Report of the SIDS Expert Meeting on Science and Technology for Sustainable Development, 30 August to 3 September, 2004, Singapore

I. BACKGROUND

While all developing countries face challenges, small island developing states (SIDS) experience specific problems arising from the interplay of such factors as their limited size, remoteness, geographical dispersion, vulnerability to natural disasters, the fragility of their ecosystems, constraints on transport and communication, isolation from markets, vulnerability to exogenous economic and financial shocks, a highly limited internal market, lack of natural resources, limited fresh water supplies, heavy dependence on imports and limited commodities, depletion of non-renewable resources, migration (particularly of personnel with high-level skills) and limited ability to reap the benefits of economies scale.

The combination of these challenges is what interconnects the economic, environmental, and social vulnerabilities of SIDS. It is well known that the economies of many SIDS rely heavily on the environment, and the mismanagement of environmental resources often has major economic repercussions, notably those on the balance of payments and on government finance. In fact management of the environment is the only long term strategy for SIDS under which SIDS can have a relatively resilient economy, which would be less vulnerable in to future to issues of climate change and sea level rise, price of petroleum, WTO rules, that now serves to increase the level of overall vulnerability.

SIDS whom through there history have been beneficiary of science and technology developed outside and transported in, as befits the situation now finds themselves in a period of history where the major issues confronting these continued existence are not yet priority on other countries radar. SIDS seen as a special case since the 1192 UNCED meeting continue to pursue policies that have their foundations in consensus for larger countries, which have not many similarities to SIDS. The majority of SIDS have a situation in which the resources to meet consumptions requirements and the resource generating potential of the economy are out of balance, and becoming more so resulting in more vulnerability. Correcting this current out of balance situation should be a priority for the SIDS leadership. And it will require SIDS to make significant changes to the way they manages the role of science and technology. Like the Asian food security problem of the forty years ago, many SIDS are experiencing environmental security problem, science and technology will have to play key in helping SIDS find innovative solution.

At the inter-regional meeting to prepare for the ten year review of the BPOA in The Bahamas in January 2004, the membership of AOSIS, given the critical role that S and T would have to play based on the outcome of the meeting, requested that the UNDP would facilitate such a meeting of Experts.

The Bahamas meeting suggested to UNDP that the S and T meeting should address crucial issues such as energy technologies, biosafety and waste management, as well as consider cross cutting issues such as capacity building, training and research, as well as cultural-related matters. In addition the S and T meeting was requested to formulate possible mechanisms and cooperative frameworks for promoting S and T in SIDS as well as the application of SIDS specific technologies in SIDS.

II. PRESENTATIONS AND DISCUSSIONS -- WHERE IS SCIENCE AND TECHNOLOGY IN SIDS

The Experts Meeting was held at the Rendezvous Hotel, Singapore from 30 August to 3 September 2004. A welcome address was given by Mr.David Chua, Assistant Director, Technical Cooperation Directorate, Ministry of Foreign Affairs, Singapore. Opening remarks were given by Dr. Leonard Nurse, the Workshop Coordinator. This was followed by brief remarks by Prof. Al Binger, University of the West Indies Center for Environment and Development and by Mr. Richard Leete, the UNDP Resident Representative, based in Kuala Lumpur. After a special address by H.E. Ambassador Jagdish Koonjul, Chairman of the Alliance of Small Island States, the meeting was officially opened.

Presentations were made by Allen Zack, Leo Moseley, Joseph Hui, Tay Joo Hwa, Ramsey Saunders, Ho Hiang-Kwee, Harry Seah, Poh Soon Hoong, Phosun Kallee, Russell Nari, Russell Howorth, K. Raghavan, David Lambourne, Julia Rose, Haruo Uehara, Hiroshi Sasaki, Edison Garraway, Audia Barnett, Lim Li Lin, Andrew Giger, Tom Wichman, Melchior Mataki, Jennifer Harper, Taholo Kami, Queh Ser Pheng, Paul Micallef, Gurinder Shahi, Armando Rodriguez Batista and Leonard Nurse. The presentations will be made available on SIDSNet (www.sidsnet.org).

The participants represented a mix of experts from SIDS, other developing and developed countries. The areas of expertise included biotechnology, information and communications technology, renewable energy, biosafety, waste conversion, and marine and agricultural sciences. Experiences and information were exchanged through presentation, demonstrations, field visits and working groups, and plenary discussions.

The Meeting found common agreement in describing Science and Technology in the vast majority of Small Islands to be (notable exception of those independent islands that had highly developed economies – in those cases it was concluded that S and T was a major contributor to the development of those countries and these countries intend to have continued dependence to main current level and supply future development targets) to be characterized by:

1. Limited Allocation of Financial Resources --- the level of investment by the majority of SIDS is significantly less than the recommended level established by the OECD for their membership, and in general significantly less than the levels recommended by the UN Commission of Science and Technology for Development in its

ongoing work. Over the last two decades, the relative importance of SIDS in global merchandise trade diminished by half (from 0.4% of world exports of goods in 1980 to 0.2% in 2000), while their share of global trade in services remained stable (0.7% of world exports of services). SIDS exports of goods and services were more unstable by 10%. SIDS, in 2001, demonstrated a level of merchandise export concentration 24% greater than that of other developing countries.

This is a result both of limited public resources and limited expectation as to potential contribution of science and technology to national development. Given this present economic conditions of SIDS the most promising option for increasing the contribution to national development is through greater participation and cooperation. A major source of under-utilize science and technology capacity lies in the tertiary institutions. The universities have a pool of human resources with academic training in various fields of science and technology, but the challenge remains to effectively channel these skills into sustainable development. Cooperation and partnerships should be regarded as the most appropriate and effective means of sharing resources within and between the regions.

2. *The Existence of Ill-equipped Legal Infrastructure* – the general view of the meeting based on the experiences is that at the national level the legal frameworks could be far more facilitating. A lack of political will and resistance to change exists at many levels of the public sector. There is also an unfavourable climate for intellectual property rights. Resolving the question of ownership of the resources and of the knowledge require new legal framework. Legal framework is required to ensure that the research carried out is of benefit to the countries and is made available to national authorities. Need to have a better level of cooperation between agencies to improve the information for decision makers which tends to be limited quality.

Transforming this unfriendly infrastructure into being more user friendly will require overhauling laws and regulations. This will require expertise that is now not easily available in SIDS. There will also be need to harmonize across sectors. Legal issues of technology transfer such as no damage environment need to be included. Governments should look to regional strategies in accessing the technical resources to support making the legal infrastructure friendlier for S and T. Included in the regional strategies is for regional organizations to provide information on quality control.

Countries need to be more vigilant in signing onto international agreements without fully understanding the implications, so that reporting requirements are often missed and there is a lack of enabling legislation. Need to look at how to improve such international agreements. The task of developing an enabling legal environment for science and technology capacity building in SIDS is a significant challenge but necessary, if the vast potential of S and T to assist with the implementation of the BPOA is to be realized, the meeting is of the opinion that SIDS - SIDS cooperation will be critical and strongly recommended.

3. Limited Sources of Inf ormation and Awareness – despite the ongoing revolution in communication access to information in the area of science and technology remain limited and needs to be significantly improved. The process of reviewing the BPOA has provided a unique opportunity for documenting information on implementing sustainable development in SIDS and the science and technology status. Based on the national reports, there continues to be limited access at the national level and consequently solar energy hot water heater is the most popular technology since the Barbados meeting in 1994. Information on and about science and technology need to more accessible and better institutionalized through the education curriculum All level of education should have science and technology included in order to reach the entire society over time and encourage entrepreneurs. To increase access to information government should provide support to a regional institution such as a University to be the information node and perform regional clearing house functions, including facilitating technology information networks within and among SID, assisting technology transfer. The proposed Small Island Universities Consortium could be harnessed to assist the regional institutions in this effort.

4. Limited Integration Traditional Knowledge in to National S and T Health Assets -- medicine and medical care in SIDS ranges from highly modern westernized to traditional, depending on economic status. For a considerable period of time traditional medicine was considered less that desirable. However the advances in the field of biotechnology is shedding light on the important chemicals contained is plants and correspondingly medicinal and cosmological value. However at the national level there is limited effort of getting traditional knowledge documented, protected, and tested. The leadership of SIDS need to decide on collective approaches to documenting, protecting and testing of traditional knowledge in order to identify successful traditional technologies that can be adopted, for modern society for example in the treatment and prevention of dengue. In this regards Singapore could provide very valuable insights.

Application of traditional knowledge go beyond medicines, they also apply to natural resources management, in key areas such as biodiversity, and management of fragile ecosystems. For example traditional practices of planting mangrove by coastal communities to enhance the productivity of their coastal fisheries represents a low cost adaptation to climate change and sea level rise, while at the same time protecting the nursery function of the mangroves within the coastal ecosystem.

5. Science and Technology is not Mainstreamed into the Development Process – this is reflected in the limited degree of coordination at the national level and the absence of long term strategies for development based on planned contribution from science and technology actively converting SIDS natural resource endowment into goods or services as is the case with Malta for example.

A very good example of this failure of coordination is in the energy sector, where despite enormous endowment they remain dependent on petroleum. However in just about every SIDS there have been efforts to find alternatives to fossil fuels. But with the exception of hydropower scheme and a few windmills there is very little capacity existing for

development of renewable energy resources. Solar energy has suffered from lack of capacity in energy storage. In the Cook Islands early solar projects failed because of faulty installation, wrong equipment and lack of maintenance.

The example of Vanuatu with renewable energy shows how important it is to mainstream S and T in the planning process. Vanuatu has renewable energy resources including wind, biomass and geothermal. However biofuels (fuel from coconut) has been the most effective, not because of science and technological innovation but a combination of circumstance defined by high petroleum prices and low copra price, which replicated technological innovation. Copra made from coconut has been the backbone of the economy for a very long time. However over the last decade the price of copra has fallen significantly on the global market. The economics showed that based on diesel fuel prices it would be viable to produce fuel for domestic market rather than copra for export. Because a similarity in the process for making biofuel and copra significant amount of the equipment to make biofuel was in place, and the population familiar with the technology of copra easily made the transition to biofuel. With investment from the private sector the production has continued to increase. And efforts on now on to get the entire government fleet to switch.

This example demonstrates a number of sustainable development issues: economic considerations: job creation through import substitution --the import of the 24 million litres of diesel imported per year represents 10% of all imports, biofuel production could thus make a large difference in the balance of payments; social considerations – the Financial resources not exported in return for petroleum will have a multiplier effect from its circulation, urban drift may be reduced as job opportunities are developed; environmental consideration -- greenhouse gas emission reduction addressed, even if the amount is very small.

The present encouraging situation with the development of biofuels in Vanuatu could be significantly enhanced with existing technologies that would make production of biofuels even more competitive with petroleum imports. The fate of the initiative is still not determents as some stakeholders in the development process are yet to be convinced of the relative cost and benefits from their individual agency perspective. The Ministry Finance has concerns about potential loss of revenue and the relative benefits of savings for the government fleet converting to biofuel vis-à-vis the significant amount of financial resources that would remain in local circulation. The senior decision makers will have to do a comprehensive analysis of the contribution to sustainable development of biofuels and then put in place the appropriate polices instruments. It should also make sure that it include in its long term planning commitment to mainstreaming S and T, as it is evident what the potential benfefits are.

The experience of Vanuatu shows that for small and medium size technology to make national contribution it has to be grasped by the population. For S and T to assist SIDS leadership to improve economic and social progress while protecting the natural resources, it has to be mainstreamed particularly in societies in which there is a very low level of tertiary education in S and T. Development of S and T capacity should begin

with building on existing regional and community-based expertise in forest knowledge, land capabilities and problems, biodiversity, climate change, water resources, medicine, waste management, etc.

6. A shortage of trained experienced professional and high levels of emigration among experienced professional – due to limited opportunity for advancement, emigration of experienced professional continues to be very high. For SIDS to begin realizing the benefits of S and T SIDS will have to find innovative solutions to reverse this situation. One possible option is for SIDS to create a ***human resource exchange mechanism*** that would allow their senior professionals to undertake for pay assignments as consultants in other SIDS, for a certain percentage of time annually. Given the growing cost of professional services to SIDS in the absence of national capacity, this could be a very beneficial mechanism for SIDS. Such a mechanism would provide SIDS with a pool of professionals with significant experiences of SIDS conditions and realities,

7. Limited Investment in the Development of Professional Capacity ----- technology transfer can only be effective if there is capacity at the national level that can be the national embodiment of the science or technology. Many examples were identified as cases of failed technology transfer, for example in the case of solar photovoltaic initial introduction was plagued by lack of knowledge about battery maintenance and operation. The failure to provide training was the weak link and resulted in limited success. Incorporation of solar stills to produce pure water for the batteries would have had a significant positive impact of the PV projects in the Cook Islands from example. SIDS depend primarily on their tertiary institutions o develop professional skills. In these institutions there is need to review the existing curriculum to ensure that capacity is being developed consistent with the scientific and technological requirement needed to address the key challenges for sustainable development as set-out in section? of this report. SIDS tertiary institutions were in the view of the meeting producing far too few scientists and engineers and that this should be addressed through scholarships incentives.

8. Many Opportunities Not Seized ------ in the vast majority of SIDS there are always a number of opportunities for science and technology innovation but seldom is there local impetus and usually gets as a result of external impetus, examples include: the use of energy efficiency technologies and practices, such as recovering energy from waste heat of electric generators for desalination and cooling services; energy audits for industries and buildings to identify energy saving; use of solar stills to produce clean water for batteries; solar dryers for more rapid drying of agricultural products to reduce post harvest losses; opportunities for development of the enormous renewable energy resources in SIDS; and for the use of bio-climatic concepts from traditional architecture remain unexploited.

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9. ICT------ Some SIDS have begun to take advantage of new trade opportunities in ICT related services. But ensuring a rapidly increasing proportion of information and services being provided electronically and to have full participation in many sectors is impossible without reliable and affordable access. Despite the improvement in connectivity, most islands have yet to take full advantage of the benefits of ICT because

of high local access costs. While SIDSNet has documented an impressive increase in connectivity for SIDS as countries, for individuals and remote communities there is a significant digital divide. The review document being negotiated for Mauritius makes reference to the need to adopt appropriate policies for ICT in SIDS, and for concerted efforts to be made by the international community in support. Nevertheless, the ICT sector in SIDS remains at a very vulnerable stage, as was demonstrated by the virtual blackout of internet access in Cape Verde in November 2004, caused by the fiber optic cable being cut by a ship.

The absence of a culture of science and technology in SIDS is making the challenge of sustainable development more difficult. The development challenges of an independent small island states is well known. Science and technology has been an essential for economic growth, and for the faster rates of growth in the newly industrialized countries. SIDS need to engage in international long term partnerships to significantly increase capacity. The partnership goal should be for science and technology as being the province of all, not just the elite. Information and communication technologies (ICT) should be the tool to deliver the goods. Science and technology must be seen as an integral part of the construction of a sustainable society. This will requires a major re-think of the educational curricula of SIDS. Major challenges for SIDS to develop S and T capacity to address are discussed in the following section, which includes climate change, there is nothing SIDS can do to stop or alleviate climate change, but they will have to do a lot to address adaptation. There is a need for more scientific information on climate change to guide the development of technological solutions.

III. CONCLUSIONS

Based on the experiences, case studies, and presentations, the overwhelming consensus of the experts was that with the exception of a couple of small island nations the vast majority have had no real vision or strategy on the role science and technology in the implementation of the BPOA. The consequence as validated by numerous examples is failure to implement activities which would provide examples of sustainable development, and the relative benefits compared to more conventional approaches based on solutions proposed from much larger countries. As pointed out key areas such as fresh water and energy services, where many opportunities to use S and T to improve current situation and help achieve targets such as the Millennium Development Goals (MDGs) lie awaiting discovery or slow in implementation as a result of lacking technical expertise.

The sugar industry is vital to Fiji's economy, but is now under threat from WTO rules, which will require Fiji sugar to be competitive with sugar from larger producers in order to compete in the international market. Given that Fiji typical of the majority of Small Island producers were always a high cost producers, there is no chance that the industry at its present level could remain viable. The recommendations from international institutions trying to the country have formulated strategies ranging from improving competitiveness of the industry, to alternate crops such as commercial help, all very traditional approaches.

Absent until recently, is viewing the challenge from a science and technology perspective. Sugarcane is a high biomass producing plant, like any other raw material it can be converted into different products, sweeter being only one. Given the high level of dependence on imported petroleum for energy, an obvious option is sugarcane for energy. From a S and T perspective biofuels form sugarcane is commercially proven system. As with the case of biofuel derived from copra in Vanuatu, biofuel from sugarcane in Fji would provide similar benefits.

Small islands are among the most fragile and vulnerable of the world's ecosystems, the physical attributes that make them attractive to tourists such as isolation, infrequent rainfall, environmental exposure, and lack of development are often the same attributes that impose hardship on residents. Small island states generally lag behind more developed countries in terms of science and technology. It has been observed that enhancing the scientific and technological development capacity of SIDS would improve prospects for achieving:

- Sustainable water supplies while reducing vulnerability to drought, floods, saltwater intrusion, and biological contamination.
- Sustainable energy systems, reducing exposure to the volatile international petroleum market, as well as meeting obligation under Multilateral environment agreements (MEA)
- Improve food security, by lessening ecosystems degradation and more efficient agriculture and fisheries practices.
- Improved environmental conditions and reduced threat to public health, which is now a result of increased pollution from in-adequate waste management.

The limited capacity of SIDS to access and utilize developments in science and technology serves to magnify their level of vulnerability. It is one thing to know you have problems and looking into possible options, it is another thing not knowing that the problem exists. Attempts to impose common international models of science and technology management would be unlikely to gain support by government and scientific communities, principally because of the small scale and limited resources of island countries.

Urgent needs for science and technology to help address major obstacles to the implementation of the BPOA are wide-ranging including such important development areas as food security, land & water resources management, marine science, energy management, climate change adaptation, land use and planning, and waste management. Formulating and implementing an agenda for scientific and technological development must begin with partnerships between schools, colleges, the United Nations (SIDS experts), AOSIS, the media, donor countries and agencies, and any other entity having credentials to effectuate progress. Scientific and technological applications must be relevant, co-owned by residents (students, faculty, politicians), yield immediate results, and most important, shared amongst island communities.

Common or integrated platforms to enable SIDS to link, manage and update information and data across sectors and themes of people, economics and environmental systems is extremely limited and needs to be strengthened. There is limited funding available to SIDS through either bilateral or from international organizations. The resources available are often focused on small-scale efforts within individual sectors. .

Given the state of affairs at the national, regional and global level with regards to the state of scientific and technological capacity within the SIDS the meeting voiced the opinion that the leadership of SIDS, in its response should give priority to the development of regional centres of excellence. Based on the reports from national and regional institutions with responsibility for the various aspects of science and technology (basic research, applied research, development, demonstration, popularization, commercialization) cooperation at the regional level is critical for success in SIDS. However based on the experience of the participants, despite the existence of mechanisms such as regional organizations, regional cooperation remains very limited as resources are very limited, and activities are to a large extent framed by the donor's agenda. SIDS need new capacity to help integrate science and technology activities with development, and integrate such actions with existing or future planning processes and mechanisms

The principal conclusion of the meeting is the need for significantly greater support from SIDS governments for S and T, which at the very least should become a significant budget line item, to be supplemented by development partners to help develop SIDS regional capacity. Regional capacity as the priority focus reflects the reality that there is need for a critical mass of professionals. Take for example the case of Tuvalu, analysis shows that in Tuvalu it is possible use plant oil production technology to convert 2/3 of the copra produced for export, to substitute for imported diesel at significant financial savings to the country. Analysis of problems resulting from animal and human wastes disposal showed that by using relatively simple technology these wastes could produce fuel for cooking and/or lighting. Tuvalu could based on its energy requirement derive all its energy services with the exception of aviation and maritime from renewable source, and at significant economic, social and environmental benefits. However significant barriers exist ranging from knowledge to institutional governance. Policies are needed to stimulate the development of renewable energy resources, which has to also address the perception of risks. Legal and regulatory frameworks are also missing,

Sadly, it is very unlikely; that any significant degree of renewable energy development will take place in Tuvalu given the limited science and technology capacity at either the national or regional level that is available to assist Tuvalu explore the feasibility of such a programme. Even more sadly is that there are so many examples like Tuvalu, and without regional capacity it is very unlikely that these technologies will anytime in the near future make a contribution to sustainable development in the SIDS. The Annex to this report contains a case study (Assessing alternative strategies for implementing science and technology strategies in SIDS: lessons learned from seeking sustainable water supply in islands) which lists a number of options for applying science and technology in improving the availability of potable water in SIDS, a critical requirement to the

realization of a number of the MDGs, but without regional capacity far more than could be the case will continue to experience hardship associated with access to safe water.

Changing this sad state of affairs requires effective support for strengthening regional scientific and technological organizations, by national governments and development partners. Past experience has shown that national governments of Small Island with little exception do not have the level of resources to retain a professional in the technical areas of the BPOA. Past experience has also shown that professionals at the national level seldom are fully utilizing their skills and experience. Additionally, SIDS continues to experience significant migration of technical and scientific personnel, and much of the experienced professional are located within regional institutions or organization. A major complaint about regional institutions at the national level is the limited attention and perceived benefits, seldom is the cost considered.

SIDS can best realize the benefits of science and technology through regional and inter-regional cooperation. At the regional and inter-regional level is where professional capacity can be more cost effectively be developed. Treating science at a national level alone, and especially from a sectoral point of view, will mean that cross-sectoral and regional synergies are overlooked, and scientific services will be too peripheral, or too costly, for SIDS. . Different science and technology systems to cope with different needs and SIDS should ensure that the professional being trained are equipped to address SIDS needs.

SIDS government should seek partners to invest in the development of regional centres of excellence in science and technology guided by the areas of the BPOA. Already in SIDS are a number of regional organizations whose resources and capacities are a total mismatch for the existing needs within the context of the MDGs, these institutions should be the first ones strengthened. The increasing use of Information and Communication technologies provide options to create among national government and regional institutions and academic institution A centred centre of excellence, consisting of SIDS professional in the various geographic regions, organized by area(s) of the BPOA.

Experience has shown that return on investment to build regional technical capacity return significant benefits to the partners, as for example the case of the Asian Institute of Technology (AIT)[1], which shows the use ***of regional training institutions*** as centres of excellence for S and T capacity building.

Effectively managed investments to operationalize regional centres of excellence[2] is critical for the implementation of the BPOA by providing SIDS based institutional capacity to:

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[1] Asian Institute of Technology, see http://www.ait.ac.th/ for details

[2] Centre of excellence is defined as a institutional entity that has a critical cadre of professionals in an area(s) of the BPOA. This is not necessarily achieved by establishing a new institution, as existing entities can be strengthened as required to implement the institutional functions.

- Help national governments define a simple framework for the advancement of science and technology activities (science and technology agenda) in or as part of the sustainable development process
- Provide assistance to island countries to adopt this framework to develop national S and T agenda that approximates their national situation, and to use it to review their science and technology activities in relation to environmentally sound and sustainable development.
- Provide a critical mass of scientist and technologists with appropriate specialization in the areas of the BPOA who will advise and assist governments and civil society in assessing options and priorities.
- Provide a critical mass of scientists and technologists with appropriate specialization in the areas of the BPOA who works closely with national level counterparts in the developing and advancement of the national S and T agenda.
- Assist government with addressing the significant barrier to science and technological innovations which range from knowledge to institutional governance and policies, and legal and regulatory frameworks.
- Provide technical support to the private sector and entrepreneurs on the technologies which manufacturing for domestic or regional markets are potential viable, and facilitating technology transfer.
- Provide quality assurance and control for projects, assistance with patent applications and the training of new professionals.

The relatively low level of science and technology in key areas of vulnerability for SIDS will require substantial initial investment to achieve threshold capacity. Learning from past mistakes SIDS should make sure that in partnership with donors that a dedicated institutional support structure is in place to provide the necessary assistance. Most desirable would be technology transfer and development facility located within the UN systems performing the following functions, in support of science and technology capacity in SIDS:

a) helping to identify and disseminate information science and technology that helps resilience-building in order to address the vulnerability.

b) assisting SIDS in making critical technological choices, providing information on previous experience with the science or technology;

d) facilitating technological systems licenses for the management of waste as a resource, energy efficiency, renewable energy development, through mechanisms such as regional development banks

c) providing technical assistance to SIDS to help them develop institutional arrangements conducive to the registration of intellectual patents, and identification of potential partners for commercialization;

d) facilitating the strengthening of science and technological collaboration with the SIDS through north-south and south-south co-operation;

h) supporting research into new products maximizing the use of existing SIDS resources;

e) catalysising the development of appropriate programmes in support of national and regional efforts to build the science and technological

capacities of SIDS, and particular investments for SIDS appropriate science and technology;

f) assist in providing promotion and protection of traditional knowledge and practices;

g) assisting in the review science and technology activities in relation to environmentally sound technologies and sustainable development;

h) providing technical support to reduce environmental risk in the application of science and technology and in the utilization of indigenous technologies; and the strengthening and further development of SIDS-SIDS cooperation and experience sharing in this area is crucial and should be made a priority, especially in regard to utilizing the national and regional institutions of SIDS.

IV. KEY SUSTAINABLE DEVELOPMENT CHALLENGES – SIDS S AND T AGENDA

To move beyond the general assessment, analysis and conclusion three working groups were established. The terms of reference for the groups were: to identify the key issues that have emerged in the meeting on the topics of 1) water, energy and waste, 2) ICT, intellectual property and policy, and 3) food security, biosafety and biotechnology, based on the presentations, the discussion and on their own experience. They should bear in mind that the points developed for these topics should also have general applicability across other sectors. For each point there should emerge a recommendation, and there should be a set of key steps that would be required to guide implementation of that recommendation. Scale is an important factor to bear in mind, so that where appropriate an attempt should be made to look at national, regional and inter-regional disaggregating. Where appropriate we should identify what are the key inputs or prerequisites for ensuring that these steps guiding implementation will actually occur – such as legal frameworks, information, networking etc. and in this way identify priorities among the BPOA sectoral areas as well.

The deliberations of the working groups

Based on the deliberations of the working groups ??? areas were identified within the context of BPOA for sustainable development of the SIDS, as priority elements for consideration by AOSIS members for inclusion in the national S and T agenda.

Strengthening and Diversifying the SIDS Economy

The diversification and strengthening of the national economy is required to address the growing economic vulnerability of SIDS as concluded by the UNDP SIDS Expert Team[3].

[3] Report of vulnerability and SIDS August 2002 UNDP Policy Journal

The major constraints to economic growth in SIDS continue to be high energy and capital which interact to make the investment return potential in SIDS less attractive than larger countries.

One area where SIDS, by virtue of geographic location, has a significant resource endowment is in renewable energy resources. The development of or partnership to effect technology to capitalize on renewable energy should be a priority for capacity strengthening. SIDS high dependence on imported energy sources causes significant economic burden on the country. Reduction in the level of petroleum import would free up precious financial resources for investing in the MDGs and the BPOA. Renewable energy potential of SIDS developed in am manner where scientific and technological choices result in maximum synergy with other sectors (like waste management, water, agriculture, fisheries, tourism) have the potential be a major driver of sustainable development in SIDS.

Diversifying and strengthening the SIDS economies will require changes in the basic assumptions that underlie investment decisions by all groups of stakeholders in sustainable development. The current investment decision integrates very little consideration of future climate and by extension weather. Climate change and sea level represent factors which now need to be integrated in investment decisions. The entire national policy for sustainable development has to include the increase personal and economic threat posed by changing climate. Science and technology capacity will have to be significant strengthened in this area.

The rapid development of information and communication technology holds the potential of reducing the isolation of SIDS, connecting them more extensively to the rest of the world. This in turn opens up possible new economic opportunities, which have been exploited to varying degrees by the SIDS – e.g., remote information processing, technical support and call center services. Within the context of the development of science and technology in SIDS, there are fledgling initiatives aimed at strengthening ICT literacy and skills development. International support for infrastructure development as well as for supporting the promotion of appropriate policies is required.

While SIDS recognize the potential of information and communication technologies, there is a digital divide within and among SIDS, with new technologies just beginning to penetrate many SIDS. Delays in exploiting the opportunities offered by these technologies threaten to further increase the already wide gaps between developed and developing countries, particularly SIDS.

Strengthening the economy in face of globalization means becoming more competitive, the major area of disadvantages to the SIDS economies are the high price of energy and capital cost, will have to be offset by more productive labour and less costly energy services achieving this will require SIDS to significantly strengthen existing capacity.

Energy and Water

Water like energy are major issues for the 21st century, and the vast majority of SIDS have very limited amounts of the global freshwater (which is only 2.53% of all water) endowment. In other SIDS the growth rate of demand is outstripping supply growth, as agricultural expansion, tourism and settlement combine to reduce the area of catchments. Poor management of waste continue to contaminate subsurface source in the majority of SIDS.

Fresh water resources in the majority of SIDS are very limited, and are in the majority of cases under stress. Managers of this resource face a number present challenges as well as the projected impacts of global warming in the future, which further exacerbate the challenges. Meeting future fresh water requirements will have to come increasingly form desalinization and reuse. Promising technologies in this area are

- ocean thermal energy conversion (OTEC)
    - spray flash desalination
    - direct thermal conversion
- anaerobic fermentation,
- high temperature pyrolisis, and
- reverse osmosis.

Integrated OTEC System produces energy, water and food. Many important materials contained in deep-sea water such as lithium – 5% more than in normal seawater. Almost all SIDS are good candidates for application of OTEC. A 10 MW land based plant takes about 10,000 square meters, a submerged plant is only 50 m in diameter. . Efficiency of the system is only 5-6%. Future projections of oil price based on proven reserves [4] confirm the time is right for the commercialization of OTEC system. SIDS leadership need to develop a partnership with developers in Japan to undertake commercial demonstration of technical and economic feasibility. The major obstacle with OTEC is the high initial investments. However while capital costs may be high, the project will pay for itself in short time, with water and cheaper electricity in comparison to diesel fuelled systems. Technology should preferably be transfer on a build-operate-transfer rather than the purely commercial sale of energy and water. The demonstration must also include capacity building and maintenance training. Commitment has to be there for establishing the technologies in SIDS and for making it work.

Waste heat to use as source of energy for desalination is a technological that the water stressed SIDS who are now using desalination or consider for large scale fresh water production should consider. Waste heat from industries, utilizing the methodology of the Uehara cycle of OTEC, and spray flash evaporation can be used to produce fresh water from the ocean cheaper than any other technology. .

Energy

SIDS as mentioned previously have significant renewable energy resources, but continue to rely very heavily on imported petroleum. In order to benefit from this vast resource

[4] University of Uppsala study -- Kjell Aleklett, Uppsala University, Sweden, and president of the Association for the Study of Peak Oil & Gas, quoted in the New Scientist vol 179 issue 2406 - 02 August 2003, page 9

SIDS will need to act in a collaborative manner to effect technology transfer, demonstrations to develop credibility. There will also be need to put in place capacity for training in the operation and management of these technologies. The technologies recommended by the meeting for consideration into the national S and T agenda are:

- Biofuels – fuels produced from plants that can supplement for petroleum.
    - Plant oil to substitute for diesel fuel
    - Ethanol to substitute for gasoline
- Anaerobic fermentation (production of fuel for multiple use – electricity, lighting or cooking) of organic waste
- Tidal and Wave energy
- Biomass Cogeneration
- Wind and geothermal
- Solar PV

SIDS have debated energy and sustainable development for some time, and in addition to promoting renewable energy the other and most beneficial in the short term is energy efficiency. Recommendations from the SIDS Expert meeting on Energy for Sustainable Development of SIDS, Niue, July 2003 included cooperative action by SIDS for:

- Disseminating technology options for improving end-use energy efficiency in the residential and commercial buildings sector, including wider diffusion of technologies, such as more efficient equipment and appliances; efficient heating and air-conditioning systems; and more efficient building envelope designs.
- The introduction and adoption of tariff and customs reform to encourage the wider utilization of energy efficient appliances and equipment through star rating programs and the introduction of minimum energy performance standards for equipment and appliances will assist in meeting these requirements.
- Establishing institutional mechanisms that are required for regulatory and legal frameworks for implementing policies on incentives; energy efficiency standards and labelling of equipment; and incentives for the private sector and communities to contribute to achieving the intended goals

Fresh Water Resource s Management and Protection

Sustainable water supply and water security could be achieved in many of the water stressed SIDS, through technology based on solar energy and hydraulic lift pump, by combining the use of *solar* (thus using renewable energy) and *Clarke pumps* (Clark pumps are desalination pumps that work solely by the application of pressure – around 80-100 psi) with scavenger well couples, based on relatively simple technology. The meeting heard progress on an ongoing initiative supported by the United Nations to develop and demonstrate technology that produces fresh water from saline aquifers that were previously not a source of potable water. Among the key lessons leant from the initiative is the many benefits to be gained from collaboration among SIDS scientists and underscored the need for demonstrating, documenting and disseminating SIDS-relevant technologies more widely.

Singapore expanding production of NEWater from non-industrial waste water is evidence that science and technological innovation in partnership with public education and

awareness have the potential to address sustainable development challenges in a very effective and comprehensive manner. NEWater produced from the collecting of the wastewater and use the effluent rather than discharge to sea. Technology based on use of microfiltration and reverse osmosis and meetings all the various standards for drinking water, as well as WHO and US EPA standards. The three plants in operation process 45 million gallons per day. Current uses are direct non-potable use in industry and then indirect potable use by passing it through the reservoir. Electronic wafer industry uses the NEWater extensively. It is also used in industrial and commercial cooling.

Given that critical nature of fresh water in a number of SIDS a special paper was prepare on water with recommendations as to how SIDS that are water stressed can improve fresh water availability through the use of S and T, this paper is attached as Annex1. The paper as did the participants in the water working group recommended that in the critical area of fresh water SIDS collaborate to build capacity in the following technologies

- Waste water stream analysis and conversion to usable resource
- Desalination and purification techniques that are suitable for SIDS situations
- Maximization of existing water resources using eg scavenger wells and advanced water catchments techniques and retention structures
- Desalination using waste heat from industries

Pollution Prevention – Waste Management

The current state of waste management and its impact on the overall environment of SIDS is documented in a report to the UNDP resilience series report on ***Waste Management in SIDS*.**

The meeting heard experiences with the use of different technologies and practices in waste management. Technologies which operated in the circumstances defined by scarcity of land and always increasing quantities, and varied levels of public awareness, and institutional capacity. Very successful example of large scale solid waste 3000 tons per day, management was presented by Singapore. Who now are recycling 47 percent of solid waste looking to increase to 60% by 2012. Aspects of the Singapore system include mechanical sorting of waste, plastics that are pre-consumer wastes are recycled, metals are recovered from electronic wastes

Examples of negative impact on public health from water pollution linked to animal waste and how simple science and technology in the form of biogas plants (anaerobic fermentation) was used as the means of protecting the public from ciguatera poisoning in some Pacific Islands, where pig rearing is part of the culture. Examples from the Caribbean showed a high degree of dependence on imported technologies with very little policy or legal encouragement.

In none of the regions was there any organized structure at the regional level for government policy and decision makers to exchange experience. Such exchanges would help in the selection of technologies. Given the similarity of the situation with waste in the vast majority of small islands there is significant potential for collaboration in the

strengthening of waste management capacity, this is among the recommended early action by the SIDS Expert Meeting on Waste Management.

The Singapore experience was notably different from the rest of SIDS, although seeing rapid development, the country has done so without experiencing many of the waste related environmental problems that exist in other SIDS, and for which solution are being sought. The Singapore approach started out as command and control, then transitioning to a partnership stage, and now seeking to have national ownership of the environment. Major pollution issues are clean air and water issues. Emerging pollution issues are in air pollution (new pollutants such as PM 2.5) as result of the increasing wealth and urbanization, which has also resulted in greater pollution, CO2 emissions and increased petroleum use. Country produces daily some 3000 tons of solid waste which is all collected and 47 percent recycled.

National ownership of the environment will move the country from environmental performance to environmental sustainability in which the population takes ownership of the process and participate active. Success requires improving the social progress to establish buy-in from the population. This desire for environmental stability, which is applicable to all SIDS, is driven by the need to be innovative and efficient in the use of scarce resources a lesson that should be well understood in all small islands. The major difference between Singapore achievement and the SIDS search for solutions, is the high level of investment that country made in developing capacity to apply science and technology to waste management. This is validated by the number of waste processing enterprises that currently exist in Singapore compared to the other Small Island. The next pollution and waste management problem where technological capacity is being built is for going beyond emissions standards to finding the solutions, such as green vehicles and other innovations for alternative uses of waste, such as waste minimization, using waste ash for road construction projects. It assessing Singapore enviable achievements it should be pointed out that the size of their population provides for advantages of economic scale, that exist in only a few other small island.

Based on the experiences and information provided through presentations from the experts there are a number of waste management technologies and techniques that SIDS should evaluate for capacity building, they include:

- Science and technologies that have the characteristics to use various components of solid waste as a resource to provide goods or services for domestic or foreign markets, they are:
    - Low temperature and low pressure pyrolysis for the conversion of plastics and tyres in petroleum products and construction material.
    - Composting – Vermiculture, Aerobic
    - Anaerobic fermentation – biogas
    - Thermal waste to energy systems – gasifiers, incinerators
- A number of recycling technologies and techniques that should be investigated by the tertiary institutions in Small Island to access potential compatibility with the problems, the social and economic realities, and level of awareness. There is also

some experiences available form some techniques that have been tried out in different parts of the SIDS, and through mechanism such as SIDSNet, there is need for a concerted effort to ensure documentation to support replication of the best methods. Additionally recycling is stymied by lack of raw material specification in writing, high capital and operating costs and very vulnerable to political decisions and cultural practices, creating a need for model recycle legislation to help the vast majority of SIDS, who have yet to implement legal requirement for recycling and container return, to assist ongoing initiative for recycling by the private sector. The techniques include shifting SIDS towards an integrated waste management approach in terms of reducing, re-using or recycling as far as possible, and seeking agreements with exporters to accept recycled containers in return. SIDS need to:

- characterize the waste stream – sources and types of waste, spatial and temporal
- undertake surveys of best practices and appropriate technologies
- develop cooperative approaches to strategic planning in regions and across SIDS

Ocean and Marine Resources

As pointed out in the Expert Meeting on *Ocean Management* SIDS have their largest resource endowment in their Exclusive Economic Zone (EEZ). The report of that meeting recommends a number of actions at the national regional and inter-regional level to position SIDS to derive significantly more benefits from this asset in order to lessen the pressure on other resources and provide additional resources to support the growing expectations and material needs of the people. Realizing benefits from this resource will require significantly increased capacity on the part of SIDS in key science and technology areas, including:

- Marine biology
- Coastal geomorphology and marine geology
- Coastal and ocean area management approaches that more effectively integrate linkages and interactions between land use practices in the watershed, and activities within the marine/coastal area.
- Restoration of critical degraded marine habitats and ecosystems including coral reefs and seagrasses, and their associated biota.
- Design and application of low-cost, appropriate, environment-friendly fish (and other marine resource) harvesting technologies
- Ocean Energy Systems
- Coastal and marine Engineering
- The design, implementation and maintenance of marine monitoring and surveillance systems and equipment

Food Security – Biotechnology and Biosafety

SIDS as a result of changing food preferences, costs, global trading agreements, growth in tourism and population are becoming more dependent on food importation. In the Caribbean for example another aspect of SIDS trade is the heavy and increasing dependence on imports for strategic products such as energy and food. The CARICOM

food import bill increased by 47 per cent between 1994 and 2001. A particular area of concern has been the high cost of obtaining energy services from petroleum sources. This concern seems set to be heightened by the recent decision of Shell/Chevron to reduce estimates of its oil reserves by 20 per cent. This action comes in the wake of the published results of a study by a highly respected Swedish group of scientists that suggest that estimates of global oil reserves have been grossly overstated. Whether these assertions are proven correct or not, it is anticipated that Shell/Chevron will most likely be emulated by other oil companies. If this should happen, SIDS can expect a dramatic increase in the price of oil-based energy products and services.[5]

SIDS like Asia in the early part of the 1960s and 70s are facing a future of food insecurity. The case in SIDS is however not driven by population growth per se., but rather is the result of a combination of issues relating to the history of agriculture in SIDS, particularly the relationship with their trading partners. As a result of the coming into force of World Trading Organization (WTO) rules, the historical trading partners of SIDS can no longer pay a higher price for agricultural products such as sugar, bananas, copra, coffee cocoa, which were the historical foundation of the agricultural and in the majority of case the national economy as well. Without special price support mechanisms, SIDS as pointed out in the UNDP report on *The Growing Vulnerability of SIDS the Challenge of Building Resilience,* are not able to be competitive against big volume producers in agricultural commodity production because of a combination of factors including: the high cost of production due to small physical space which limits benefits of scale, high energy and capital cost, and very high transportation costs.

As earnings from the agricultural sector represented a major part of the financial resources to pay for food imports, these countries must now develop a response to improve the food security status of the population. The international agencies with mandates for providing technical assistance to SIDS have proposed various strategies, including (i) crop substitution in which there is replacement of the commodity crop with food crop(s) for domestic or export markets or combination and (ii) replacement with another commodity with better market prospects, but no guarantee that large producing countries will not also follow market signals and create the same situation for small producers in the future. While there are a few examples of successful diversification from commodities, what has been more successful has been the application of science and technology to product diversification. For example corn is no longer simply a source of carbohydrate for human and animal consumption, but also thanks to technology, it is the raw material for sucrose widely used in the beverage industry, and the manufacture of margarine, oil, and ethanol. Similarly, crops such as peanuts and soybeans are not merely used for eating and the production of oil, respectively, but are now the raw materials from which a much wider range of goods are manufactured..

Two of the major commodity crops grown in SIDS have potential for different products through use of science and technology. Sugarcane and coconuts have already shown this potential and SIDS who are traditional producers of these crops should begin developing

[5] Statement by Edwin Carrington, SG of Caricom, to the Inter-regional preparatory meeting, Nassau Bahamas, Jan 2004.

collaborative mechanisms to build capacity in these areas. As discussed earlier in the energy section of this chapter, biofuels could be a major product of the renewable energy industry in many SIDS. A sound biofuels industry will make a major contribution to food security, through employment creation and increasing the availability of foreign exchange to pay for imports.

Threats to SIDS food security also come in the form of safety considerations. In an effort to protect consumers and the environment a number of global biosafety agreements have been authored during the last decade. This agreement range from protocols governing movement of organisms, to the release of bioengineered material into the environment. Many of these agreements will require additional capacity to assess quality and issue legal documents. The capacity in bio-safety is extremely limited and need much more attention as it will figure prominently in SIDS ability to export in the future. Similar to the recycling issues most SIDS suffer from the absence of appropriate enabling domestic legislation which is hindering ratification of the biosafety protocol.

On the issue of biotechnology the meeting was told of the differences between the use of genetic engineering and biotechnical issues, with particular emphasis on environmental and socio-economic impacts and ethical issues. Developing countries were pushing for biosafety approaches to food security since there was the view that they did not understand the risks, or had the ability to control the risk management strategies. It is clear that there is very little data about the actual risks of the food safety issues in consuming GMO foods. Many independent studies have lacked follow up and further research. Environmental impacts are potentially serious and need to be understood and SIDS need to better understand the full implications of the *principle of prior informed consent*. Questions arose as to whether SIDS should even be involved in biotechnology given the whole range of other priorities that face these countries. The meeting agreed that biotechnology and biosafety are priority areas in which SIDS must build capacity, but that this would be best done through regional approaches that involve, *inter alia* the following key elements:

- Filing of patents
- Comprehensive risk assessment and management for SIDS
- Common framework legislation and national regulatory instruments that protect the interests of SIDS. This should include the setting of minimum standards for use.
- Development of a SIDS data bank/clearing house for biotechnology and biosafety information . This may be achieved either as a mandate of the Consortium of Universities or through SIDSNET.
- Preparation of inventories of current use of biotechnology and biosafety products (e.g. LMOs; GMOs), as a first step in evaluating their safety.
- Design and implementation of a common administrative framework/system for compliance with the Biosafety Protocol.
- Preparation of a Roster of Experts on biosafety and biotechnology, to be updated on an ongoing basis.

Climate Change

SIDS are among the most threatened by the future prospects of climate change and sea level rise despite making no significant contribution to global greenhouse gas emissions.. As the national communications to the Framework Convention on Climate Change (FCCC) from the SIDS become available, a recurring pattern is emerging. All SIDS have very low emissions of greenhouse gases, even when measured on a per capita basis. In addition, SIDS have in many instances reduced their emissions and in many cases have taken significant steps to curtail further growth in emissions by implementing a range of policy options.

There are quite a few proven and technology and energy conservation principles for reducing emissions, already in the SIDS, however not widely deployed. Reducing emissions through the use of renewable energy and energy efficiency technologies makes sense for SIDS as it also reduces their reliance on imported fossil fuels. Which in SIDS this is more of a national priority for the short and medium term than meeting the obligations of international convention. The real science and technology in SIDS is for minimizing vulnerability to the likely effects of climate change as documented in the most recent IPCC report.[6]

The assertion that the costs of combating climate change is simply too great to bear for the large developed countries is faulty, as the IPCC report shows emission is caused primarily by the energy sector. Many experts have carefully considered the reported emissions profile for most of the developed countries (through their national communication). It is apparent that many countries are indirectly subsidizing energy wastage, and that industrial energy consumers are not paying the true price of energy. It is clear that the growth industries are no longer in the carbon-intensive sectors. It is also clear to us that the political will to address the issue of climate change is still missing.

In this context the development of the science and technology capacity for SIDS becomes a clear priority. Apart from those areas mentioned earlier under the sub-themes of energy and water, waste management, biotechnology and food security, key capacity building needs include:

- Science of risk management.
- Development and application of decision-support tools, e.g. multi-criteria analysis, integrated assessment modeling
- Design of appropriate construction codes
- Comprehensive disaster management
- Design and application of early warning systems
- Development of climate change scenarios appropriate to the reality of islands, asd the basis for making future projections
- Downscaling of global and regional climate models to the 'island scale'
- Research on extreme events (e.g. tropical cyclones/hurricanes, floods, drought) and their implications for building resilience and designing adaptation strategies

[6] IPCC Third Assessment Report, Working Group 2, Climate Change 2001: Impacts Adaptation and Vulnerability, Chapter 17, Small Island States.

- Research and development in adaptation technologies for the various economic and social sectors
- Refinement and further application of renewable energy technologies

Management of Intellectual Property Regime – Traditional Knowledge

The intellectual property of SIDS (including biodiversity, traditional knowledge and culture) is considered as one of the major resources that must be developed to help relieve pressure on the natural environment to provide livelihoods for a growing population with rising expectations. "The survival of small island developing states is firmly rooted in their human resources and cultural heritage, which are their most significant assets; those assets are under severe stress and all efforts must be taken to ensure the central position of people in the process of sustainable development."[7]

The main issues facing SIDS in the area of culture relate to both the social and instrumental value of culture in development, and importantly, to the less emphasized economic value of cultural manifestations and expressions of SIDS. The challenge faced by SIDS is how to maximize the commercial benefits of culture while ensuring the continuity of the role of culture in social stability, preservation of heritage and diversity, and positive reinforcement of national and regional identities, especially for youth.

As regards the social and instrumental value of culture, SIDS are challenged by how to safeguard and promote their tangible and intangible cultural heritage for national and regional development. There is an urgent need to adopt appropriate legal, technical, financial and policy measures for the protection and promotion of cultural heritage in areas of importance to SIDS such as social practices, rituals, traditional knowledge, visual and performing arts, festivals and national languages. The promotion of heritage with special attention to the engagement of indigenous people in the process, and stimulation of the unique creativity of the people, is also among the areas for priority attention elaborated by SIDS.

Experience from the Pacific suggests that a good IPR could potentially solve issues related investment climate, promote development, protect TK and protect genetic resources. But what has been happening is detrimental. Kava has been sold as a crop to pharmaceutical firms without appropriate compensation for the thousands of years of usage of the kava extracts in the Pacific. The DNA of the Hagahai tribe of PNG was sought patented in the US by a research company. The one relatively successful example revolves around the mamala tree in Samoa, where the resource owners will be paid a small fee for the benefits accruing to the research company. However, the concerns of other SIDS where the tree is also present have not been addressed.

There has been some progress in that there is now recognition in Vanuatu of traditional IP – in particular that of the Pentecost islanders and the original bungee jumping. Legislation was enforced to ensure that persons from other islands were prohibited from calling their bungee jumping by the same name as that used by the Pentecost islanders.

[7] Review document for Mauritius International Meeting

But for the most part IP legislation where it exists is all based on western models, and is not even being applied forcefully. There is inadequate protection for TK, natural resources and culture. Specific legislation has been tried in the model law on TK and expressions of culture.[8]

There is a concomitant need to ensure that new intellectual property created within SIDS is protected and nurtured from the outset without impairing the ability of SIDS to capitalize on existing traditional knowledge and cultural property which may already be effectively protected. In this regard SIDS should be mindful of Trade Related Aspects of Intellectual Property Rights (TRIPS) language in the WTO which promotes monopoly privileges of trans-national corporations and impedes developing countries from realizing their full developmental potential. These privileges supersede those of entire countries as well as local communities. For example, more than 90% of patents on living organisms and the processes needed to identify, isolate and engineer genetic materials are held by corporations in the North.

TRIPS legally grant private monopoly control rights that effectively hinder future innovation. TRIPS are inherently anti-competitive and anti-development. New dangers lurk in the regional FTAA 'TRIPS Plus' agenda which may go even further than the WTO to promote the interests of large pharmaceutical companies at the regional level even while they may be somewhat constrained multilaterally. The FTAA could go further in granting monopoly to corporations by extending their patent rights. The SIDS agenda must include negotiation of agreements, which acknowledge country, and community ownership and can thus protect the traditional knowledge and cultural property rights. SIDS must also assert their freedom and flexibility to determine and adopt appropriate regimes of sui generis systems that provide maximum protection for their artists, farmers, breeders and local communities.

The following could be pursued by AOSIS:

1. TRIPS negotiations should advance the case for recognition of the unique situation of SIDS, and the need for special protection of their community rights within the context of their traditional knowledge and cultural heritage being recognized as a special form of intellectual property – sui generis flexibility. Argue the case for companies and individuals to obtain prior consent from governments, with the participation of local communities, before having access to SIDS cultural and biological resources. Adopt the position that individual and corporate applicants should identify specific resources, the purpose for which they request access, the benefits foreseen and how these benefits would be shared with the state and community. Develop protocols that require corporate and individual applicants to agree not to apply for patents over community knowledge or innovation.
2. Train a pool of SIDS experts with the knowledge to address disputes.
3. Develop a specialist Center for Biological Diversity of SIDS as a gateway for sharing of expertise on the genetic resources of SIDS and their sustainable development.

[8] See Miranda Forsyth 2003 7 Journal of South Pacific Law.

4. Lobby for international assistance through UNCLOS and other agreements (bi- and multilateral for resources (technical and financial) to fully demarcate the EEZ of SIDS.
5. Develop/strengthen public awareness and education programs to inform the population of importance of traditional knowledge, cultural assets, and biological diversity (land and marine).
6. Consider establishing a SIDS task force to begin work on protection and commercialization of biodiversity resources

There is a need for a new partnership with the international community to support should support SIDS in order to:

- Access and coordinate donor funding support for priority renewable energy initiatives to achieve economies of scale;
- Access to and information on efficient and low maintenance alternative energy technology, instituted after careful evaluation of economic, social and environmental implications – also for other fields identified in the Singapore meeting
- Access and develop human resources for the regional renewable energy sector – also for other fields identified in the Singapore meeting
- Develop mechanisms to encourage R&D and private sector investment in priority renewable energy projects.

IV. RECOMMENDATIONS

The meeting agreed to submit a number of proposals for consideration by AOSIS membership

i. Development of Regional Centres of Excellence for S and T. Considered by the participants as critical and a prerequisite to the development of national capacity in critical areas such as climate change and sea level rise.

ii. In each field of professional availability there is need for strengthening and maintaining networks of SIDS professionals. Too often development projects and programmes in SIDS seek to recruit external expertise, rather than use the services of qualified professionals available in national or regional institutions, as well as in other SIDS countries. The meeting recommended urgent updating of the SIDS *roster of experts* , and its early utilization by the UN system, and other donor organizations. It should also become the resource of first choice for sourcing of professionals for projects to be implemented in SIDS.

iii. Governments must ensure that there is greater political and administrative support for science and technology in SIDS, particularly for applications that are either produced in SIDS or have particular relevance to SIDS.

iv. The meeting emphasized that decision makers and their constituents in SIDS must recognize that technology is not only hardware, but also involves the *modification* of such hardware and the application of systems and *processes* . Actual examples

were presented that demonstrated how simple modifications of existing technologies had rendered them appropriate for SIDS. Likewise, examples from some SIDS were also highlighted that showed the disastrous consequences that could result from the adoption of inappropriate, unmodified technologies.

v. The meeting lamented the fact that there are too many economic sectors in SIDS that still fail to recognize the valuable contribution that science and technology could make to their growth and sustainability. It was recommended that Governments needed to urgently explore the greater contribution of science and technology to sectors such as tourism, the sourcing of niche markets, as well as the development of new products from traditional crops or underutilized produce.

vi. There needs to be an analysis of the current legal and regulatory frameworks, in order to (a) assess the various barriers to science and technology implementation and innovation (b) develop solutions to overcome these constraints and (c) eliminate conflict among different pieces of legislation in the same country. This should lead to the building of a national legislative framework and improved institutional capacity to evaluate and manage technologies, taking into account the concerns of the private sector and the wider community. Further, it was agreed that SIDS should be assisted in developing appropriate enabling legislation including policy frameworks, before being 'forced' to ratify or adopt international conventions and treaties from which they could not extract immediate benefits.

vii. There is also a need to adopt comprehensive government policies on science and technology applications in SIDS. The approach must be truly integrative and inter-sectoral, ensuring that the tendency to perpetuate "empire building" in the various ministries and other organs of Government is discouraged. The experts also cautioned that the policies should also seek to ensure that technologies selected for application in one sector do not negatively impact other interests in the same or other sectors. In this respect, some appropriately configured clearing house mechanism for assessing the efficacy of technologies would be helpful.

viii. Matters relating to copyright and intellectual property rights constitute major impediments that frustrate the ability of SIDS to commercialize and market many products, especially where these countries have a comparative advantage. Equally, SIDS must be aggressive and vigilant in ensuring that intellectual property rights and patents are not claimed by countries or their agents, that are not properly entitled to such rights.

ix. The meeting stressed the need to develop innovative, national and regional policies and strategies for waste diversion and for recycling, inclusive of *product life -cycle analysis* . This would reduce the dependency on processing and disposal technology. It was further agreed that this exercise should be combined with the development of product importation guidelines and

capacity for technology assessments at the national and regional levels. In addition national *waste characterization profiles* should be carried out as a basis for designing solutions for each segment. The experts reiterated that waste management responsibilities should be decentralized, but acknowledged that in order to be effective, this process requires the infusion of adequate resources. It was also agreed that SIDS needed to take due account of international regulations on waste management when developing regulations, frameworks and programmes of regional cooperation. It was agreed that meaningful progress could not be achieved in this sector unless SIDS sought to establish appropriate incentives for waste management. The experts acknowledged that there were many different approaches to waste management, but noted that there were already simple but effective strategies operating in some countries such as *command and control* , e.g. container-return legislation, or legislation that rewards the entrepreneur for incorporating elements of waste reduction in his operations.

x. It is vitally important to ensure that sustainable development *demonstration projects* are implemented to identify and capture special opportunities for science and technology applications in SIDS. In this context, the meeting was in full agreement that there should be a well-coordinated science and technology display at the International Meeting in Mauritius. It was felt that the exhibits should span a range of sectors, including information on the application of solar, OTEC and other renewable energy technologies.

xi. The experts cautioned that SIDS must recognize that it is not always necessary or prudent to seek complex high-tech solutions, where low-tech applications are more appropriate. For example, experience in many SIDS has shown that it is possible to effectively confront various environmental health challenges by adopting simple community health programmes.

xii. Training in applied sciences and the sharing of experiences through various media, including the SIDS universities consortium, are vital opportunities that must be grasped by decision makers in all SIDS regions. In this way, countries can better exploit the benefits of learning from successful examples of science and technology applications in other SIDS, and eschew the path of failure.

xiii. Increase collaboration among tertiary institutions in the SIDS through the SIDS University Consortium. As stated in other meetings, it was reiterated that part of the mandate of the university consortium should be the development of strategic approaches to science and technology development in SIDS. Similarly, the consortium should also seek to ensure that published research does not abrogate the intellectual property rights of local communities. This could be accomplished by enforcement of a strict code of ethics.

xiv. It was agreed that since energy availability and costs are impediments to the achievement of sustainable development, energy audits in the industrial, commercial and domestic sectors should become routine requirements in SIDS. The process should include options for retrofitting and redesign so that energy use can be made more efficient, and 'waste' (including water) reduced, recycled or converted to other useful products.

xv. The meeting recommended that SIDS should establish a roadmap for the commercialization and better understanding of biotechnology applications in their various regions, with the flexibility to engage in inter-regional cooperation. SIDS should be insistent that there be some special recognition of the particular risks and challenges they face, in particular in relation to international liability and redress. In this regard, SIDS must urgently adopt appropriate biosafety frameworks based on their individual priority interests in biosafety. Such frameworks should not be designed solely for the purpose of facilitating the import of LMOs, but should cover a range of possibilities that include considerations of risk management and the option to impose a national moratorium, where this action is in the country's best interest.

xvi. The experts agreed that more research on technology applications in SIDS should be undertaken. As an important element of this research, there should be more comprehensive assessments of the overall impact of the use of various technologies (environmental, social, economic, cultural), including their efficacy under different scenarios, e.g. climate change.

xvii. The meeting acknowledged that managing the transition to achieve more effective and efficient use of ICT technologies in SIDS will require considerable vision and political championing. The approach to the implementation of ICT must be sustained and systematic, and should be supported by appropriate demonstration projects in the various sectors. The process therefore urgently requires support to improve the capacity and skills of SIDS leaders and decision makers, charged with the responsibility of overseeing the implementation of appropriate ICT initiatives in their countries.

xviii. There is a need for recognition that appropriate scientific advances in SIDS do not always result in appropriate technological applications of that science. This disconnect requires special attention by SIDS governments and institutions.

In addition to the foregoing specific recommendations, the experts concluded that the following broad, guiding principles should be considered for adoption by all SIDS:

• Policy Review: Design and enhance policies and regulations to ensure that foreign researchers and institutions (i) provide to appropriate local agencies, national government and other appropriate agencies, 'raw' data (in hard copy and electronic format) gathered

in SIDS jurisdictions and (ii) seek and receive approval from the relevant SIDS to publish and disseminate research findings generated from such raw data.

- Legal Reform: Strengthen efforts to develop and enforce legislation on intellectual property at the national level. Establish and maintain systems to protect against unfair or illegal exploitation of indigenous or community property rights e.g. bio-piracy.

- Fundraising: Secure international commitment and support for the establishment of regional research-funding agencies.

- Capacity Building and Training: Place stronger emphasis on science and technology programmes in the curricula of both secondary and tertiary institutions in the regions.

- Stakeholder Participation: International commitment and support for efforts to ensure that research, especially that extracted from local communities, benefits the sustainable development of those communities, and involves their participation.

- Research:
  (i) Promote greater synergy between academia and industry, to maximize and enhance the impact of science and technological development on national productivity and competitiveness.
  (ii) Assign responsibility to specific regional entities centres to promote and disseminate information on resources available for research from alternative funding sources such as foundations.
  (iii) Support the establishment of a biodiversity centre at tertiary or other appropriate institutions within of SIDS, which would collaborate and share information with similar institutions in the various regions.
  (iv) support for targeted research on practical sustainable development actions at the national level, such as in the areas of inshore fisheries, coastal management, climate change & SLR adaptation options; and valuation of natural resources.

- Public Awareness of SIDS-Appropriate Technology: Increase public awareness and disseminate information on science and technology methods and adaptations of technology that have been successfully applied in other SIDS, and which could have benefit for other communities. Equally, the meeting expressed its strong support for greater utilization of SIDS-appropriate technologies, and urged that Governments should first investigate the availability of such technologies before resorting to applications designed for non-SIDS jurisdictions.