnership (UNDP, 1999).

S&T partnerships between the developed and the developing world could help in the rapid generation and diffusion of knowledge coupled with rapid technological advances affecting all facets of life in all countries. But such partnership arrangements often have uneven consequences in the DCs in terms of economic growth and social progress. While opportunities for sustainable development have been created by expansion in investment and trade, growth has also generated social and environmental external costs. In particular, developing countries face new challenges and specific adjustment problems linked to their particular conditions and to emerging far-reaching, interrelated and accelerating changes.

## REALISING MUTUAL BENEFIT

Scientific & Technological co-operation between the EU and DCs is firmly anchored on dialogue for the identification of priorities and partnership in the implementation of joint-research activities. The European Union has initiated S&T dialogue involving the scientific communities and decision makers in several key regions such as Asia (ASEM), Latin America & Caribbean (ALCUE), Mediterranean (MoCo) and the EU-ACP S&T dialogue. Furthermore, bilateral dialogue is carried out with Candidate Countries, as well as with a limited group of countries with whom the Union has established specific S&T Agreements such as Argentina, South Africa, China, India, Brazil, Chile and Mexico.

Many research problems can only be tackled by working with and within developing countries themselves, for example combating the results of climate change, diseases such as malaria, preservation of natural resources, fighting against land degradation or limiting the loss of biodiversity. Developing countries are considered as "hot spots" of global research issues related to sustainable development.

Though 93 percent of the world's burden of preventable mortality occurs in developing countries, too little research funding is targeted to health problems of developing countries, creating a dangerous funding differential. Both utilitarian and humanitarian arguments can be made for training scientists and health professionals in developing countries in the use of modern laboratory and epidemiological skills. Building capacity in developing countries is a necessary strategy for preventing the global spread of infectious agents. In addition to technical issues, successfully implementing a new technology depends on economic support, political co-operation, functional infrastructure, good communication, and an understanding of sociocultural issues and environmental concerns.

Developing country governments should actively seek to increase and reinforce partnerships with international S&T actors in the EU, and with the EU as a whole. Such initiatives could include, for example, matching the level of company's investment, implementing 'computers for schools' schemes whereby the hardware is supplied by the EU, and developing joint education programs through setting up training institutes. This would be consistent with EU objectives to cooperate with DCs on "sustainable development and socio-economic welfare….including sustainable management of natural resources, health, food and economic development, including efforts to combat poverty, and preservation of cultural heritage" (EC, 2001). To implement this, the EU should aim to invest in long-term education policies that develop and upgrade the technological competence and know-how of the workforce in developing countries. Such polices must be comprehensive in their coverage and include, for example, the local suppliers. This could be best achieved through partnering with the local education establishments.

In 2001, a group of six American and European publishing companies announced that they would provide free, or at drastically reduced cost, electronic access to nearly 1000 medical journals to developing nations. Led by the World Health Organisation, the medical journals initiative will benefit nearly 600 institutions, including medical schools, research laboratories and government health departments in developing countries, mostly in Africa. The programme will offer training to enable researchers to properly access the medical information by computer.

The EU could create a free on-line education and trading site for the developing nations. Such a site could offer, among other facilities, help on e-commerce, banking and learning resources. The beneficiaries of such a site would include graduates, entrepreneurs, educational

establishments just to name but a few. The EU would be creating new markets and generating demand for their products. The profits from these potential markets would more than offset any monetary and logistical problems. Such an initiative thus represents a win-win scenario for both the EU and the developing countries.

European nations could provide technical expertise and research input that would raise the knowledge base of the developing countries with a view to reducing the digital divide and hence their information poverty. Education for economic purposes must, therefore, be high on the agenda of the EU. EU policies based on this philosophy would facilitate productivity and the development and exploitation of new technology and new skills within the developing countries. In addition, the provision of training should be rooted in innovation, evolution and updating the technical know-how of developing countries. It is worth noting that the developing nations represent a great reservoir of untapped talent, which through support from the EU, would flourish and, in turn, contribute to the EU' economy and prosperity. At the same time, attention should be paid to the distorting effects of brain drains from the developing to the developed world. The EU might realise short-term benefits from attracting talent from developing nations, but if this were to come at the expense of the home countries, sustainable development would be undermined. Genuine S&T partnerships are needed, not only in terms of technology but in the other factors affecting the success of collaborative R&D.

Actual experience of European S&T partnerships with developing countries has raised a number of challenges, principally the capacity of the developing countries to capture and employ knowledge for economic, social and environmental benefit. Velho (2004a) has observed that "Only those countries with the ability to produce, select, adapt, commercialise and use knowledge seem to be able to grow economically and to offer decent life conditions to their populations." Langrish *et.al.* (1972) found that appropriability of knowledge depends on the capacity to generate new knowledge and to innovate locally. This in turn depends on local knowledge and an assessment of relevance to local needs and circumstances.

It can be misleading to view knowledge generation as primarily originating from Europe and other developed countries, if publication is used as the primary indicator. According to Kyazze (1999), endogeneity is far more important to successful innovation in the developing world than transfer and adaptation of technology developed elsewhere. Europe would do well to reflect on how it has achieved balanced economic development and convergence within its own geographical area when undertaking partnerships with countries elsewhere in the world.

In the case of an S&T partnership between Sweden and Nicaragua (Velho 2004b), the fragmentation of support modalities meant that knowledge generated as part of researcher mobility, a main feature of the programme, was isolated from the Nicaraguan institutional infrastructure. The research supported in the agricultural university, for example, was not linked to the production sector. Thus, there was minimal impact by the programme on the local economy. The INCOPOL study (Rhode & Stein, 1999) found that this approach is characteristic of many European S&T partnerships with developing countries, which suggests that caution should be applied to existing modes of European S&T partnerships with developing countries in favour of a form of partnership that more neatly mirrors how European partnerships are conducted within Europe itself.

While there is a need to acknowledge the internal diversity of DCs in terms of policy formulation and their respective stages of development, one factor is common to their economic progress. These countries need to build effective, sustainable partnerships with global S&T actors, including the EU. Such partnerships will be critical in nurturing and delivering a receptive

S&T culture, making technological appropriability realistically feasible. The ultimate objective would be to build a knowledge-based society in the DCs that has the capacity of utilizing effectively information and ICTs, while being able to generate as well as to absorb new technology. Scientists are often hampered in their work by poor infrastructure and governance, limited funds, lack of critical mass of human resources and isolation. On the other hand, scientists are well-placed to identify priority problem areas, to interact with policymakers and international colleagues, and to contribute to training.

## EXTENDING THE EUROPEAN MODEL

Certainly, the experience gained through European approaches to combining the intra-European, integration objectives with problem-oriented priorities in the Framework Programme and other, complementary approaches, could provide potentially useful models for more widespread cooperation.

The distinctly European "style" of research is influenced by the formalities, customs and ethos of European Community/Union cooperation more generally, as well as by experience of collaboration in the many other existing European S&T programmes, networks and organisations. European-style S&T cooperation is a learned skill, as well as being a manifestation of shared historical and cultural experience that is not necessarily applicable to, or natural to, people in other parts of the world. Global cooperation will necessarily have to accommodate the far more diverse set of ideas and cultures present around the world. Nevertheless, European approaches to cooperation may provide practical, tried and tested models that can contribute to the design of future policies and programmes. For example, the IPR regime for the global Intelligent Manufacturing Systems programme was based on European experience under the Third Framework Programme (Parker, 1998).

There are few global-scale institutions which can provide a basis for organising multilateral cooperation in S&T. United Nations organisations such as FAO, UNEP and UNESCO, and the OECD Global Science Forum, provide valuable loci for stimulating cooperation and exchanging information, but have limited scope for implementing projects, let alone programmes that are flexible enough to accommodate the diverse and rapidly changing world of science and technology.

As the world shrinks and globalisation becomes an increasingly important determinant of the economic, social and political conditions in countries and regions around the world, simple pragmatism would imply a need for greater cooperation on a global scale. The penetration of ICTs into the technoscientific world, including groupware and broadband, is accompanied by the development of skills amongst researchers that makes working across geographical distances and time zones increasingly effective. These changes, along with the widespread use of the English language in scientific communication, have made global cooperation in science and technology, in all fields, a realistic prospect.

The European Community has only limited instruments with which to conclude international agreements, which in common with most other countries and institutions is dominated by bilateral and case-by-case arrangements. But European scientific organisations, European industry and publicly supported programmes, including COST and the Framework Programme, can and are being used to extend cooperation worldwide. Non-European members are built into concerted actions and research consortia, although naturally, and inevitably, they

participate on European terms. These partnerships provide a valuable means for non-Europeans to learn about the European model. However, this extension of European practices does not extend to involving partners in decision-making, management or strategic policy making in a systematic way. It would appear that Europe has yet to apply what it has learned about creating S&T partnerships for sustainable development within Europe, to European cooperation with the rest of the world.

## CONCLUSION

There has been a gradual but discernible, growing recognition that global S&T cooperation needs to be systematised in a way that preserves diversity, ensures plurality of funding structures and objectives, and yet provides a "framework" for considering the most appropriate specific model for cooperation.

Europe provides a tried and tested model for S&T partnership that manages organisational, scientific, legal, disciplinary, project management, commercial, geographical, intellectual property, financial and human aspects of collaboration, for the most part successfully. The "European experiment" has demonstrated the efficacy of pooling capacity along with a commitment to both scientific and non-scientific objectives whereby proposals can be fairly evaluated. Europe has shown that collective decision-making and the distribution of research responsibility are not only workable but help to build capacity and stability within distributed research communities.

European researchers will be quick to appreciate the need for genuine partnership with collaborative partners, but this style of cooperation is unfamiliar to most of the rest of the world, accustomed to more hierarchical, established and non-collaborative models. However, Europeans too need to overcome historical, traditional and resource-related patterns of "partnership" that do not adequately recognise the knowledge, capacity for innovation and valuable sociocultural assets of non-European partners, particularly within the developing world.

It is incumbent upon Europe to share the solutions it has developed over the past half century with its global partners, and together with other countries to find ways to apply lessons learned in a way that is applicable to S&T partnerships in the world as a whole.

Neither European nor developing countries can cope effectively with sustainability problems in isolation. As the European Union's internal experience has shown, partnerships built on mutual respect and genuine cooperation, where responsibility for policy, management and research are shared, lead to robust, stable, mutual benefits. For the developing world to benefit from S&T partnerships, there need to be mechanisms for assessing local priorities, institutional capacities, and for ensuring local ownership. For all partners, dynamic cooperation in recognition of global interdependencies is key. Over the long term, only by creating balanced "partnerships of equals" can enduring sustainability be fostered, both in the organisation of research and in its relevance to our common agenda.

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