International Experience on Regional Programmes for Science and Technology:

Lessons for Africa's Science and Technology Consolidated Plan of Action

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Executive Summary

The African Ministerial Conference on Science and Technology met in Dakar, Senegal on 29-30 September 2005 to adopt Africa's Science and Technology Consolidated Plan of Action. This review forms one of three studies commissioned by NEPAD to inform discussion of Consolidated Plan of Action and its subsequent implementation. In additional to this review of international experience in regional programmes of S&T, the others consider innovative financial mechanisms and a review of existing African networks and experience. As a set, these reports are designed to help guide the implementation of the Consolidated Plan of Action and engagement with other stakeholders including the donor community.

The review reviews experience from the regional S&T programmes in Latin America and Southeast Asia before considering activities from the United Nations system, the European Union and the Organisation of Economic Cooperation and Development (OECD). The summary of each Section considers the lessons that can be learnt for implementation of the Plan of Action (CPA). These points are collated in the final Section of the review to present an analysis of best practice for Africa.

Key points in the summary are repeated here:

- The process to design and implement the CPA must be owned by African nations and institutions.
- Implementation of the CPA should have appropriate political ownership and oversight. This is currently provided the African Ministerial Conference on Science and Technology, and would be enhanced in the Pan-African Parliament were to establish a Committee with responsibility for Science and Technology.
- The African Ministerial Conference on Science and Technology has an important role in providing political leadership and enhancing international cooperation in Science and Technology. The OECD ministerial level meetings and G8 Carnegie meetings have similar functions. It is likely to be beneficial for AMCOST to create a dialogue with these groups.
- Priority setting for the content and implementation of the CPA should be owned and driven by African nations, and this should include opportunities for the participation of end-users of technology, civil society and the private sector.
- The proposed African Science and Innovation Facility needs to have a clear legal status and should have procedures to address IPR issues.
- Linkage with national poverty reduction strategies and the Millennium Development Goals will promote engagement of UN system and bilateral donors
- Regional programmes for Science, Technology and Innovation need to be distinct from, and add value to existing country-level activities.
- Many countries in Africa will require additional bilateral support to strengthen national systems of innovation
- Individual countries would benefit from a regional approach to support the development of national science, technology and innovation strategies.
- Africa's Science, Technology and Innovation Initiative in the Consolidated Plan of Action will have an important role to inform national and regional policy on S&T. Linkage with appropriate MDG indicators would help to promote engagement with development donors. Integration of this work with the African Peer Review

Mechanism would add further political legitimacy to this process and provide a further link between regional S&T and good governance[3].

- Lack of absorptive capacity in African Institutions may limit new regional and national S&T Initiatives. Strengthening human capacity will require new a new commitment by countries, donors and the private sector to support S&T in secondary, tertiary education and lifelong learning.
- An innovative and flexible funding mechanism is required to support implementation of Africa's Consolidate Science and Technology Plan of Action. This must be able to work with different types of contributions, including national governments, multi and bilateral donors, foundations and the private sector. Financing needs to be secured on long time horizons and through predictable cycles.
- International donors should be challenged to work together through a Donor Forum and adopt their own agreed guidelines for best practice as defined in the UN Conference on Financing for Development and the OECD Paris Declaration on Aid Effectiveness.
- Promoting private sector engagement and investment is essential to achieve development including those promoted through Africa's Consolidated Science and Technology Plan of Action. Promoting private sector investment to support the Consolidated Plan of Action will require intellectual property issues to be addressed during the establishment of the African Science and Innovation Facility and associated projects.

Further detail is provided in Section 8 of this report. The information from this study and the others in this series will be used by NEPAD to design follow-up activities to support and promote implementation of the Plan of Action.

[3] A conclusion and recommendation derived from analysis in this report.

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List of Abbreviations

Abbreviation	Definition
ADB	Asian Development Bank
AFSTD	African Forum on Science and Technology for Development (NEPAD)
APEC	Asia-Pacific Economic Co-operation
ASEAN	Association of Southeast Asian Nations
ASF	ASEAN Science Fund
ASTNET	ASEAN Science and Technology Network
AU	African Union
CDF	Comprehensive Development Framework
CGIAR	Consultative Group on International Agricultural Research
COST	Committee on Science and Technology (ASEAN)
CPA	Consolidated Plan of Action (for Science and Technology)
CSTP	Committee for Scientific and Technological Policy (OECD)
DAC	Development Assistance Committee (OECD)
DBS	Direct Budgetary Support
DFID	Department for International Development (United Kingdom)
DG-Research	Directorate General for Research (European Commission)
DSTI	Directorate for Science, Technology and Industry (OECD)
EC	European Commission
ECOSOC	Economic and Social Council (United Nations)
EDF	European Development Fund
EEC	European Economic Community
EESC	European Economic and Social Committee
ERA	European Research Area
ESSD	Environmentally and Socially Sustainable Development (Network, World Bank)
EU	European Union
FAO	Food and Agriculture Organisation
FP6	The 6th Framework Programme for Research and Technological Development of the European Commission
GDP	Gross Domestic Product
GEF	Global Environment Fund
GMS	Great Mekong Sub region
GNI	Gross National Income
GSF	Global Science Forum (OECD)
HIPC	Highly Indebted Poor Country (scheme) (World Bank and International Monetary Fund)
IDB	Interamerican Development Bank
IFC	International Finance Corporation (World Bank Group)
IFI	International Financial Institution(s)
ILRI	International Livestock Research Institute (CGIAR)
IMF	International Monetary Fund
IPR	Intellectual Property Rights
ITRE	Committee for Industry, Trade, Research and Energy (European Parliament)
JRC	Joint Research Centre (European Commission)
MDG	Millennium Development Goal(s)
MEP	Member of the European Parliament
MSI	Millennium Science Initiative (World Bank)
MSTI	Main Science and Technology Indicators (OECD)
NAR	National Agricultural Research (institute / agency)
NEPAD	New Partnership for Africa's Development
OAS	Organisation of American States
OECD	Organisation for Economic Co-operation and Development
OED	Operations Evaluation Department (World Bank)

Abbreviation	Definition
OEED	Organisation for European Economic Development (now OECD)
PPP	Public/private partnerships
PRSP	Poverty Reduction Strategy Paper
R&D	Research and Development
S&T	Science and Technology
SME	Small and Medium Enterprise
STI	Science, Technology and Innovation
STOA	Scientific Technology Options Assessment (EU)
UN	United Nations
UNCSTD	United Nations Commission on Science and Technology for Development
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
WB	The World Bank
WHO	World Health Organisation
WSSD	World Summit on Sustainable Development

1 Introduction

1.1 Africa's Science and Technology Consolidated Plan of Action

1.1.1 Africa's Science and Technology Consolidated Plan of Action[4] has been produced by the African Union (AU) and NEPAD (New Partnership for Africa's Development) and was adopted by the 2nd African Ministerial Conference on Science and Technology (AMCOST) at their meeting in Senegal (September 2005). It is based on the outcomes of an extensive process of consultation with African stakeholders. It presents a vision of regional activities in Science and Technology (S&T) to support development objectives in the region. The Plan contains four[5] Programme Clusters:

- Biodiversity, Biotechnology and Indigenous Knowledge;
- Energy, Water and Desertification;
- Material Sciences, Manufacturing, Laser and Post-harvest Technologies;
- Information and Communication Technologies and Space Science and Technologies.

1.1.2 These clusters will be supported by a set of additional programmes designed to improve policy conditions and support innovation systems.

1.2 Purpose of this Review

1.2.1 This review forms one of three studies commissioned by NEPAD[6] to inform discussion of the Consolidated Plan of Action and its subsequent implementation. In additional to this review of international experience in regional programmes of S&T, the others consider innovative financial mechanisms and a review of existing African networks and experience. As a set, these reports are designed to help guide the implementation of the Consolidated Plan of Action and engagement with other stakeholders including the donor community.

1.2.2 This review covers issues of direct relevant to the Consolidated Plan of Action. For this reason, whilst objective, it is not a fully comprehensive review of either regional and international S&T programmes, or S&T programmes designed to support development. The emphasis has been to review selected examples which have the characteristics of being development-focused and regional or global and being of relevance to Africa's unique situation and to the proposed Plan of Action. The central aim being to draw out lessons learned and best practice that lend support to the rationale and approach of the Consolidated Plan of Action. Regional and global programmes addressing environment issues (such as the Earth System Science Partnership, ESSP) have not been discussed to maintain the focus on development in this review.

1.3 Approach

1.3.1 The review starts with the assumption that Africa's situation and challenges are unique in terms of the characteristics of pre-existing human capacity, infrastructure, scientific challenges and development objectives. For this reason, the review did not look for a single system to transfer to Africa, but instead looked for examples of best-practice around the world that could be adapted to become appropriate in support of the Consolidated Plan of Action.

1.3.2 The report presents two regional examples, Latin America and Southeast Asia. These were selected as having relevance to Africa. In both regions there are increasing political and scientific collaborations and countries with a range of stages of economic development. In addition to efforts from individual

[4] In this document also referred to as the "Consolidated Plan of Action" and "Plan of Action"

[5] An additional cluster of mathematical science is being considered.

[6] Supported by the United Kingdom, Department for International Development (DFID)

countries, in both regions bilateral and multilateral agencies are supporting development processes including science and technology. SE Asia is particularly interesting because of significant development progress (as measured against the Millennium Development Goals) which has been linked to investment in science and technology (including by the private sector). Latin America's relevance is as an example of strong multilateral engagement in S&T by both the Interamerican Development Bank and the World Bank Group.

1.3.3 Within the global context, the review considers the role of the United Nations (UN) in application of science and technology to support development. This includes an examination of historical activities as well as considering the changing nature of the UN's engagement to support development over the five years post the Millennium Declaration and the outcomes of the 2005 World Summit.

1.3.4 The OECD is included in the review because of its work in public-policy issues relating to S&T. An important component of this is the work to develop S&T indicators, an activity of direct relevance to Africa's Consolidated Plan of Action. OECD's activities for major developed economies have many similarities to those of NEPAD's African Forum on Science and Technology for Development and those being discussed for the proposed African Science and Innovation Forum.

1.3.5 The European Union is discussed because of its major regional S&T programme, the Framework Programme which has a clear aim of supporting European development. It is noted, however, that whilst this is the largest regional S&T programme on a global scale, its funding only represents 4 % of the European total expenditure on S&T[7]. The relevance to Africa is also limited, by that fact that this programme is funded by the European Commission through taxation and linked to a regional parliament with legislative powers, which are major differences when compared with the African Union and Commission.

1.3.6 The final section of this report provides a summary of international experience in regional science and technology programmes. This has been presented as how this knowledge can be used to best support Africa's Consolidated Science and Technology Plan of Action.

[7] This total includes investment by the private sector. The EC's Framework Programme represents around 10 % of public expenditure on S&T in Europe.

2 Regional Cooperation in Latin America

2.1 Introduction

2.1.1 Latin America was chosen as a regional case study because a number of national and regional S&T initiatives that can offer lessons for Africa. Latin America offers a continental region with a mix of countries ranging from middle income through to highly impoverished. Middle income countries such as Brazil, currently have relatively high investment in S&T, well established higher education systems and technology-based industries (e.g. aerospace). In contrast, the poorest countries in the region such as Bolivia have high levels of poverty, and limited national scientific capacity.

2.2 Political framework

2.2.1 The Organization of American States (OAS) is the main geopolitical grouping that covers the entire region of the Americas and the Caribbean. It plays a role in strengthening institutions in countries of the Americas working against broad political, economic and social development goals. The OAS is a regional, membership body comprised of 34 Member States.

2.2.2 The OAS has a regional Science and Technology programme whose focus is the popularization of science and the promotion of knowledge based societies. Their S&T programme is housed in the Office of Education, Science and Technology which is part of the Executive Secretariat for Integral Development. The Executive Secretariat is a branch of the OAS' General Secretariat. The first meeting of the OAS Ministers of Science and Technology took place in 2004.

2.2.3 The OAS S&T programme has a strong emphasis on supporting economic development, including setting of systems that lower industrial pollution (i.e. cleaner technologies) and the standardization of the quality of products. There is also an emphasis on de-regulation of markets for ICT. Projects are varied and fall under three strands: ICT, Productive sector and S&T policy. OAS has trans-boundary pilot programmes such as the *Trans-national Digital Government Project.* For example, this project seeks to combine five advanced information technologies into one integrated system and apply the resulting system to the automation of a public sector function (currently piloted for migration purposes). Other initiatives include the formation of knowledge based networks such as the Science and Technology Indicators network. The regional programme promotes activities that add value at regional level.

2.2.4 Mercosul (Mercosur) is a sub regional economic grouping representing Brazil, Argentina, Paraguay and Uruguay with Bolivia and Chile as associate members. Through the process of regional integration, this economic grouping is starting to develop common policies and approaches on S&T and the links to economic development. This work is ongoing.

2.3 Regional Science and Technology Programmes

2.3.1 There is no single international body that acts to coordinate regional S&T initiatives supporting development in Latin America. Within the United Nations system, UNESCO (United Nations Educational, Scientific and Cultural Organisation) and the World Bank have been active, but their work has been mainly at country level. UNESCO has had initiatives to catalyse regional integration. Interviews were held with the head of UNESCO's regional S&T programme.

2.3.2 In Latin America, a great number of *national* Centres of Excellence are government parastatals. A review of a handful of countries indicates that these are independent bodies dedicated, in most countries, to the design and management of grant making programmes for Science and Technology. Usually known as 'Councils for Science and Technology', these centres have technical cooperation programmes with international donors and also receive financial support from their Government.

2.3.3 These Centres of Excellence have a national remit and act as hubs, coordinating donor interventions and spearheading the design and implementation of national policies on S&T. Their remit is mainly

national, their grant making schemes support higher education and research. There have been efforts to co-ordinate some of these Centres into regional networks, but there has been limited impact to date, mainly because of the lack of funding for regional initiatives.

2.4 United Nations System

2.4.1 The UN system has a strong presence in Latin America, mainly through the Consultative Group on International Agricultural Research (CGIAR, Section 5) and through the activities of UNESCO. The CGIAR centres are focused on research and capacity building for agriculture and designed to deliver global public good research. For example CYMMYT in Mexico specialises in issues related to wheat and sorghum, CIFOR's Brazilian regional office is focused on forestry. The impact on CGIAR centres on regional S&T and capacity is difficult to assess. Some would say that the presence of CGIAR centres has helped to supplement weak institutions in the region. Others would counter this argument with a statement that the CGIAR centres have failed to strengthen local institutions and in some cases may have provided an excuse for lack of investment by governments. In either case, there is limited demand for significant expansion of CGIAR activities from other stakeholders.

2.4.2 The role of UNESCO is to act as a forum or hub for regional debates on S&T focusing on capacity building. The role of UNESCO in the region has evolved over time. In the 1950's UNESCO supported the development of Councils of Science, a concept that flourished in Latin America and the Caribbean. In effect, these formed a regional network of Centres of Excellence and it was though these that the UN supported S&T policy processes in the region. However, these activities were hampered as a result of the reduction of UNESCO's budget during the '80s and '90s, when its role shifting to support the creation of specialist networks, in themes such as: popularization of science, physics, maths, geography, biology. Currently, UNESCO is looking into creating an umbrella policy, as a sort of referential framework that will look into hosting all the networks, to create a horizontal 'network of networks'. This umbrella network will facilitate South-South cooperation. The thematic focus of UNESCO's Regional Office for Science in Latin America and the Caribbean will continue to be Science and Technology for Innovation, aiming to achieve Sustainable Development.

2.5 International Financial Institutions (IFIs)

2.5.1 Both the World Bank and the regional Interamerican Development Bank (IDB) have provided support for S&T initiatives in the region. Most of this has been provided at country level, though there has been limited support for regional (or sub-regional) initiatives for science and higher education. The development and adoption of a S&T strategy for the IDB in 2000 (Interamerican Development Bank, 2000) has resulted in increased investment and better co-ordination of activities supported by the Bank. The IDB decided to focus on areas of competitive advantage, with the aim of strengthening national innovation systems and to link these with the global knowledge society. The programme now tends to concentrate on the contribution of S&T to the productive economy

2.5.2 The World Bank's support in the region has tended to concentrate on support for individual countries. Recently, the World Bank launched their Millennium Science Initiative (MSI) in the region. MSI Initiatives support in-country institutes such as research centres or labs which are effectively small Centres of Excellence that adopt specific themes (i.e. support to a *Laboratory for High-Energy Physics');* they are frequently hosted in national Universities or Centres of Excellence. MSIs are financed by both national governments and the WB through loans or grants.

2.5.3 The first MSI launched in Chile is outlined in Box 1. Since this time the initiative has expanded elsewhere in the region including Brazil and Mexico. In all cases the MSI approach has been used to strengthen national systems of innovation. There are proposals to expand the MSI process within Africa and Asia.

Chile's Millennium Science Initiative Project.

The aim of this initiative is to advance the training of human capital by world class scientists engaged in cutting edge research. The US$15 million project was partly funded by the World Bank, through a US$5 m loan, the rest of the capital was provided by the Government of Chile.

Most of the funds – US$ 12.5 million will be spent on a competitive grants fund for Scientific Excellence. The Fund will provide grants to fund: a) research, b) expansion of doctoral and post doctoral programmes, and finally, c) promotion of scientific research. The rest of the funding will be spent in two projects of equal value, focused on creating a network for the promotion of scientific excellence and on setting up the management system for the MSI.

The MSI programme was conceived from the outset as the starting point for a decade long investment programme. The Government of Chile had the highest level of political commitment to the project, which was highly consultative.

Box 1 Chile's Millennium Science Initiative

2.5.4 The MSI process in Chile has not been a complete success. Funding for the Institute of Cellular Biology and Biotechnology was not renewed in 2005 after an external MSI review that highlighted significant management problems including conflict between the Institute's Director and senior researchers. Chile's Ministry of Planning also conducted a review following allegations of mismanagement. This review recommended that the Director should resign, which he refused. These problems highlight the importance of institutional governance for major science initiatives.

2.5.5 The role of the MSI's external experts in the Chilean dispute raises questions of governance of the MSI in relation to Africa. The AU-NEPAD programme and Consolidated Plan of Action stress the importance of regional ownership. In Chile, the final fate of a *Chilean* institute was decided by a group led by the head of the MSI Science Initiative Group, based in the Institute of Advanced Study, The University of Princeton in the United States. This approach adopted by the MSI raises a significant issue of ownership and would not be well received by African institutions, including specifically the AU and NEPAD.

2.6 The Private Sector

2.6.1 The IDB's S&T strategy (Interamerican Development Bank, 2000) identifies low private sector investment being a factor limiting innovation and economic development. It states that "evidence of adequate private sector investments in R&D is restricted to very few areas". The current strategy suggests that most new investment in S&T by middle income countries (such as Brazil) should come from the private sector, whilst public and the Bank's development funds should be used to target the development of effective innovation systems in poorer countries.

2.7 Lessons for Africa

2.7.1 There are significant lessons from Latin America that can be relevant to the successful implementation of the Consolidated Plan of Action. The key lessons are presented here:

- ***Regional initiatives need to build on top of existing national systems of innovation***.
- ***Regional initiatives require dedicated funding*** that is additional to investment provided at national level.
- ***Priority setting should start at country level to ensure broad-based political support*** (e.g. Chile's MSI) and should include civil society and industry.
- The UN's (UNESCO) initiatives have helped to establish S&T networks in the region, but lack of regional funding has resulted in limited impact. ***It is necessary to have dedicated funding for regional S&T activities.***
- The World Bank's Millennium Science Initiative has had some success in strengthening national innovation systems, but limited impact at regional level. Recent experience in Chile demonstrates the **importance of good governance of S&T initiatives** and raises questions about the degree of local ownership of the overall MSI programme[8].
- ***The Interamerican Bank's adoption of a Science and Technology strategy was effective in promoting public investment in S&T throughout the region.***
- Investment in S&T by the private sector continues to be low in Latin America. ***Further effort is required to deliver enabling conditions (policy, legal, fiscal) to enhance the engagement of the private sector in linking innovation to economic development.***

[8] Questions of ownership of MSI projects in Africa have been further accentuated by the development of World Bank supported projects on biotechnology (Uganda, Cameroon, Botswana, and Namibia) and mathematics. To date, there has been very limited integration of the MSI process with related AU-NEPAD Flagship Programmes.

3 Regional Co-operation in SE Asia

3.1 Introduction

3.1.1 The Asia and the Pacific region has seen some of the most significant progress, on global basis, in human and economic development over the last several decades. Much of the development and economic progress in the region has been linked to individual countries, specifically China and India. In both countries, S&T has played a crucial role in supporting development, but for the purposes of this review, there are limited examples of regional co-operation linked to development in China and India. South-east Asia provides better examples and as in Latin America, these are very clearly linked to geopolitical groupings, the Association of Southeast Asian Nations (ASEAN) and the Asia-Pacific Economic Co-operation (APEC).

3.2 Political framework

3.2.1 ASEAN is a multi government body created in 1976, as a result of the strategic interest of South East Asian Nations to strengthen bonds and common goals. Their intention was consolidated by the ASEAN Declaration, ASEAN's purpose is to: (i) accelerate the economic growth, social progress and cultural development in the region (ii) promote regional peace and stability in the region. ASEAN adopted their Vision 2020 at the 1987 summit. This is a strategic policy paper that aims to support development in the region. Science and technology feature strongly in the vision (Box 2). The resulting Hanoi Plan of Action identifies the need to promote the development of science and technology and infrastructure for information technology.

ASEAN Vision 2020

The 2020 vision adopted by ASEAN at the 1997 ASEAN meeting contained a number of resolutions relevant to S&T policy. These include:

"We resolve to: …

accelerate the development of science and technology including information technology by establishing a regional information technology network and centers of excellence for dissemination of and easy access to data and information"

and the vision for social development in the region stated that

"We envision a technologically competitive ASEAN with an adequate pool of technologically qualified and trained manpower, and strong networks of scientific and technological institutions and centres of excellence."

Box 2 ASEAN's vision 2020.

3.2.2 APEC, the Asia-Pacific Economic Co-operation is a much wider geopolitical grouping that covers most countries on the Pacific Rim, including major economic powers such as the United States and Japan. APEC provides a regional forum for discussion, but these are non binding. APEC promotes S&T discussion and ministerial-level meetings. There have been S&T initiatives that have come out of these discussions, but very informal nature of this group means it is of limited relevance to Africa and it will not be considered further here.

3.3 ASEAN Regional Science and Technology Programmes

3.3.1 Implementation of ASEAN's agenda for S&T is now the responsibility of the Committee on Science and Technology (COST). This body, along with associated ministerial-level meetings, has taken on the challenge of developing a regional approach to S&T. The implementation of ASEAN's activities is guided by the ASEAN Plan of Action on Science and Technology developed by COST. The first version of the Plan of Action was published in 1981 and this has been revised on a number of occasions. The most recent version for the period 2001-2004 was adopted by the Ministerial meeting in 2001. It is clear from this that ASEAN's research agenda is led by the aim to increase the competitiveness and economic performance of the region.

3.3.2 The ASEAN Science Fund has been established to promote regional S&T activities, with resources provided through contributions from member countries and development (dialogue) partners. The Fund is meant to provide resources for the purpose of providing seed financing for the various programmes, projects and activities under ASEAN science and technology cooperation, as identified and approved by the ASEAN Committee on Science and Technology. The management and access to the ASF is the responsibility of COST. An Advisory Body on the ASEAN Science Fund (ABASF) assists COST in establishing the guidelines and procedures for utilization of the Fund, and in reviewing project proposals requesting support from the Fund. The resources currently available through the ASF are small and for this reason it has limited impact at regional level.

3.3.3 Although ASEAN has started to utilize its own resources to support a number of its S&T projects, contributions from third parties are accepted (i.e. New Zealand, a 'Dialogue Partner' and the Perez Guerrero Trust Fund) and remain important in driving the S&T cooperation in the region. Among the ASEAN Dialogue Partners, China, EU, India, Japan and ROK have supported S&T projects in the past year.

3.3.4 ASEAN has established a number of regional centres with a S&T remit, examples include the ASEAN Centre for Energy and the ASEAN Regional Centre for Biodiversity Conservation. Others such as the ASEAN Institute for Health Development have been adopted as ASEAN initiatives being developed from national facilities. The establishment of many of these initiatives has been supported by development partners through short-term projectised interventions. Long-term impact and sustainability has been limited when initiatives have been linked to ad-hoc donor support.

3.3.5 In the current Plan of Action, the first thrust is the networking of S&T Centres of Excellence (Box 3).

THRUST 1. NETWORKING OF S&T CENTRES OF EXCELLENCE and programmes so as to optimise resources and achieve maximum results

Action 1: Hasten the development of the ASEAN S&T Network (ASTNET) and create a hub of activities to promote and sustain it.

Action 2: Identify centres of excellence on S&T and develop a resource database and network to facilitate information sharing human resource development and technical cooperation between the public and private sector.

Action 3: Develop a network of national and regional projects and databases to support integration and achieve optimisation for regional implementation taking into account the diverse economies, stage of development, and readiness of member countries.

Action 4: Promote a modern and competitive small and medium enterprise (SME) sector in ASEAN by leveraging on ASTNET and the related S&T networks and resources.

Box 3 ASEAN's Plan of Action for S&T, 2001-2004. Thrust 1, Networking Centres of Excellence.

3.3.6 The first action, the establishment of a S&T Network (ASTNET, http://www.astnet.org) has provided a portal into regional activities. ASTNET facilitates specialist networking for its members, it is a hub for the exchange of knowledge and the development of regional projects. ASTNET subcommittees organize specialist activities along the following themes:

- Meteorology and Geophysics;
- Food Science and Technology;
- Biotechnology;
- Space and Technology Applications;
- Science and technology infrastructure and resources development

3.3.7 The structures and approach adopted by ASEAN are similar to those proposed in Africa's Consolidated Plan of Action and therefore of significance in this paper. There is strong political support for the process, but the limited impact currently observed should be attributed to the lack of an appropriate funding mechanism.

3.4 United Nations System

3.4.1 The United Nations System is actively promoting S&T in the region, using similar approaches and structures as described in Latin America (Section 2.4). UNESCO and the CGIAR are active in the region and address a range of themes from primary research through to human capacity. In addition, the Food and Agriculture Organisation (FAO) has activities supporting S&T, through its regional office in Bangkok.

3.4.2 In SE Asia, the arguments about the ownership of these UN programmes in the region are very similar to those discussed previously for Latin America. These relate to the priority setting process and the degree that organisations such as CGIAR centres contribute to the needs of nations in SE Asia, including building local capacity. It has been observed that the move to recruit local scientists in host countries for the UN system has added to the effective "brain-drain" from nations, with their scientists now working on projects in other global regions as the UN system focuses on global public goods.

3.5 International Financial Institutions (IFIs)

3.5.1 The World Bank and Asian Development Bank (ADB) have made a number of investments in S&T and higher education in the region, but these tend to be for individual countries. In recent years the ADB has adopted a stronger regional focus in some areas, the best example being in the Greater Mekong Subregion (GMS) with programmes such as the GMS Biodiversity Corridors Initiative. The lending profile in the region demonstrates ad hoc decisions leading to lack of coherence. In contrast to the IDB (for the Americas) the ADB does not have a S&T strategy, nor does it have an office with responsibility for linking S&T and development. This review suggests that this may be a major contributor to problems in establishing regional S&T programmes.

3.6 The Public Sector

3.6.1 Public sector investment in S&T and Higher Education varies significantly in the region. It would be simplistic to report the correlation between GDP or economic performance and public sector investment in S&T, but this would not lead to better understanding of cause and effect. Malaysia provides one good example.

Public Sector Investment in S&T in Malaysia

In Malaysia, there was very high-level political support for S&T with a Prime Minister who provided a vision of technological-led investment. This vision was supported by significant public investment in providing infrastructure, human capacity and research itself. This combined with fiscal and policy measured designed to promote engagement with industry has undoubtedly contributed to development outcomes in Malaysia. This political vision and support has been essential in promoting technology-led development with the basis of the economy shifting from dominance of primary and extractive industries to an increasing contribution from technology sectors. This should be contrasted with Indonesia which had a similar development status as Malaysia immediately after the 2nd World War. The differences in political governance and vision provided in the two countries has resulted in highly contrasting development outcomes, with Malaysia being a Middle Income Economy with growing presence in the global economy for high-technology goods. Indonesia's economy is still largely dependent on the primary and extractive industries and low-technology manufacturing (e.g. clothing).

Box 4 Public sector investment in S&T in Malaysia

3.7 The Private Sector

3.7.1 It was noted above that there has been very significant technology-led development in SE Asia. As noted above, there has been a lack of coherent public policy and funding across the region, though there has been notable success in individual countries such as Malaysia. The reason for rapid technological progress throughout the region has been investment and engagement by the private sector. This has been most effective when it has been done in conjunction with public investment (see the example of Malaysia, Box 4).

3.8 Lessons for Africa

3.8.1 The Southeast Asia region provides a highly relevant regional S&T example for Africa. The strategy is fully embedded within the regional ASEAN geopolitical grouping. Their Committee on Science and Technology and associated Ministerial Meetings are key to this process. Having said this, progress in the region has been on an ad-hoc basis resulting from the leadership and investments from individual countries, the private sector and bilateral development partners. The lack of a S&T strategy in the Asian Development Bank has resulted in poor coherence of actions designed to incorporate S&T into regional development.

3.8.2 From this discussion, key lessons for Africa include:

- The ASEAN S&T Ministerial Meetings and associated regional Committee on Science and Technology and Plan of Action have been very effective in ***generating high-level political support and leadership*** for the application of S&T to support development.
- Individual ***countries need to invest their own resources to support S&T and higher education***.
- Donor support for S&T initiatives in the SE Asia region have lacked coherence and ***would have had greater impact and sustainability if donors had worked together and promoted local (regional) ownership of the development process.***
- ***Involvement of and investment by the private sector can be a significant driver for development***. This requires an appropriate policy and fiscal environment and a skilled work force. The development of human capital required investment in education and training by both the public and private sectors.
- ***Regional development agencies or banks should provide leadership as well as finance***. A S&T strategy can provide this. The Asian Development Bank lacks such a document and this impact of this is apparent when considering lending profiles and development incomes when compared with Latin America.

4 United Nations System

4.1 History and Structure

4.1.1 The United Nations came into existence in October 1945 after the United Nations Charter had been ratified by the majority of 50 states involved in its development. Since then the United Nations has grown into a complex system of organisations (Figure 1).

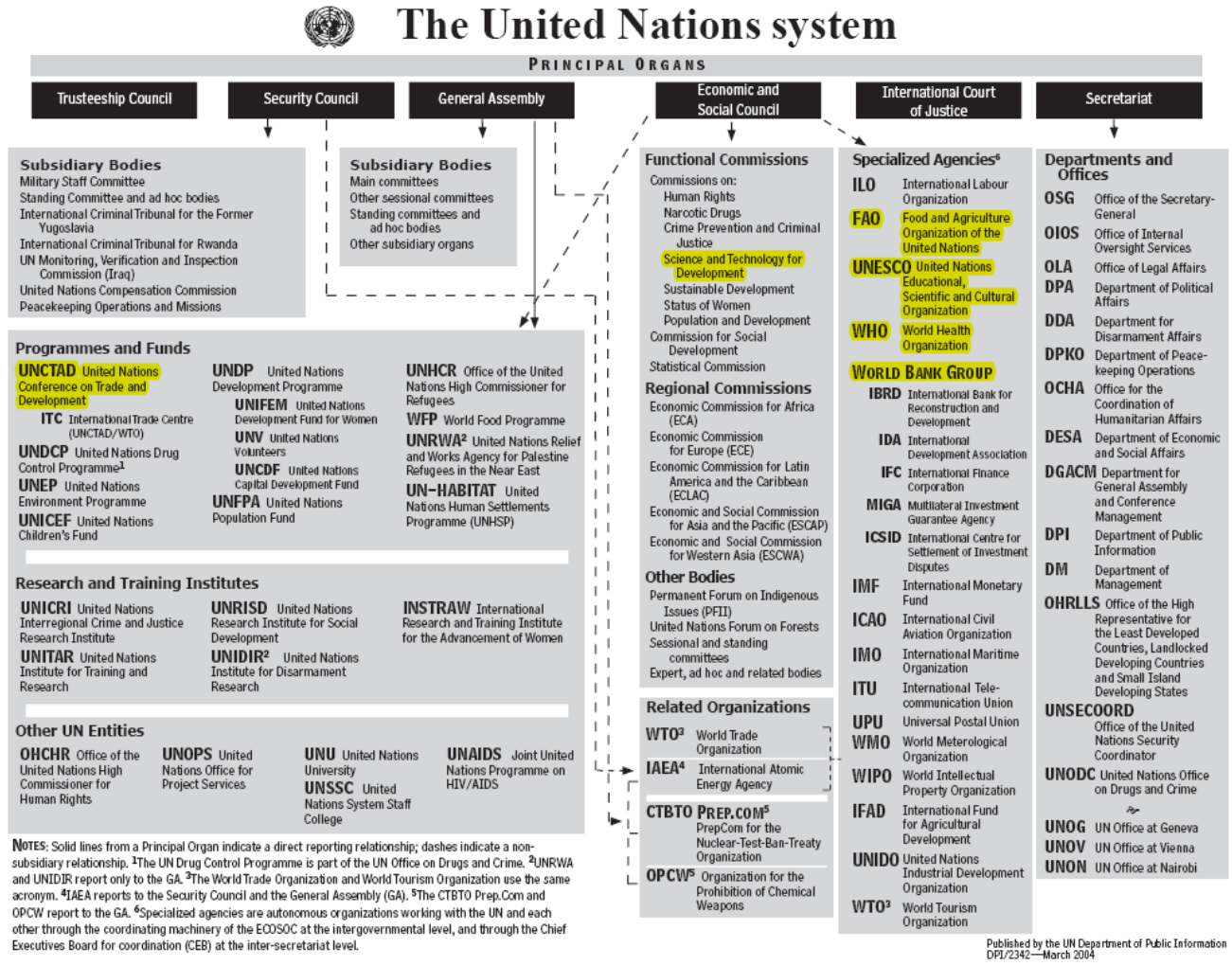

Figure 1 Organisation of the United Nations system. Highlighted organisations are discussed in more detail are being relevant to the implementation of a regional programme of Science and Technology in Africa.

4.1.2 The Millennium Declaration of the General Assembly of the United Nations, (United Nations, 2000) set a challenge for the international community to address global poverty. A road map for implementation of the Millennium Declaration (United Nations, 2001) was adopted by the General Assembly in 2001 and introduced the eight Millennium Development Goals (MDGs). In the following year (2002) the World Summit for Sustainable Development (WSSD) discussed strategies for development and the resulting plan of implementation (United Nations, 2002b) strongly highlights the need to invest in science to support Africa's development.

4.1.3 The Secretary General of the United Nations launched the Millennium Project in 2002 as an independent advisory body given the task to develop a concrete action plan to achieve the MDGs. The Millennium Project reported their findings to the Secretary General in January 2005 (UN Millennium

Project, 2005b). The role of Science, Technology and Innovation (STI) in achieving the MDGs is stressed repeatedly in the Millennium Project's main report, based on the recommendations of the STI Task Force (UN Millennium Project, 2005a).

4.2 S&T in the United Nations in 2005

4.2.1 The report of the Millennium Project identifies key policy issues and investment options for S&T that will be required to achieve the Millennium Development Goals. The main report proposes the adoption of MDG-based frameworks for development based on seven clusters of public investment and policies, of which one is "building national capacities in science technology and innovation". The report notes that scientific capacity in developing countries needs to be expanded through investment in major universities, national laboratories and through the establishment of national science advisory units[9]. They also state that national and local governments should take the lead on deciding priorities for investment working in partnership with civil society.

4.2.2 Most of the recommendations of the Millennium Project require action at national level, but the report recognizes that this alone will not be sufficient to meet the MDGs. In relation to science and technology it is stated that "*Meeting the Goals requires a special global effort to build scientific and technological capacities in the poorest countries—and to direct research and development toward specific challenges facing the poor*". It is also noted that it will be essential to mobilise global science and technology in areas such as health, agriculture and environment.

Four Challenges: Science and Technology for Development

- Expanding access to science and technology education and research
  Enhancing science and technology education is seen as a critical driver of economic transformation. It is suggested that developing countries need to expand access to higher education, but that universities need to do more than just offering more places, they need to develop better links with industry and be more development orientated. The extension and maintenance of centres of excellence for scientific research, including the financing of research at universities was seen as important.

- Promoting business opportunities in science and technology
  Developing countries need to use technology to help create new business opportunities. Adopting a "fast follower strategy" aimed at utilising existing technologies would help to develop business and build a foundation for future research.

- Promoting infrastructure development as a technology learning process
  Recognising that infrastructure projects can play an important role in a country's technological learning process, the report recommends that policymakers need to take the initiative to acquire available technical knowledge from the international and local construction and engineering firms they contract with for such projects.

- Improving science and technology advice
  There needs to be action to promote the use of science and technology by governments. It is suggested that an advisory structure should be established, usually with a science advisor reporting directly to the President orPrime Minister. It was also noted that countries need to strengthen the capacity of scientific and technical academies to contribute to the policy process.

  Source: Adapted from the final report of the Millennium Project, (UN Millennium Project, 2005b)

[9] The establishment of an office of science advisor to the president or prime minister to consolidate the role of science in national policy making is seen as a "quick win" solution to help achieve the MDGs. It is debatable if a single science advisor would work in all countries and an alternative interpretation would be the provision of advice, which may come from a unit in government.

Box 5 Challenges for science and technology identified by the STI Task Force of the Millennium Project (UN Millennium Project, 2005a)

4.2.3 The 60th General Assembly of the United Nations in September 2005, included a high-level plenary meeting, the World Summit, designed to act as a follow-up to the Millennium Summit and subsequent activities outlined above. The final outcome document of the High-level Plenary meeting (United Nations, 2005) includes statements on the role of science and technology for development (Box 6). The General Assembly of the United Nations has given a very clear lead on the important role of S&T in development and specifically in achieving the MDGs. The remainder of this section will consider how key UN agencies are likely to contribute to this process and lessons from their previous interventions

Science and technology for development

60. We recognize that science and technology, including information and communication technology, are vital for the achievement of the development goals and that international support can help developing countries to benefit from technological advancements and enhance their productive capacity. We therefore commit ourselves to:

(a) Strengthening and enhancing existing mechanisms and considering initiatives to support research and development, including through voluntary partnerships between the public and private sectors, to address the special needs of developing countries in the areas of health, agriculture, conservation, sustainable use of natural resources and environmental management, energy, forestry and the impact of climate change;

(b) Promoting and facilitating, as appropriate, access to and the development, transfer and diffusion of technologies, including environmentally sound technologies and corresponding know-how, to developing countries;

(c) Assisting developing countries in their efforts to promote and develop national strategies for human resources and science and technology, which are primary drivers of national capacity-building for development;

(d) Promoting and supporting greater efforts to develop renewable sources of energy, such as solar, wind and geothermal;

(e) Implementing policies at the national and international levels to attract both public and private investment, domestic and foreign, that enhances knowledge, transfers technology on mutually agreed terms and raises productivity;

(f) Supporting the efforts of developing countries, individually and collectively, to harness new agricultural technologies in order to increase agricultural productivity through environmentally sustainable means;

(g) Building a people-centred and inclusive information society so as to enhance digital opportunities for all people in order to help bridge the digital divide, putting the potential of information and communication technologies at the service of development and addressing new challenges of the information society by implementing the outcomes of the Geneva phase of the World Summit on the Information Society and ensuring the success of the second phase of the Summit, to be held in Tunis in November 2005; in this regard, we welcome the establishment of the Digital Solidarity Fund and encourage voluntary contribution to its financing.

Box 6 Statement on science and technology for development extracted from the final outcome document from the World Summit, High-level Plenary session of the General Assembly of the United Nations, September 2005 (United Nations, 2005).

4.3 Financing for Development. The Monterrey Consensus

4.3.1 The UN's International Conference on Financing for Development (Monterrey, 2002) brought together governments, civil society, private sector and development agencies to discuss a global approach to financing development. The resulting Monterrey Consensus (United Nations, 2002a) discussed building a global alliance for development. Key aspects discussed included mobilising domestic and international resources for development, international trade as a engine for development and increasing technical and financial co-operation for development. The Consensus challenged donors to adopt more effective practices through effective partnership with developing countries. The international follow-up to Monterrey included activities of the OECD-DAC leading to the 2005 Paris Declaration on Aid Effectiveness (Section 6.5)

4.4 United Nations, Educational, Scientific and Cultural Organization (UNESCO)

4.4.1 Established in 1945 as a specialised agency of the UN and acts to promote international co-operation in the fields of education, science culture and communication. UNESCO supports programmes on Education, Natural Sciences and Social and Human Sciences. For education, UNESCO assists countries to formulate educational policies that promote development. For science, UNESCO aims to reinforce the capacities of developing countries. There is again a strong emphasis on providing technical assistance so that governments can formulate effective policies and strategies.

4.4.2 UNESCO supports a number of international scientific programmes, including the International Hydrological Programme, Intergovernmental Oceanographic Commission, Man and the Biosphere, International Geological Correlation Programme and the Coast Regions and Small Islands Platform.

4.4.3 Throughout these activities, the role of UNESCO in science and technology is to provide a forum for communication and coordination at regional and international levels. It does not have the remit or financial resources to facilitate major initiatives.

4.5 United Nations, Commission on Science and Technology for Development (UNCSTD)

4.5.1 The United Nations Commission on Science and Technology for Development is a subsidiary body of the Economic and Social Council (ECOSOC), and administered as an initiative of UNCTAD that first met in 1993. It is now the UN's lead division on science and technology. It has a mandate to provide the General Assembly and ECOSOC with high-level advice to guide the development of common policies and actions.

4.5.2 From 2003 onwards, the questions discussed within the CSTD have focused on the application of science and technology for the achievement of the Millennium Development Goals (MDGs). This discussion has focused on creating enabling environments for Science, technology and innovation through capacity building, debating high level issues and facilitating networking. Current themes being discussed include:

- the examination of science and technology questions and their implications for development;
- the advancement of understanding on science and technology policies, particularly in respect of developing countries and;
- the formulation of recommendations and guidelines on science and technology matters within the United Nations system.

4.5.3 UNCTAD and CSTD together promote the Science and Technology for Development Network (StDev, http://stdev.unctad.org/) as a portal to information on science and technology within the UN system.

4.5.4 The 8th session of the Commission addressed the theme "*Science and technology promotion, advice and application for the achievement of the Millennium Development Goals*". The report of the UNCTAD secretariat (United Nations: Economic and Social Council, 2005) makes a series of recommendations (Box 7) most of which are addressed to national governments.

Recommendations of the 8th session of CSTD

CTSD should:

- In collaboration with international scientific organizations, facilitate the establishment of a network of centers of excellence in developing countries to allow scientists and engineers to interact with each other and make use of state-of-the-art research facilities offered by these centers;
- Collect and compile "best practices" case studies, especially of newly industrializing countries that showcase the link between S&T and socio-economic development.

National Governments should consider the following:

- Ensure that science, technology and innovation strategies are incorporated in national poverty reduction strategies;
- Encourage the establishment of incubators and science and technology parks;
- Create innovative compensation and reward structures to promote research directed to solving developmental problems aligned to national objectives such as agriculture, health, or mitigation of natural disasters;
- Strengthen S&T educational systems, including the introduction of entrepreneurial skills, relevant IPR issues, and the protection of tradition knowledge;
- Incorporate social science courses in the education of scientists, technologists and engineers and encourage them to focus their attention and effort to address indigenous issues of importance to their country or region;
- Improve national mechanisms for the promotion of knowledge-based and innovative enterprises through various interventions and incentives, as well as for the transfer of knowledge and technology;
- Support venture capital and ensure that adequate funding is allocated for infrastructure projects for S&T development, taking into account their own needs for technological upgrading and development;
- Ensure that FDI projects in infrastructure have a maximum local component and participation in order to facilitate technology transfer to developing countries and the future sustainability of the project;
- Adopt and implement competition policies, sectoral regulations and/or contractual requirements in order to enhance the quality and operational efficiency of infrastructure at reasonable cost.
- Involve representatives from industry, academia and public sectors in carrying out a comprehensive technology foresight exercise with the purpose of identifying technologies that are likely to help address pressing socio-economic issues and establish accordingly priorities in S&T policy and governmental programmes on research and education;
- Provide S&T graduates with incentives and resources to start innovative enterprises, with a view to improving gainful employment;
- Provide opportunities for continuing education to personnel employed in traditional enterprises, with a view to strengthening the innovative capabilities of these enterprises.
- Strengthen linkages between public research and private industry, and tap into regional and international R&D networks.

Box 7 Recommendations of the 8th session of CSTD (2005)

4.6 Food and Agricultural Organisation, FAO

4.6.1 FAO is a specialised agency of the UN working with a mandate to raise levels of nutrition, improve agricultural productivity, better the lives of rural populations and contribute to the growth of the world economy. It achieves this through activities in four main areas:

- **Putting information within reach**. Acting as a knowledge network
- **Sharing policy expertise**. Sharing experience for policy and national strategies for rural development
- **Providing a meeting place for nations**. Providing a neutral forum for nations to build a common understanding.
- **Bringing knowledge to the field**. Working to support field projects around the world. FAO provides technical expertise and mobilises and manages funds made available from bilateral and multilateral agencies and other sources.

4.6.2 FAO has limited resources to fund projects in its own right.

4.6.3 FAO's Research, Extension and Training Division forms part of the Sustainable Development Division. It's main approach is to generate, adapt and transfer appropriate technologies for improved and sustainable production of agricultural, forestry and fisheries systems for use by developing countries. The Research Division comprises of four units and provides a good example of regional (global) co-operation in research. The units comprise of:

- **Extension, Education and Communication Service.** Helping to upgrade national agricultural education, extension and training programmes and institutions.
- **Research and Technology Development Service.** Assisting developing countries in building and strengthening *their* capacity for research and technological development[10].
- **Environment and Natural Resources Service.** Assists developing countries develop a cross sectoral approach to the policy, planning and management of activities related to sustainable development, environment and energy.
- **CGIAR Science Council Secretariat** provides technical and administrative support to the advisory committees of the Consultative Group on International Agricultural Research (CGIAR, Section 5).

4.6.4 The approach adopted by the FAO's Sustainable Development Research Division mirrors significant themes coming out of the UN's Millennium Project. Support is mainly provided to help individual countries through, upgrading education, strengthening local institutions, transfer of appropriate technology and support of international (regional) networks of excellence through the CGIAR. It is however, important to note that FAO does not fund science in developing countries. The study of the CGIAR presented below demonstrates how it works with other agencies, notably the World Bank, bilateral donors and Foundations to implement this work.

[10] This group also has responsibility for co-ordinating research and technology development activities within FAO.

4.7 World Health Organisation (WHO)

4.7.1 The World Health Organisation is the UN's specialised agency for health[11]. The WHO is organised into six regional offices, with two representing countries in Africa, (Regional Office for Africa and the Regional Office for the Eastern Mediterranean[12]). Much of the research used by WHO is provided by a network of collaborating centres. These are national centres designated by WHO to form part of an international network carrying out activities supporting WHO's mandate. The functions for centres include:

- Development, application and evaluation of appropriate technology
- Participation in collaborative research developed under WHO's leadership, including monitoring and evaluation and dissemination of results.
- Education and training, including research training.
- Provision of information and advice on scientific, technical and policy issues.

4.7.2 Whilst much of the work of WHO is devolved to the regions, the headquarters has a unit supporting evidence and information for policy which includes knowledge management, research policy and co-operation.

4.8 World Bank

4.8.1 The World Bank is an agency of the United Nations, formed as a Bretton Woods organisation to assist funding reconstruction and developing following the World War II. Today, the World Bank Group consists of five organisations, with the International Development Association (IDA) and the International Bank for Reconstruction and Development (IBRD) together being considered the "World Bank".

4.8.2 The World Bank is the most significant actor ***funding investment*** in science and technology within the UN system. This is done through three main support mechanisms, the most significant being grants and loans in response to requests from individual countries. A second mechanism is the direct funding of international scientific programmes, the best example being the CGIAR. Finally, the WB directly commissions a limited amount of scientific work, mainly to inform its own work and policies. In addition to direct funding of science and technology, the World Bank Institute provides training resources that are available to Bank staff and partners in developing countries.

4.8.3 Direct investments in country are agreed by the Bank's Country Office and will respond to the WB's Country Assistance Strategy for that country. Since the introduction of the Comprehensive Development Framework (CDF) and subsequent requirement for Poverty Reductions Strategy Papers (PRSP) for HIPC eligible countries (Highly Indebted Poor Country Scheme) these country-owned documents have determined funding by the Bank. In the absence of a PRSP[13] the Bank's lending may be guided by any other nationally-owned (participatory) development strategy. The process of development harmonisation being promoted by OECD-DAC has meant that many bilateral donors are now aligning their investments with this approach. The World Bank and other donors are increasingly adopting Direct Budgetary Support (DBS) as their aid modality where donor-funds are allocated through the normal budgetary process of recipient governments in response to priorities set in PRSPs.

[11] As such, WHO has the same status as FAO

[12] Covering Djibouti, Egypt, Libya, Morocco, Somalia, Sudan and Tunisia.

[13] For example PRSPs are not required for middle income countries.

The World Bank is probably the most important single potential source of funds for investment in science and technology for Africa. The importance of PRSPs in influencing spending decisions by the World Bank and major bilateral donors cannot be underemphasised. For this reason, this report re-emphasises the conclusion of the 8th session of the UN's Commission of Science and Technology for Development that countries should "ensure that science, technology and innovation strategies are incorporated in national poverty reduction strategies" (see Box 7 above). This point is reiterated by the Millennium Project's Task Force on STI who state that "Poverty Reduction Strategy Papers should be used as vehicle for advancing the role of technological innovation in development[14]".

Chief Scientist, S&T Strategy

4.8.4 The World Bank's Chief Scientist's office is located within the Environmentally and Socially Sustainable Development Network (ESSD). The current Chief Scientist, Robert Watson, published a report in 2003 addressing the strategic role of science and technology in development (Watson *et al.*, 2003). This report suggests that the lack of a specific unit having responsibility for promoting S&T capacity has led to an *ad hoc* approach within the Bank. The Bank is currently developing a new strategy which is likely to adopt some of the recommendations from the 2003 working paper. These included four goals:

- Human capital development
- Stimulation of demand for technology from the private sector
- Strengthening the public role in S&T
- Increasing access to ICTs.

Box 8 Suggested goals for S&T in future World Bank strategies (Watson *et al.*, 2003).

4.8.5 The process proposed to deliver against these goals is informative. The report identifies the need to increase the emphasis on S&T in basic and secondary education and to expand tertiary education. It suggests that demand for technology will be enhanced through promoting linkages between industry and knowledge institutions. The need to create an enabling environment will require action on IPR, taxation and the investment climate. It suggests that strengthening the public role in S&T will require enhanced participation in priority setting and increased transparency in S&T funding. Two further actions are suggested, promoting the government as a consumer of knowledge[15] and extending the Millennium Science Initiative beyond Latin America (see Section 2.5). In relation to ICT, the report recommends that the Bank's focus should shift away from R&D on new aspects of ICT and emphasise widening distribution and usage with a priority to build human capacity for ICT.

[14] (UN Millennium Project, 2005a)

[15] This is equivalent to the CSTD and Millennium Project recommendations on creating a scientific advisor for developing country governments.

Knowledge Economy, Knowledge for Development

4.8.6 The World Bank Group, through its international activities has generated a vast quantity of knowledge supporting development. The concept of the knowledge economy is supported through the Knowledge for Development programme of the World Bank Institute. This brings together what are considered to be the four essential pillars of the Knowledge Economy

Four Pillars of the Knowledge Economy

- Education and training
- Information infrastructure
- Economic incentive and institutional regime
- Innovation systems

Source: World Bank Institute.

Box 9 Four Pillars of the Knowledge Economy.

International Finance Corporation (World Bank Group)

4.8.7 The International Finance Corporation (IFC) is the part of the World Bank Group with the remit to promote sustainable private sector investment in developing countries as a way to reduce poverty and improve people's lives. The IFC has the most experience of working with the private sector to promote development and it may be relevant to seek their input to the Consolidated Plan of Action.

World Bank Summary

4.8.8 The World Bank is important in relation to future S&T investment in Africa. It has the potential to be a major source of funding and knowledge to support this process and the Bank's activities will influence other donors[16]. There is obviously a need to enhance the representation of S&T in country-owned PRSPs (or equivalent). The four goals suggested by the Watson review of S&T in the WB (Box 8) give a strong indication of where future investment is likely.

4.8.9 The case for enhanced investment in S&T would best be supported by the development of innovation strategies for individual countries, a concept supported by many OECD countries (section 4). This could be supported by the establishment of a national advisory office for S&T reporting directly to the President or Prime Minister. It should be recognised that many countries may be reluctant to request support for S&T from the World Bank if this is likely to be provided as a loan before they can be convinced on the likely return on investment.

4.8.10 In addition to support for S&T provided directly to individual countries, the World Bank has provided support for a number of regional initiatives. The two most relevant, the CGIAR and Millennium Science Initiative (MSI) are discussed in detail below. There are others, including the Global Environment Fund (GEF), and the Global Fund for AIDS, TB and Malaria, but these are not discussed in detail in the current report.

[16] Donors may conversely try to influence WB policy in this area.

4.9 Lessons for Africa

4.9.1 The UN system is complex and there are a number of organisations with responsibility for, or interest in science and technology. CSTD (UNCTAD) and UNESCO share a responsibility for overall policy and promotion of S&T, whilst operational issues are split between specialise agencies including FAO and WHO or programmes including UNDP and UNEP.

4.9.2 The World Bank is the most significant source of funding for S&T within the UN system, at national, regional and global levels. For individual countries, support for S&T is provided through normal lending or grant making mechanisms. For most countries in Africa, this will now be linked to country-owned PRSPs or equivalent poverty-focused development framework. There are a wider range of mechanisms used by the World Bank to support regional or global activities, including the CGIAR and GEF.

4.9.3 In spite of this diversity, there is an increasingly consistent message provided from the UN system and this was reinforced by world leaders at the 2005 World Summit. It was recognised at this meeting that S&T is crucial to achieving development goals. A number of common themes have also emerged which are relevant to Africa.

- ***AU-NEPAD's proposed activities on S&T indicators provides an opportunity to link S&T investment with MDG targets and indicators*** and promote investment by UN agencies. The Millennium Development Goals provide a unifying theme for development activities of the UN system.
- ***It is important that S&T are incorporated into PRSPs and if possible supported by national innovation strategies.*** The main source of UN funds for investment to support S&T in Africa will be the World Bank. The majority of investment is likely to be allocated via standard budgetary processes against priorities set in PRSPs.
- ***Development activities of the UN system should respond to priorities set by national governments and regional groups.*** It is important to stress the desire and need to have African ownership of the priorities contained within the Consolidated Plan of Action and its implementation.
- The UN system generally does not work well with the private sector, but ***recognises the need to engage with industry to promote development***. The International Finance Corporation[17] may have relevant experience that could be used to promote private sector investment in S&T in the region.

[17] Part of the World Bank Group

5 Consultative Group on International Agricultural Research (CGIAR)

5.1 History

5.1.1 The Consultative Group on International Agricultural Research (CGIAR) evolved from international concern for the need for agricultural research to address concerns of the risk of widespread international famine. The CGIAR grew out of earlier initiatives from the Rockefeller and Ford Foundations that had established four international research institutes, CIAT (Tropical agriculture, Columbia), CIMMYT (Maize and wheat, Mexico), IITA (Tropical agriculture, Nigeria) and IRRI (Rice, Philippines). During the 1960's it had become apparent that the Foundations could not provide the long-term sustainable funding required for these centres. The Foundations entered into negotiations with the World Bank, FAO and the UN Development Programme (UNDP). This group then worked to convince influential donors that a new approach was required to generate international public good research on agriculture. This process led to the creation of the CGIAR, with the World Bank leading and FAO and UNDP acting as co-sponsors. Since then the World Bank has provided the Chairman and FAO has housed and funded the secretariat for the Technical Advisory Committee (now Science Council).

5.1.2 The governance of the CGIAR has emphasised the independence of individual centres. Each centre has its own management structure and Board of Trustees and the CGIAR Secretariat provides a degree of co-ordination. The main sources of funding for the CGIAR is provided by a group of donors, led by the World Bank. Funding is provided as unrestricted (core) funds, restricted (programmatic) funds and in addition CGIAR centres compete for research funding from sources such as the European Commission and Foundations. The proportion of unrestricted funding has decreased in recent years as donors have sought to have more influence in the CGIAR's research programmes.

5.1.3 The way that CGIAR centres work has changed significantly over the thirty years of their existence. From an initial four centres the total grew to 18 and after recent mergers is now 15. There is now a much stronger emphasis on poverty reduction in line with the MDGs and an attempt to promote much greater participation of scientists in organisations in partner countries and to strengthen the capacity of National Agricultural Research (NAR) agencies. In spite of these acknowledged positive trends, at the end of the 20th century, the system was in crisis with declining funding and lack of consensus on future direction. The CGIAR and donors reviewed the structure and governance of the system and have put in place a series of reforms and new initiatives across the whole CGIAR. The CGIAR internal reviews and the World Bank's review by their Operations Evaluation Department (OED) were influential in this process

5.2 A new direction in the 21st Century

5.2.1 The OED evaluation concluded that the CGIAR is a unique example of international co-operation that has had significant impact on reducing poverty (OED, 2003), but is now facing huge challenges. These include a reduction in the focus on enhancing agricultural productivity, declining funding in real terms and an increasing proportion of restricted funding. The review concludes that donor preferences are now currently determining resource allocation rather than the assessments led by the Technical Advisory Committee or other stakeholders *including* developing country partners.

5.2.2 There was broad agreement that the CGIAR needed to change and a series of system-wide reforms have been instigated since 2000. The new structure (Figure 2) includes the establishment of an Executive Council and the transformation of the Technical Advisory Committee into a Science Council. Whilst not adopting the full set of reforms suggested by the OED review, the changes have been significant. The adoption of the CGIAR charter in 2004 has helped to address roles and responsibilities of components of the system. The issue of better co-ordination and perceived need for a legal entity[18] for

[18] The Global Environment Fund, (GEF) in contrast has a defined legal status.

the CGIAR remain. The need for a legal entity is related to the need to address IPR issues, seen as an increasing impediment to building partnership with industry and their adoption of resulting new technologies.

5.2.3 The CGIAR response to increase co-ordination between centres has been to launch the Challenge Programme, an initiative promoting cross-centre collaboration on thematic programmes. In 2003, the first three programmes were launched, ***Water and Food*** (growing food with less water), ***Generation*** (applied molecular biology) and ***Harvestplus*** (breeding nutrient dense staple foods). In 2004, the CGIAR AGM approved in principle the ***Sub Saharan Africa Challenge Programme*** (Improving livelihoods through integrated agricultural research for development) for a five year period subject to an 18 month inception phase.

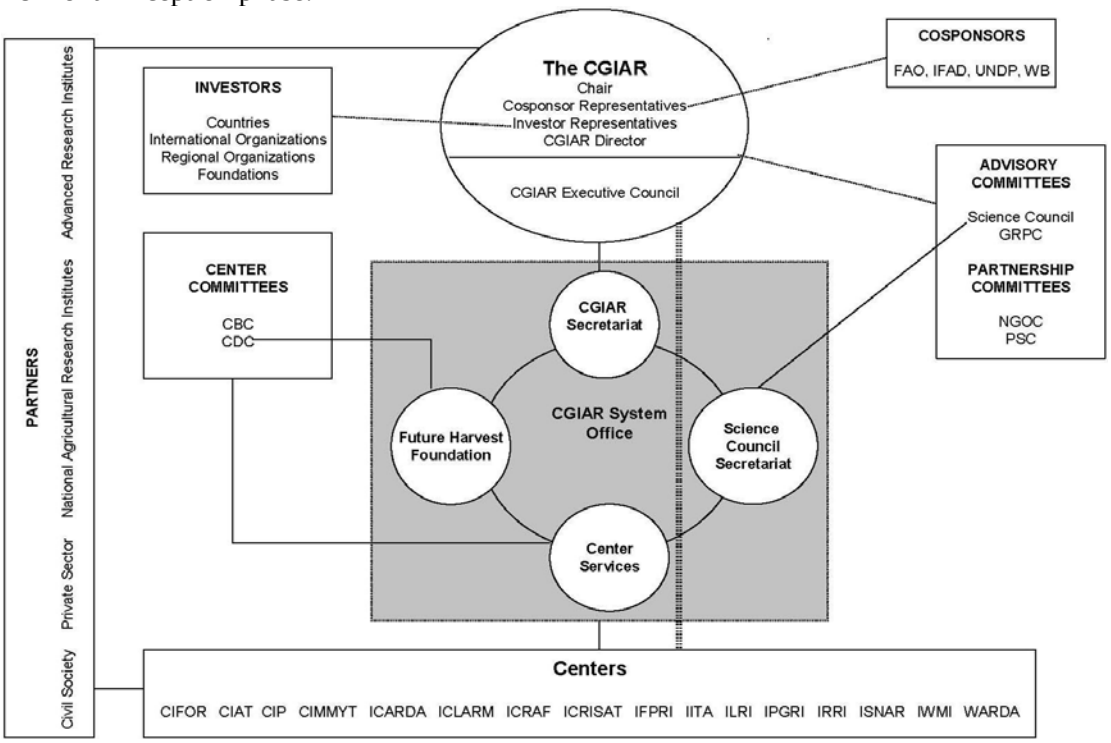

Figure 2 New structure of the CGIAR

5.2.4 The CGIAR provides one of the most extensive examples of an international (or regional) S&T programme that addresses important development issues. The CG system already has a high profile in Africa and it is a system that the donor community is reasonably comfortable in supporting. Analysis of recent changes and reviews, however, suggest that this model should not be directly transferred to the AU-NEPAD S&T strategy. Three of the main issues are the lack of African ownership, low-levels of engagement with the private sector and the relatively poor track record in local capacity building.

5.2.5 This review identifies the following as being key remaining challenges:

- Getting governance right. A defined legal status and agreement of responsibilities (MOU) is required to address issues including IPR and building partnerships with industry. There is a strong and ongoing regional role for AU-NEPAD in this action.
- Shifting power so that decisions on priorities for research moves from the international donor community to African stakeholders. (Reducing the proportion of restricted funding being determined by the donor community).
- Promoting enhanced ownership by African nations, if possible through linkage with their own Science and Innovation strategies and PRSPs.

- Enhancing the participation of civil society and industry in setting priorities for research and in its implementation and extension activities. This could be done effectively through the PRSP process and a participatory "foresight" exercise to develop national science and innovation strategies.
- Enhancing the opportunities for participation of scientists from countries in the region and enhancing their skills and career options.
- Enhanced participation of national research and extension agencies (e.g. NARs for Agriculture), including building human capacity, supporting institutional change and building infrastructure.

5.3 The CGIAR's relevance to regional S&T in Africa

5.3.1 There is no doubt that the CGIAR has been and will continue to be an important actor implementing S&T in Africa. As noted above, it is a system that the donor community is willing to support. The ongoing discussion on the challenges facing the system and the simple fact that the CGIAR only addresses agriculture means that extension of the system will not address all the needs identified in Africa's Consolidated Science and Technology Plan of Action.

5.3.2 Discussions of the role of the CGIAR in Latin America and SE Asia (Sections 2.4 and 3.4) led to the question of ownership of their research programmes. Funding to the CGIAR comes from multilateral and bilateral development agencies, foundations and host countries[19]. This leads to the risk that CGIAR centres are not accountable to the countries where the research centres are physically established, let alone other countries in the same region. The CGIAR Executive Council reports to investors and co-sponsors, to which Centres are ultimately responsible to, as opposed to the national governments of potential beneficiaries. Individual CGIAR Centres may develop links with national research institutes for certain aspects of research such as rural level field work, but the CGIAR remit remains international. System-wide initiatives such as the challenge programmes are partially designed to address this, but it could be argued that this is a mechanism to get centres to work together rather than to get the CGIAR to respond to regional need.

5.3.3 The CGIAR has a poor track record on engagement with the private sector. This can be attributed to a number of factors, but the most significant is probably that of IPR. The CGIAR concentrates on generating and disseminating global public goods. This approach does not create a favourable environment for investment by the private sector who will need to link their R&D effort with potential future opportunities to generate revenue. The lack of a clear legal status for the CGIAR system (as opposed to individual centres) adds to this difficulty. It is currently far easier for the private sector to wait for the CGIAR to place knowledge into the public domain as a global public good, before considering ways to exploit new technology.

5.4 CGIAR compared to the MSI

5.4.1 The much newer Millennium Science Initiative promoted initially by the World Bank in Latin America (Section 2.5) is designed to promote local ownership of S&T initiatives. MSIs are co-financed and led by national governments. Frequently, they are physically established as a unit within existing research institutes or universities and its mission would fall under national policy for S&T (i.e. it may not add value at the regional level). Funding for MSI programmes has to undergo standard budgetary processes to receive approval by congress or parliament; its effectiveness can be evaluated by both, the World Bank and the borrowing country.

5.4.2 The MSI process is designed to promote local ownership and investment by countries in their own process to promote the application of S&T to support development. This seems to have worked well in the Latin American context, where there was pre-existing national capacity. Plans exist to expand the MSI into Africa, both at country and regional levels. It remains to be seen how effective this process will be, especially in promoting effective African ownership of this process (see Footnote 8, Section 2.5), which would set it aside from existing CGIAR centres . Institutions supported through the MSI

[19] Host country contributions to the CGIAR are often contributions in kind of staff or facilities.

are required to address legal issues, including IPR, and for this reason there are more incentives for industrial participation in MSI activities. Finally, as MSI initiatives normally involve a loan from the World Bank, host countries will expect to see a return on investment and hence take much stronger interest in ensuring delivery of impact.

5.5 Lessons for Africa

5.5.1 The CGIAR provides a good example of a range of donors co-ordinating their activities to fund long-term research initiatives with a global or regional focus. The CGIAR originally came into existence to meet the need for more predictable funding through pooling the resources of a number of donors. The OED review (OED, 2003) clearly demonstrated the benefits of developing predictable long-term funding for research. The same review also highlighted a number of issues that are currently limiting the impact of the CGIAR, which could be summarised as three additional themes, ownership, legal status and governance.

5.5.2 One of the criticisms of the CGIAR from scientists from developing countries is that the system inherently contributes more to the career development of scientists from developed countries, than it does for those of developing countries.

5.5.3 The model provided by the CGIAR is one of success, but one that should not be directly transferred into the African context. Important lessons can be learnt and these are summarised[20] here:

- ***A flexible funding mechanism will help to promote engagement by a wide range of donors*** (i.e. development banks, bilateral development agencies, foundations, NGOs). Care is needed to ensure that the funding mechanism does not impinge on ownership and governance of research.
- ***Regional research programmes ideally should be owned by countries in that region***. A fundamental aspect of ownership is to determine research priorities and investment in infrastructure and human resource development.
- ***Research initiatives should have clear legal status to be able to deal with topics such as IPR and to promote participation of the private sector.***
- ***Getting governance right is a prerequisite to successful research and development***[21]. It will ensure local ownership and promote uptake through partnership with potential beneficiaries.
- ***Regional research programmes should be developed in such a way that promotes the professional or career development of scientists in that region***[22]***.***

[20] Of these only the funding mechanism of the CGIAR is essentially transferable, and only then if there is limitation to the proportion of restricted funds. Most of the other points are drawn out of the OED meta evaluation as ways of increasing impact and effectiveness.

[21] The important of good governance of major initiatives is reinforced by the problems with one of the Chilean MSI. (Para. 2.5.4).

[22] It must be recognised that many previous international science initiatives have been more effective in enhancing the careers of international staff than those of the national scientists participating in the programme.

6 OECD, Organisation for Economic Co-operation and Development

6.1 Background

6.1.1 The OECD (http://www.oecd.org) is a forum for its 30 Member countries to work together to address economic, social and environmental issues. Currently its main role is that of a provider of comparative data, analysis and forecasts to underpin multilateral co-operation of Members.

6.1.2 The mission of the OECD is defined through the OECD Convention, signed in 1960. The OECD aims to promote policies designed:

- to achieve the highest sustainable economic growth and employment and a rising standard of living in Member countries, while maintaining financial stability, and thus to contribute to the development of the world economy;
- to contribute to sound economic expansion in Member as well as non-member countries in the process of economic development; and
- to contribute to the expansion of world trade on a multilateral, non-discriminatory basis in accordance with international obligations.

6.1.3 The OECD grew out of the earlier Organisation for European Economic Co-operation (OEEC) which was set up in 1947 to co-ordinate the Marshall Plan for the reconstruction of Europe after World War II. In recent years the OECD has expanded its focus to work in partnership with a range of developing and emerging market economies.

6.2 Structure and Governance

6.2.1 Decision-making powers lies with the OECD Council, made up on one representative of each country, plus the European Commission. Decisions are taken by consensus. Representatives of the Member countries meet in specialised committees, working groups and expert groups. The work of the OECD is supported by its Secretariat in based in Paris, France and its staff carry out research and analysis at the request of OECD member countries.

6.2.2 The structure of the Secretariat reflects that of the specialised committees, with 13 directorates, the Economics Department and Centre for Co-operation with Non-Members. It is the work of the Directorate for Science, Technology and Industry and the Development Co-operation Directorate that are most relevant to this report.

6.2.3 The OECD provides a setting and opportunities for reflection and discussion based on policy research and analysis. This may help to shape policies of individual Member governments or lead to formal agreements in appropriate international fora.

6.2.4 The OECD is funded through contributions from Member countries using a formulae based on the size of each Member country's economy. Unlike the Bretton Woods institutions of the World Bank (WB) and International Monetary Fund (IMF), ***the OECD does not dispense money***.

6.3 Science Technology and Industry

6.3.1 The Directorate for Science, Technology and Industry (DSTI) aims to provide governments with analytical information for policy formulation. The development of the Main Science and Technology Indicators (MSTI) has helped to OECD to produce annual data on scientific and technological performance of the OECD and seven non-OECD countries. This is analysed and collated with additional information to produce the biannual Science, Technology and Industry Scorecard, the most recent edition being 2003, (OECD, 2003). The analytical work conducted by the DSTI assists the work of the committees and expert working groups.

Committee for Scientific and Technological Policy

6.3.2 The Committee for Scientific and Technological Policy (CSTP) works to inform policy debate on the contribution of science and technology to development. At its most recent Ministerial Level meeting in 2004, the CSTP highlighted the benefits that society can derive from advances in Science and Technology. Three themes were addressed for the OCED, but they can be considered to be equally important to the discussion of the development of S&T in the African Continent.

These were:

- Promoting stronger relationships between science and innovation systems, including the changing roles of intellectual property rights (IPR) in stimulating knowledge creation and diffusion.
- Ensuring sustained development of human resources in science and technology
- Global-scale issues that call for enhanced international co-operation in science and technology

6.3.3 The final communiqué (OECD, 2004) concluded that greater international co-operation in science and technology is required to meet global challenges including economic growth, better health and sustainable development.

6.3.4 Ministerial meetings within the OECD are opportunities for high-level political debate of topics including science and technology. They can help to promote harmonization of policy and international cooperation in S&T. The African Ministerial Conference on Science and Technology plays a similar role.

International Scientific Co-operation

6.3.5 International co-operation for science and technology is supported by a number of OECD initiatives. The Global Science Forum (GSF) provides opportunities for officials from OECD countries to facilitate international co-operation in scientific research. Recent work has included the provision of a template document (Memorandum of Understanding) for the establishment, funding and management of international science projects (OECD, 2005a). Earlier work included a workshop on identifying the principles of best practice in creating and sustaining research co-operation. The report from this workshop includes a set of generalised recommendations and a checklist both of which could contribute to the design of an international S&T programme to support implementation of the AU-NEPAD strategy.

6.3.6 In addition to those mentioned above, a number of OECD publications are highly relevant to the implementation of plans for regional S&T initiatives in Africa. The theme of innovation systems in a series of publications that address governance (OECD, 2005b), management (OECD, 2005a) and the role of innovation clusters as drivers of national systems for innovation (OECD, 2001a).

6.3.7 Much of OECD's policy work for S&T is derived from analysis of extensive survey data obtained from member countries. The Frascati Manual published by OECD provides standard methodologies for the measurement of S&T activities. The current edition (OECD, 2002) is supplemented with information provided electronically from the OECD website.

6.3.8 The OECD considered the need for international co-operation in S&T to achieve sustainable development through a conference held in 2000. The conclusions of this meeting (OECD, 2001b), reinforced the need to strengthen co-operation through effective partnership. They also highlighted the need for capacity building noting that "*successful technology transfer involves much more than the transfer of physical hardware… Technology transfer and capacity building to adapt, absorb and diffuse technologies and, finally, reach a higher level of capability for technological innovation, are two sides of the same process*".

6.3.9 The policy recommendations resulting from the workshop highlighted the following issues:

- International co-operation to develop appropriate technologies for sustainable development *should start with the identification of local needs.*
- Responding to local needs requires human and institutional capacities for assessing, adapting, developing and diffusing technology. These underpin the absorptive[23] and adaptive abilities in the developing countries.
- Responding to local needs through suitable capacity building requires access to and diffusion of information[24].
- S&T partnerships stimulate the participation and commitment of the stakeholders involved. The recommendations suggest a wide range of stakeholders should be directly involved in research, including governments, the private sector and civil society. Public/private partnerships (PPP) were held up as a good mechanism to address the needs of S&T to support development.
- Resolving intellectual property issues is crucial to promote technological development and diffusion. It was concluded that there should be easier access to the results of public R&D, especially for firms in developing countries. Countering this, there is a need to protect IPR to promote adoption, especially when private sector partners are involved in R&D.
- Innovative financing mechanisms are required to support international collaboration for S&T to support sustainable development.
- Governments in developing countries should strengthen regulatory and other framework conditions so that any international (or regional) initiatives can function under predictable and transparent conditions. Key areas include IPR and policies to enhance public-private partnerships.

[23] Absorptive capacity is a theme often ignored when designing international collaborative S&T programmes. Within the development domain it is now considered being a key factor limiting development impact and effectiveness when scaling-up interventions (e.g. de Renzio and P, 2005).

[24] This theme is often linked to the need to enhance infrastructure for ICTs. Whilst this an important component of any S&T strategy, it is recognised that many stakeholders, particularly those in developing countries will continue to require other methods for the foreseeable future.

6.4 Development Assistance Committee

6.4.1 The Development Assistance Committee (DAC) and Development Co-operation Directorate are the main bodies through which the OECD deals with issues relating to co-operation with developing countries. The statistics provided to the DAC play a very significant role to inform development policy and action of OECD member governments and multilateral agencies. DAC guidelines will be highly influential in relation to external support when designing systems of governance and financial systems for regional S&T initiatives in Africa because the largest majority of international development assistance and funding is provided by OECD members,.

6.5 Aid Effectiveness and Donor Practices

6.5.1 OECD-DAC set up a Working Party on Aid Effectiveness and Donor Practices in the context of the follow-up to the Monterrey Consensus on Financing for Development (Section 4.3). This process led up to a high level conference in Paris during 2005 which produced the Paris Declaration on Aid Effectiveness (OECD, 2005c). This declaration is considered to document best practice for building partnerships for development between developing countries and development actors. It highlights 5 themes:

- Ownership;
- Harmonisation;
- Alignment;
- Results;
- Mutual Accountability.

6.6 Lessons for Africa

6.6.1 The OECD provides a number of relevant lessons for the African Union and NEPAD. OECD's origin from supporting the economic and social reconstruction of European nations after the 2nd World War is in many ways similar to NEPAD's role supporting the development of African nations.

6.6.2 OECD's benchmarking studies provide quantitative data on S&T investment in OECD countries. The linkage between investment in S&T and overall economic growth is complex, but three essential points emerge. These are:

- Investment in S&T (or R&D) is ***positively correlated with economic growth***.
- Economic growth is stimulated when there is ***significant private sector investment*** and involvement in R&D activities.
- The benefits of investment in S&T (R&D) are higher when there is ***complementary investment in higher education***[25] or broader capacity building

6.6.3 The OECD's Directorate for Science, Technology and Industry plays a very important policy role that has some similarities to NEPAD's African Forum on Science and Technology for Development (AFTSD). OECD's Committee for Scientific and Technological Policy provides a forum for national policy makers in OECD countries to discuss cross-cutting S&T issues linked to regular high-level ministerial meetings. NEPAD's AFSTD has adopted the same effective approach.

6.6.4 The ministerial level meetings of the Committee for Scientific and Technological Policy plan an important role in promoting harmonization of policy and international co-operation in science and technology. The African Ministerial Conference on Science and Technology plays a similar role in Africa. There may be benefits in creating dialogue between these groups.

[25] In practice this conclusion would apply to other forms of post-secondary education and training.

6.6.5 The OECD as an organisation, does not allocate financial resources for S&T activities, but instead seeks to influence the spending by OECD nations and relevant multilateral organisations. This separation of policy from funding may also be relevant for consideration in the African context and the roles of key African stakeholders, specifically, national governments, the African Union, NEPAD and the African Development Bank.

> ***Separation of responsibility for OECD policy on S&T and funding of "regional" activities has generally worked well and provides a good model suitable for consideration by the AU and NEPAD.***

6.6.6 OECD as an organisation, and also specific OECD countries have a wealth of experience in establishing regional or international programmes for S&T collaboration. This has been collated into a number of recent publications and guidelines. Some of these have been listed above (Section 0), and three key points are reiterated here:

- ***Regional programmes should have very clearly documented linkages to local needs*** in participating or member countries.
- ***Intellectual property issues need to be addressed early*** in the process of building initiatives.
- ***Innovative funding mechanisms are required***. "Loans don't work".

6.6.7 ***The Paris Declaration on Aid Effectiveness provides a challenge to the donor community.*** Africa's Consolidated Science and Technology Plan of Action is an initiative very likely to benefit from donors adopting their own agreed best practice. The establishment of a Donor Forum linked to the proposed African Science and Innovation Facility should consider issues of effectiveness contained in the declaration.

7 European Union

7.1 History and Structure of the European Union

7.1.1 The Treaty of Rome in 1957 created the European Economic Community (EEC) to complement the European Coal and Steel Community and the European Atomic Energy Community. Ten years later, in 1967, these were merged to form the European Commission, Council of Ministers and European Parliament. Originally members of the Parliament were appointed by national parliaments but from 1979, there have been direct elections for Members of the European Parliament (MEPs) every five years. In 1992 the Treaty of Maastricht provided for enhanced co-operation between Member States and created the European Union (EU) and in the following year the single market took effect. The Lisbon European Council in 2000 produced a strategy for boosting employment and economic development in the EU. The resulting Lisbon Declaration emphasised the role of knowledge in promoting economic development and social cohesion in Europe and provided impetus for enhanced investment in European Research.

7.1.2 Closer economic and political co-operation between Member States has led to a requirement for joint decision making on many matters. As a result there are European policies on many issues, including specifically research (Science and Technology) and development. The EU's Executive Agency is the European Commission (EC) which administers a significant budget for European activities on behalf of Member States and their citizens.

7.1.3 The European Union functions through a number of institutions. Those with direct relevance to S&T are listed here:

European Parliament

7.1.4 The European Parliament consists of representatives of Member States directly elected by citizens. The Parliament has the responsibility to examine and adopt European legislation, but shares this power equally with the Council of the European Union. Parliament is also require to approve the EU budget and exercise democratic control over other EU institutions.

7.1.5 Much of the work of the Parliament is conducted through its committee structure. The Committee on Industry, Trade, Research and Energy (ITRE) has direct responsibility for research, science and technology, whilst a number of other committees use research information to support the evaluation and development of policy. ITRE has responsibility, jointly with the Council of the European Union for the European research budget, which is administered by the European Commission's Directorate General for Research (DG-Research). The Committee on Development (DEVE) has responsibility for the promotion, implementation and monitoring of the Development Policy of the European Union. Expenditure by the European Union on development is administered through DG Development of the European Commission. The EuropeAid Cooperation Office implements external aid instruments of the Commission and as such is responsible for all development spending under the EC budget line and the European Development Fund (EDF).

7.1.6 Scientific and technological advice to all committees is provided by STOA (Scientific and Technological Options Assessment). This unit assists the work of committees in policy making, by commissioning independent assessments of policy options. This structure provides a direct mechanism for the application of S&T to inform policy-makers. Similar structures and mechanisms are present in most of the parliaments of Member States. This ensures a formal process for the use of S&T in the democratic process.

Council of the European Union

7.1.7 The Council of the European Union[26] is the main legislative and decision-making body in the EU. The Council provides a forum for representatives of European governments to assert their interests in relation to policy. There are regular meetings of working groups (usually civil servants from Member States), Ministers and Heads of State.

7.1.8 The Lisbon meeting of the Council in March 2000 set the Union a goal of becoming by 2010 "the most competitive and dynamic knowledge-based economy in the world, capable of sustained economic growth with more and better jobs and greater social cohesion". The resulting *Lisbon Action Plan* or strategy has had very significant impacts on European research. At this meeting, the Council endorsed a plan proposed by the EC to create a European Research Area (European Commission, 2000). The Lisbon Action Plan is discussed in detail in Section 7.4.

7.1.9 The Council, in conjunction with the Parliament sets the rules and budget for the activities of the European Commission, which acts as the executive agency of the EU

European Commission

The European Commission is responsible for much of the day to day work of the European Union. It is responsible for drafting legislation to be considered by the Parliament and Council. The Commission is headed by 24 Commissioners. There is one Commissioner for Science and Research, who is supported by two Commission Departments, the Directorate-General for Research (DG-Research) and the European Joint Research Centre (JRC). The allocation of funds to support European research currently represents just under 4 % of the EC's total budget and is one of the largest areas of expenditure after structural funds (Common Agricultural and Fisheries Policies, Regional Integration).

7.1.10 The Commissioner for Development and Humanitarian Assistance is supported by DG Development. Commission staff work on policy-level aspects of development and are supported in recipient countries, by staff in the Delegation of the European Commission. The responsibility for implementation of development programmes is given to EuropeAid.

European Economic and Social Committee

7.1.11 The European Economic and Social Committee (EESC) acts as an advisory body acts to represent the voice of civil society and involve them in the European political process. A very wide range of interest groups are represented, including employers and trade unions.

7.2 DG Research and the EC's Framework Programme

7.2.1 DG Research administers the EC's budget and proposes policy for research supported by the European Union. These activities are coordinated through a series of 5-year Framework Programmes. The current 6th Framework Programme (FP6) covers the period 2002-2006 and was allocated a budget of €17.5 billion[27] which was subsequently increased to nearly €20 billion when the acceding states joined the Union in 2004. The structure of FP6 is shown as Figure 3, showing a design influenced by the Lisbon Strategy to establish a European Research Area. Plans for the 7th Framework programme are currently being discussed by the EC, European Parliament and Member States. One significant possible change for FP7 which will commence in 2007, is the proposed establishment of a European Research Council, but any decisions are dependent on finding solutions to the current impasse on the budget for the European Union.

[26] Formerly known as the Council of Ministers

[27] Equivalent to US $22 billion.

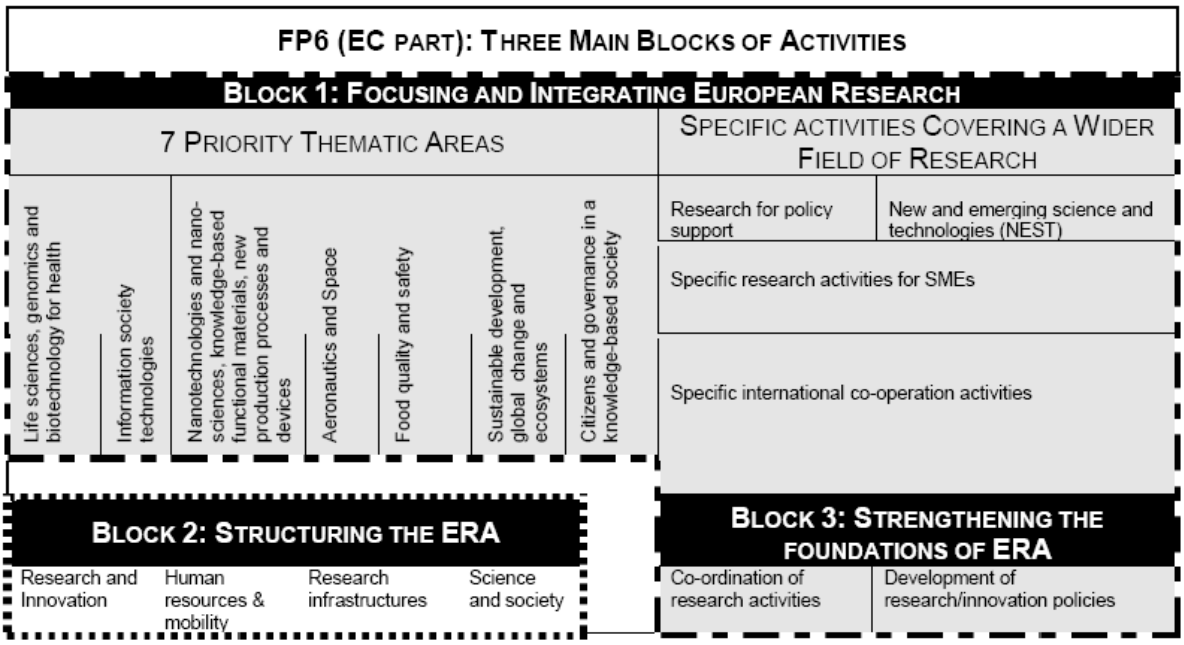

Figure 3 Schematic overview of the EC's 6th Framework Programme (2002-2006) (European Commission, 2000)

7.2.2 FP6 has been designed to be the main financial and legal instrument to implement the European Research Area, support collaboration in research, promote mobility and help to mobilise scientific resources in support of other EU policies. The total budget of €17.5 billion for the 2002-05, whilst large, represents only 4-5 percent of total expenditure on research and development in EU member States (European Commission, 2002b).

7.2.3 The majority of actions under FP6 are undertaken through a competitive process linked to calls for proposals (or tender) under seven priority thematic areas and cross-cutting activities covering a wider field of research (including specific international co-operation activities (INCO)). These actions are termed "indirect", and are in addition to "direct" research activities implemented for the European Union by the Join Research Centre.

7.2.4 The Framework Programme does not cover all possible areas of research, science and technology, but are linked to strategic objectives agreed by the European Parliament, Council and Commission. The programme also does not cover the full costs of research, and expects significant contributions from Member countries. Projects are required to be transnational and specifically excludes projects that are best carried out at a national level.

7.2.5 In support of the Lisbon Strategy, the Framework Programme makes the case for strong linkage between investment in research and the economic and social development of Europe. Throughout the programme there are methods to promote the participation of industry and specifically that of Small and Medium Enterprises[28] (SMEs). SMEs are estimated to represent 99% of all enterprises in Europe[29]

[28] Defined formally as an enterprise with less than 250 employees and turnover of less than €50 million *per annum.*

[29] http://europa.eu.int/comm/enterprise/enterprise_policy/sme_definition/index_en.htm

7.3 The Joint Research Centre

7.3.1 The Joint Research Centre (JRC, http://www.jrc.cec.eu.int/) is a research-based policy support organisation and a full part of the EC. The JRC provides the scientific and technical information to support EU policies. The JRC is organised as seven institutes with work split between direct support of Commission policy-making, support for specific Directorates-General and in strategic relationships with the scientific and business community. The JRC works within guidelines that their work should add value at European level, rather than competing directly with research establishments or the private sector in Member States.

7.3.2 The JRC's Mission Statement provides a good overview of the role that it plays to support the institutions of the European Union:

JRC Mission Statement

The mission of the JRC is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of EU policies. As a service of the European Commission, the JRC functions as a reference centre of science and technology for the Union. Close to the policy-making process, it serves the common interest of the Member States, while being independent of special interests, whether private or national.

Box 10 Mission Statement of the European Commission's Joint Research Centre

7.3.3 As the only significant research organisation funded directly by the European Union, two points are relevant for transfer to the African domain. These are the need to link directly-funded regional research activities with demand from end-users (demand-led research) and the provision of S&T support for the policy-making process.

7.4 The Lisbon Strategy

History

7.4.1 The Lisbon Strategy[30] was adopted by the Council of the European Union in 2000 in response to a proposal from the EC (European Commission, 2000). The establishment of a European Research Area was seen as integral to enhancing the economic and social development of Europe. Much of the Commission's analysis was based on benchmarking studies using OECD statistics demonstrating Europe's poor performance with other major economies with specific emphasis on the United States and Japan.

7.4.2 In 2002, the Barcelona Council meeting reviewed progress towards the Lisbon Strategy and Heads of Government agreed that investment in research should be increased with the aim of approaching 3 % of GDP[31] by 2010 and to increase the share of business funding to be two-thirds of total investment in S&T. Later in the same year the Commission released a consultation document "*More research for Europe – Towards 3 % of GDP*", (European Commission, 2002a). This was followed in 2003 by the Council inviting members to take concrete action to reach the objective of 3 % of GDP and recommending specific actions to increase business investment in research and development.

7.4.3 The second Communication from the Commission in 2003 provided an action plan to adopt the Lisbon Strategy (European Research Area) and Barcelona Objective (3 % of GDP). This document "*Investing in research: An action plan for Europe*" (European Commission, 2003). The action plan was designed to address a number of fundamental issues aimed at boosting the Union's competitiveness.

[30] http://europa.eu.int/comm/research/era/3pct/index_en.html

[31] In contrast African states have agreed a target of 1 % of GDP.

7.4.4 Four main sets of actions were proposed.

1. ***Enhanced co-ordination between Member States***, supporting steps taken by European countries. This also included the proposed establishment of "European technology platforms[32]" to bring together the main stakeholders[33] around key technologies to devise and implement a common strategy for the development, deployment and use of these technologies in Europe.
2. ***Improving public support for research and technological innovation***. This included plans to improve career prospects for researchers. These actions addressed public policies designed to promote European research.
3. ***Increased public funding for research***.
4. ***Improving the environment for research and innovation***. Intellectual property, competition rules, financial markets, the fiscal (tax) environment and relationships with industrial R&D are addressed here.

Current status of the Lisbon Strategy

7.4.5 In 2005 the European Union is half way through the intended time period for adoption of the Lisbon Strategy. It is now clear that progress has been less than desired and recent reviews have resulted in the Strategy being refocused on only two areas, productivity and employment. The review of progress concluded that the success of the regional initiative requires enhanced commitment and investment from Member States and industry. This point is especially important when it is recognised that the European Commission currently provides less than 4 % of total R&D expenditure and that the Lisbon Strategy included a target of increasing the proportion of industrial funding of research within Europe to be two-thirds of the total.

7.4.6 Key messages coming out of the revised strategy that are relevant to science and innovation include:

- Europe should promote a framework that ***encourages more investment from public funds and even more through private investment***.
- ***Member States need to increase their research funding*** and put in place measured to encourage private investment at the national level.
- There needs to be ***enhanced investment in people and their training*** to promote research and innovation.
- ***Industry[34] should contribute to the identification of strategic research needs***.
- Measures to strengthen research need to be ***complemented by appropriate measures to improve the absorption of new knowledge by potential end-users***.

Box 11 Key messages for science, technology and innovation in the revised Lisbon Strategy of the European Union

[32] This action is similar to the Networks of Excellence proposed by NEPAD for Africa.

[33] Stakeholders explicitly included, research organisations, industry, regulators and user groups.

[34] Elsewhere this is interpreted as end-users or beneficiaries of technology.

7.5 DG Development and Europe's Development Policy.

7.5.1 The European Commission proposed a new Development Policy during 2005 that will be considered by European Heads of State at the December 2005 meeting of the European Council. The draft Development Policy[35]. This document proposal several significant changes from previous policy. Poverty reduction is central to the draft policy which recognises the eight Millennium Development Goals. A common thematic framework is proposed for the EU and Member States' development policies in an aim to facilitate greater coherence in implementation.

7.5.2 The draft Development Policy makes a very clear statement that finance for programmes will utilise direct budget support as the preferred aid modality where appropriate. This along with the commitment to the principles described in the Monterrey Consensus means that EC development funding is likely to become aligned with PRSPs. Whilst indicating this change, the EC document does provide an indication of areas likely to receive European Support. These include, trade; infrastructure and transport; water and energy; rural development, agriculture and food security; the environment and sustainable management of rural resources; and human and social development. There are potential links to several of NEPAD's priorities as described in the Consolidated Plan of Action.

7.5.3 The EC's draft Strategy for Africa[36] discusses the proposed EU's response to Africa's development challenges. Central to this is a commitment to provide more and more effective aid, increasing to a target of 0.7 % of GNI by 2015 with an increasing proportion of this being allocated to Africa. This document expands the themes identified in the draft Development Policy. Whilst the current draft has limited reference to science, technology or innovation, there are again numerous areas which would benefit from more explicit linkage with the AU-NEPAD Africa's Science and Technology Consolidated Plan of Action.

7.6 S&T in Europe's Political Process

7.6.1 The role of the European Parliament in setting S&T policy for the European Union is discussed in Section 7.1. The EP's Committee on Industry, Trade, Research and Energy (ITRE) has responsibility for influencing and approving the EU's policy on Science. As one of twenty EP Committees, it has the responsibility to amend and adopt legislative proposals and can produce reports on its own initiative. The remit of the committee, including industry and trade promotes the application of technology to support economic development in Europe. In addition to ITRE's role in policy making, it has responsibility for parliamentary oversight of the Joint Research Centre, and dissemination and application of research findings.

7.6.2 Science and technology can have significant inputs into all other areas of European policy-making. Many of the projects funded under the S&T Framework Programme are designed to provide policy-relevant information to be utilised in the legislative process of the European Parliament, or the Parliaments of European Member States. The Joint Research Centre (Section 7.3) is the EC's research-based policy support organisation, as captured in their mission statement "*The mission of the JRC is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of EU policies*". This introduces the very important concept of monitoring the impact of policies. In addition to support provided by the JRC, technological advice is provided to all of the EP's committees by the Scientific and Technological Options Assessment unit of the EP.

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[35] COM(2005) 311 Final. Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions. Proposal for a Joint Declaration by the Council, the European Parliament and the Commission on the European Union Development Policy. "The European Consensus".

[36] COM(2005) 489 final. Communication from the Commission to the Council, The European Parliament and the European Economic and Social Committee. EU Strategy for Africa: Towards a Euro-African pact to accelerate Africa's Development.

7.6.3 The European Union and many of its Member States increasingly utilise processes of public consultation as an integral part of the policy-making process. These consultations create further opportunities for S&T to influence policy. Consultations are open to all and are a good way for learned societies, civil society and even individual researchers to influence the policy process. Whilst the value of consultative processes is not questioned, their efficiency is recognised as being highly variable leading to the creation of guidelines for consultation in some countries (e.g. in the United Kingdom, The Cabinet Office, 2000).

7.7 Lessons for Africa

7.7.1 The European Union provides highly relevant examples in relation to regional approaches to commissioning and utilising science and technology. Before considering the main messages and their implications, it is necessary to consider the similarities and differences between Europe and Africa, and the European Union and the African Union.

7.7.2 The EU can be traced back to the establishment of the European Coal and Steel Community in 1950/51 and as such has been established for a period of over fifty years. Over that time European organisations have matured and enhanced regional integration has produced a regional legislative process (through a directly elected Parliament), regional budget (administered by the EC) and common policies on numerous issues. In contrast the AU came into existence in 2002, following a process promoted by the former Organisation of African Unity commencing with the 1999 extraordinary session in Sirte.

7.7.3 The most important difference in terms of operational matters relates to funding. The European Union has the ability to generate revenue through taxation and significant contributions from national governments. The financial resources available to the EU makes it possible to fund significant regional S&T initiatives such as the Framework Programme.

7.7.4 These differences are very significant and at present they mean that national governments of African states will be the most important stakeholder making decisions relating to public support and funding to promote S&T initiatives in the region.

Implementation of Science and Technology

7.7.5 Europe's experience in implementing the Lisbon strategy has been extremely informative. There is broad agreement that achieving the target of 3 % of GDP to be invested in research and innovation is desirable and will promote regional development. Despite this, there has been little progress in achieving this goal. The revised action plan has been designed to redress this. This review identified a number of common themes:

- ***Ultimate beneficiaries and users should be fully involved in setting priorities for S&T***. This explicitly includes industry, civil society and policy-makers.
- ***Regional funding for S&T should be concentrated on areas where a regional approach "adds value"***. The majority of investment within the region should come from the private sector (industry) and public funds allocated by national governments.
- ***Capacity building of researchers is required to build the S&T base of the economy***. This needs to be combined with measures to enhance the career prospects of researchers to encourage them to remain in the region.
- ***Enabling conditions and policies in individual countries need to be improved to promote investment in S&T***. Specific measures are required to address IPR, investment regimes and to promote public-private partnerships for S&T. Effective information and communication infrastructure is an important enabling condition for regional S&T.

Box 12 Common themes identified in the review of science and technology in the Lisbon Strategy of the European Union

Use of S&T by industry and society.

7.7.6 The 6th Framework Programme included measures to promote the utilisation of research. These have included promoting the role of industry and civil society in setting priorities and other to encourage SMEs to participate as partners in public-funded research programmes. The principle is that companies are far more likely to adopt new technology if they are involved in all phases of research, from priority setting, through implementation and extension.

7.7.7 Policy measures have been designed to address the enabling environment with work on IPR, investment regimes, public-private partnerships and mobility of researchers.

7.7.8 ***The Lisbon Strategy clearly states that improved engagement with industry is required to enhance Europe's investment in S&T*** and if this can be achieved it is likely to provide very significant benefits for social and economic development in Europe.

Links to policy.

7.7.9 The European Union and its constituent institutions have made explicit links between S&T and policy. This can be divided into two areas, policy *for* S&T and the use of S&T *to support* policy in other areas.

7.7.10 Policy for S&T is proposed by the Commission after extensive consultation with the public and Member States. The decision-making process is undertaken jointly by the Parliament and Council. High priority is given to promote research that will support other areas of European policy (e.g. Sustainable Development, Health etc.) This process is designed to ensure that priority setting is participatory and results in activities relevant to Europe's needs and future development.

7.7.11 One of the most important mechanisms to promote S&T in European policy-making is through the Parliament's committee structure. The Pan-African Parliament would benefit from having a specific committee with responsibility for Science and Technology.

Training and mobility

7.7.12 The Lisbon Strategy requires ***investment in capacity building*** in order to establish the ERA. There are now a number of programmes funded to provide training opportunities at regional level. Much of this is linked to investment in higher education or lifelong learning. Under the remit of education and training, the actions include, the Socrates Programme for Education and the Leonardo da Vinci Programme for vocational training. Within the Framework Programme of DG-Research, there are a set of actions designed to improve human research potential and the socio-economic knowledge base. These include, training networks, individual research fellowships and high-level scientific conferences. These components of the Framework Programme are highly valued by the wider European research community.

Development activities

7.7.13 Proposed changes to the EU's Development Policy may have very significant implications for European support for the AU-NEPAD Africa's Science and Technology Consolidated Plan of Action. The increased emphasis on direct budget support to achieve poverty reduction and other MDGs re-emphasise the need to link this plan and innovation strategies with national PRSPs or other MDG frameworks.

8 International Experience: Distilling Best Practice for Africa

8.1 Introduction

8.1.1 This final section of the report presents a synthesis of international experience on regional or global programmes on science and technology and considers how this can be used to inform the process of implementing Africa's Science and Technology Consolidated Plan of Action. This synthesis effectively represents a set of recommendations which cross reference other sections of this report or key documents. These recommendations have been grouped thematically.

8.2 Ownership and Political Context

8.2.1 The process to design and implement the Consolidated Plan of Action must be owned by African nations and institutions. This imperative was reinforced for all development activities and agreed by world leaders during the 2005 World Summit and reflects best practice for development assistance as stated in the Paris Declaration on Aid Effectiveness.

8.2.2 Implementation of the Plan of Action must be embedded within an appropriate political framework provided by the African Ministerial Conference on Science and Technology[37].

8.2.3 The Pan-African Parliament should consider the establishment of a committee on science and technology. This committee could be given responsibility for parliamentary oversight of the CPA, its implementation and results.

8.3 Priority Setting

8.3.1 Priority setting for the content and implementation of the Consolidated Plan of Action should be owned and driven by African nations.

8.3.2 Linkage with national poverty reduction strategies and the Millennium Development Goals will promote engagement of UN system and bilateral donors, especially in areas such as health, agriculture and environment[38].

8.3.3 Beneficiaries and end users of technology including civil society and private sector should be given an opportunity to contribute to priority setting and monitoring outcomes.[39]

8.3.4 Regional development organisations, geopolitical groupings and economic communities should have an important role in setting priorities. Regional development banks will be key actors and should develop supportive Science Technology and Innovation strategies[40].

[37] The same approach has been adopted by ASEAN nations (Section 3.2)

[38] The central nature of the MDGs to direct development effort was reaffirmed by the 2005 World Summit.

[39] This need was identified in the review of the EC's Lisbon Strategy (Section 7.4) and the recommendations of the 8th session of the CSTD (Box 7, Section 4.5)

[40] Derived from the comparison of the roles of the Interamerican Development Bank (Section 2.5) and Asian Development Bank (Section 3.5).

8.4 Design

8.4.1 Regional programmes for Science, Technology and Innovation need to be distinct from, and add value to existing country-level activities.[41]

8.4.2 Many countries in Africa will require additional bilateral support to strengthen national systems of innovation[42].

8.4.3 The design and implementation of the Consolidated Plan of Action should be treated as a learning and capacity building process for African Institutions and the resulting design should be expected to evolve through "living documents".[43]

8.4.4 The proposed African Science and Innovation Facility needs to have a clear legal status and should have procedures to address IPR issues[44].

8.5 Policy Advice

8.5.1 Policy advice on regional S&T issues should be kept separate from any funding mechanism of the proposed African Science and Innovation Facility. OECD's work on S&T provides a good model that could be adopted by NEPAD.[45]

8.5.2 Individual countries would benefit from a regional approach to support the development of national science, technology and innovation strategies.[46]

8.5.3 African nations and political institutions may benefit from the establishment of dedicated research units with responsibility to generate and analyse knowledge to support policy and decision making.[47]

8.5.4 Africa's Science, Technology and Innovation Initiative in the Consolidated Plan of Action will have an important role to inform national and regional policy on S&T. Linkage with appropriate MDG indicators would help to promote engagement with development donors. Integration of this work with the African Peer Review Mechanism would add further political legitimacy to this process and provide a further link between regional S&T and good governance[48].

8.5.5 The African Ministerial Conference on Science and Technology has an important role in providing political leadership and enhancing international cooperation in Science and Technology. The OECD ministerial level meetings and G8 Carnegie meetings have similar functions. It is likely to be beneficial for AMCOST to create a dialogue with these groups.

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41 This is the rationale of the EC's Framework Programme (Section 7.2)

42 Examples of this approaches are the MSI initiatives in Latin America (Section 2.5)

43 This is considered best-practice for development programmes and projects by many donors, best typified by the EC's Project Cycle Management documentation (European Commission, 2004).

44 The issue of legal status was raised as a factor limiting system wide impact of the CGIAR and engagement with the private sector during the OED meta-evaluation review of the system (OED, 2003).

45 Section 4

46 Or the national strategies for human resources, science and technology as recommended by the 2005 World Summit.

47 The Joint Research Centre of the European Commission (Section 7.3) and the Scientific, Technological Options Assessment unit (Section 7.1) of the European Parliament provide suitable examples.

48 A conclusion and recommendation derived from analysis in this report.

8.6 Building Human Capacity

8.6.1 Lack of absorptive capacity in African Institutions may limit new regional and national S&T Initiatives.[49] Strengthening human capacity will require new a new commitment by countries, donors and the private sector to support S&T in secondary, tertiary education and lifelong learning[50].

8.6.2 There is a need to provide assistance to strengthen the capacity of national and regional academies of science (and societies or their equivalent) and the role that they play in setting priorities for S&T and providing input into policy processes and decision making[51].

8.7 Funding

8.7.1 An innovative and flexible funding mechanism is required to support implementation of Africa's Consolidate Science and Technology Plan of Action. This must be able to work with different types of contributions, including national governments, multi and bilateral donors, foundations and the private sector[52].

8.7.2 International donors should be challenged to work together through a Donor Forum and adopt their own agreed guidelines for best practice as defined in the UN Conference on Financing for Development[53] and the OECD Paris Declaration on Aid Effectiveness.[54]

8.7.3 Financing needs to be secured on long time horizons and through predictable cycles.[55]

8.7.4 Development donors should have limited opportunities for micro-management of resources through imposition of conditionality or other restrictions.[56]

8.7.5 Promoting private sector engagement and investment is essential to achieve development including those promoted through Africa's Consolidated Science and Technology Plan of Action.[57] This remains a major challenge to the development community. Promoting private sector investment to support the Consolidated Plan of Action will require intellectual property issues to be addressed during the establishment of the African Science and Innovation Facility and associated projects (Para 8.4.4).

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[49] (de Renzio and P, 2005) and Section 6.3.

[50] An important conclusion of the Millennium Project (UN Millennium Project, 2005b). The EU's Lisbon Declaration and EC's Framework Programme provides an example of the importance of this approach (Section 7).

[51] Improving the use of knowledge to build policy and support decisions is a crucial aspect of developing systems of good governance (UN Millennium Project, 2005a)

[52] See separate briefing paper on innovative financing mechanisms.

[53] The Monterrey Consensus (United Nations, 2002a).

[54] (OECD, 2005c)

[55] 2005 World Summit, Monterrey Consensus.

[56] Monterrey Consensus. The OED meta-evaluation of the CGIAR noted that increasing proportion of restricted funding provided by donors had resulting in CGIAR centres moving away from their core areas of competences where they were likely to have most impact (OED, 2003), see also Section 5.

[57] This has been stated at the World Summit for Sustainable Development (United Nations, 2002c), Monterrey Consensus (United Nations, 2002a) and the Millennium Project (UN Millennium Project, 2005a; UN Millennium Project, 2005b).

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