

DEVELOPMENT OF INNOVATIVE SYSTEMS FOR PROGRAMME AND REVENUE GENERATION FOR ASEAN S&T

Terminal Report

Summary

This report presents project implementation activities undertaken by the ASEAN Committee on Science and Technology (COST) Sub-Committee on S&T Infrastructure and Resource Development (SCIRD) from October 2001 until June 2004. The project has successfully achieved its objectives, and has enabled ASEAN to gain more understanding on innovative strategies for generating resources to support S&T cooperation projects. Based on a study made by the Consultant engaged under the project, and also an expert group meeting to review the report of the Consultant, SCIRD approved a business plan on the ASEAN S&T Management and Commercialisation System (ASTMACS) as a test case. Under the initiative, a project on Market Analysis: Survey for Managing and Commercializing S&T in ASEAN is currently being implemented as a first step towards operating ASTMACS.

Background

Since the decision taken at the 8th Meeting of ASEAN Ministers of Science and Technology in Hanoi in September 1998 and the declaration of the Ha Noi Plan of Action in December 1998, ASEAN Committee on Science and Technology (COST) is committed to creating a framework and supporting mechanisms to promote the development of innovative systems for S&T programme management and revenue generation. This direction was further reinforced by the adoption of the ASEAN Plan of Action on Science and Technology 2001-2004, which sets down strategies for managing the regional S&T enterprise, collaborating with the private sector and dialogue partners, developing S&T human resources, generating income, and providing mutual assistance so as to achieve sustainability and expedite economic development and ASEAN integration.

Subsequently, in 2001, COST obtained funding from the Perez-Guerrero Trust Fund (PGTF), administered by UNDP, to develop an operational plan for revenue-generation mechanisms with the view to implementing the plan through a test case drawn from COST programmes. To formalize the cooperation between ASEAN and PGTF, a Project Document was signed in April 2001 by Mr. Rodolfo C. Severino Jr., Secretary General of ASEAN, on behalf of the ASEAN Secretariat, and Mr. Francis Blain, OIC, Special Unit for TCDC, on behalf of UNDP. The COST Sub-Committee on S&T Infrastructure and Resource Development (SCIRD) was then tasked to undertake the project through the help of a consultant.

Objectives

The immediate objectives of this project were:

- to review the output of the ASEAN COST Brainstorming Session and use it as a basis for designing practical and realistic systems for generating and managing funds to support ASEAN activities in science and technology,

- to examine options and mechanisms for the establishment and operation of autonomous enterprises to be spun-off from previous ASEAN COST undertakings,
- to identify a test case for a spin-off enterprise, and
- to develop a business plan for such test case.

The attainment of these immediate objectives will lead, in the long-term, to the enhancement of S&T cooperation in ASEAN, with the clarification of innovative strategies for generating resources to support science and technology cooperation projects and thus provide some solutions to address sustainability issues.

Project Performance

1. Execution of Activities and Report by the Consultant

Recruitment of the Consultant

The project experienced some delays in its implementation due to some difficulties in engaging a qualified consultant from ASEAN. However, when a consultant was eventually engaged, the project made a significant progress.

Dr. S.K. Chou was engaged as the consultant of the project in September 2002. To formalize Dr. Chou's engagement, a Special Service Agreement (SSA) was signed on 16 December 2002 by the Dr. Le Dinh Tien, SCIRD Chairman, and Dr. S. K. Chou. Following the endorsement of the consultant's Project Inception Report by SCIRD, the consultant started his assignments as stipulated in the SSA.

Experts Group Meeting

An Experts Group Meeting was held on 1-2 August 2003 in Ha Noi, Viet Nam, to review the draft report prepared by the consultant. The Experts Group Meeting, attended by almost all ASEAN SCIRD focal points or their designates, reviewed the draft Report of the consultant and suggested key decisions points for further consideration by the consultant in finalising his report covering aspects, among others, such as (i) intellectual property right (IPR); (ii) technology/invention disclosure, (iii) technology licensing office; (iv) sustainability of the proposed framework, (v) business plan of ASTMACS, and (vi) ASEAN-help-ASEAN context of the project.

The Meeting requested the consultant to finalise the report for the review and endorsement of the 27th Meeting of SCIRD to be held on 22-23 September 2003 in Ho Chi Minh City, Viet Nam, and subsequently the 46th Meeting of COST on 24-26 September 2003 to be held at the same venue.

Submission of the Final Report of the Consultant

The Report prepared by the Consultant entitled "Innovative Systems for Programme and Revenue Generation for ASEAN S&T" covered the following:

- a. An overview of the project and the framework of programme management and revenue generation;
- b. A business plan of the ASEAN S&T Management and Commercialisation System (ASTMACS) as a test case; and

- c. Suggested organisation and management structure for a future COST in relation to the proposed initiative.

Taking into account all comments made during the Experts Group Meeting, SCIRD endorsed the revised Report presented by the consultant. The Consultant Report, which appears as ANNEX 1, has been circulated to the ASEAN member countries.

Development of A Business Plan of ASTMACS as A Test Case

As recommended by the consultant, SCIRD developed a project proposal on ASTMACS. The proposal was submitted to the Government of Australia for funding consideration through the Regional Partnership Scheme (RPS) of the ASEAN-Australia Development Cooperation Programme (AADCP). As a first start towards operating ASTMACS, the AADCP provides support to implement an activity of project on Market Analysis: Survey for Managing and Commercializing S&T.

As an initial activity under this project, SCIRD, at its Meeting on 7 June 2004, has approved the implementation plan for a project. The project aims, among other, to undertake a market analysis to determine what services the potential users of ASTMACS require of it. The outcomes of the survey, expected to be compiled by November 2004, will be used to better define how ASTMACS will operate and how it will be implemented.

Upgrading of the ASEAN Science and Technology Network (ASTNET) Website

As outlined in the Consultant's Report, the strategy for implementing ASTMACS covers, among other, the need to upgrade the existing internet based ASEAN Science and Technology Network (ASTNET) to provide ready access by ASEAN S&T agencies to existing and future S&T databases in ASEAN. In this connection, and in support of the initiative of ASTMACS as a test case for a COST spin-off, the ASTNET Website, currently hosted by the ASEAN Secretariat was upgraded. The Website currently uses a new software equipped with additional features to improve the performance of the system. In addition, it can now accommodate a larger number of registered users. The upgrading also included the redesign of the Website appearance. Overall, the upgrading was just part of making the Website more ready to be a revenue-generating enterprise.

2. Funds Management

Financial Statements

The financial statement of the project as of 30 June 2004 appears as ANNEX 2. The balance of the project funds stands at US\$ 2,389.00. All receipts pertaining the release of project funds and also SSA for the Project Consultants are being kept by the ASEAN Secretariat.

Release of Project Funds by UNDP

Following the completion of the signing of the Project Document, the UNDP office in Jakarta released in October 2001 the first payment of the funds in the amount of US\$30,600. This amount represents 90% of the total funds approved (US\$34,000). As stipulated in the Project Document, the remaining funds of US\$3,400 will be released upon satisfactory completion of the project and submission of relevant reports by UNDP.

Disbursement of Funds and Financial Statement

As of now, the total disbursement of the funds is US\$ 28,211.00. This amount was used to support the following activities/activity items:

- Expert Group Meeting, Hanoi, 1-2 August 2003
- Payment of Project Consultant
- Upgrading of ASTNET Website

Outstanding Payments

In accordance with the SSA, the last payment of the consultancy fee amounting to US\$2,760.00 will be made upon satisfactory review of the Terminal Report by UNDP. This payment will only be made once the UNDP releases the remaining project funds. In connection with this, an official Financial Statement of the project will therefore be issued and submitted to UNDP once all outstanding payments are made.

Acknowledgement

The ASEAN Subcommittee on Science and Technology Infrastructure and Resource Development (SCIRD) would like to thank the PGTF for its support of this Project.

**DEVELOPMENT OF INNOVATIVE SYSTEMS FOR
PROGRAMME AND REVENUE GENERATION FOR ASEAN S&T**

Financial Statement

As of 30 June 2004

Contribution Received

1. Remittance from UNDP: 1 st disbursement (Oct. 01):	\$ 30,600.00
Total Contribution	\$ 30,600.00

Expenditures

1. Expert Group Meeting, Hanoi, 1-2 August 2003	
• Hosting cost	\$ 2,000.00
• Per diem, airfare and miscellaneous	\$ 1,896.00
2. Payment of expert (1 st , 2 nd and 3 rd)	\$ 15,640.00
3. Upgrading of ASTNET Website	\$ 8,600.00
3. Bank charges	\$ 75.00
Total expenditures	\$ 28,211.00
<i>Balance as of 30 June 2004</i>	\$ 2,389.00

Annex 2

**INNOVATIVE SYSTEMS
FOR
PROGRAMME MANAGEMENT
AND
REVENUE GENERATION
FOR
ASEAN SCIENCE AND TECHNOLOGY**

**A project of the
ASEAN Sub-Committee on S&T Infrastructure and Resources Development
(SCIRD), ASEAN Committee on Science and Technology (COST)**

Commissioned by the ASEAN Secretariat

Consultant's Report

September 2003

Executive Summary

The vision of a technologically competitive ASEAN, competent in strategic and enabling technologies, with an adequate pool of technologically qualified and trained manpower and strong networks of science and technology institutions and centres of excellence, was enunciated in 1997 as part of a grand vision of the future ASEAN in 2020. Then, in 1998, ASEAN Heads of Government adopted the Ha Noi Plan of Action (HPA) to provide the broad directions for getting there and a range of measures and actions to attain the vision statements.

On ASEAN S&T development, the HPA calls for intensifying R&D, increasing collaboration in research and technology transfer, and human resource development to meet the needs of industry and business. Of particular relevance to the present undertaking is the recommendation to develop innovative systems for programme management and revenue generation.

The above strategic directions provide the impetus for COST to develop its own strategic plans, and in 2001 it adopted the ASEAN Plan of Action on S&T: Implementation Framework for 2001-2004 to address the key points of the HPA and hence attain Vision 2020. COST recognizes that future ASEAN S&T development will require highly skilled manpower, not only to translate research results into commercial applications but also to create the knowledge capital that can give ASEAN that competitive edge and help ASEAN achieve sustainable economic growth.

The focus on developing S&T human resource and knowledge capital in an increasingly competitive environment underscores the need for entrepreneurial and adaptive institutions with innovative systems of management of R&D, intellectual property, sponsorship of research and development, and technology commercialisation. The focus also places strong emphasis on intra-ASEAN collaboration particularly on the sharing of experiences and resources so as to optimize those efforts and maximize the rewards.

The challenges for ASEAN and COST in particular have become more urgent and imposing with the increase to 10 nations and the enlargement of a population base across a more diverse range of economies. Nevertheless, COST recognises the potential of ASEAN's expanded membership and has made plans for intra-ASEAN S&T collaboration and fast-tracking of project implementation. It is hoped that through ASEAN integration and harmonization of practices, COST will be able to tap the synergy of ASEAN's diversity and draw benefits from it.

Therefore, in undertaking the present project, COST seeks to establish a framework on which a range of innovative systems and mechanisms for technology development and commercialization and revenue generation can thrive and contribute towards the creation of the future ASEAN S&T Community for Innovation, Competitiveness and Knowledge (ASTICK). In so doing, COST will have planted the seed for an ASEAN S&T Enterprise for Research, Innovation, Service and Knowledge (ASTERISK) called for by the ASEAN Plan of Action.

The development of the framework takes into account special considerations such as the role of COST and its public service responsibilities, equitable sharing of resources and returns, a regional intellectual property policy, diversity of ASEAN 10, priority of ASEAN-help-ASEAN projects, maximizing ASEAN science assets, and the need for integration and harmonization. The key stakeholders in the framework are COST and its subsidiary groups, participating institutions and individuals, funding agencies, private sector collaborators, venture capitalists, and end-users of technology.

The proposed innovative systems for revenue generation are specific mechanisms that operate ranging from technology development through to commercialization. Noting that institutional policies and procedures may vary from country to country, a unified approach is proposed under the umbrella of COST. To operationalise the systems and mechanisms, a new COST structure is proposed. The management structure will allow a more responsive and market-oriented approach to technology development and commercialization and collaboration with industry.

From a review of COST projects, which revealed a paucity of readily commercialisable or viable projects for business development, a business plan on ASTNET is thus proposed. The test case ASTMACS seeks to transform ASTNET into a viable business while ensuring that the public not-for-profit functions of ASTNET continues to operate. The ASTMACS plan is to create a commercial venture in close collaboration with COST's subsidiary groups, network institutions and the private sector. More importantly, it is hoped that ASTMACS will lead to multi-level spin-offs, not least of which will be to provide channels for technology flows of ASEAN's institutions and industry, platforms for technology venture development, opportunities to mount a diverse range of human resource development programmes, and a showcase on achievements of S&T.

To ensure success and sustainability of the various undertakings, optimized efforts and shared experiences of the collaborating parties are needed. Therefore, some priority ASEAN-help-ASEAN projects focusing on human resource development and S&T networking are proposed for immediate or near-term implementation. In conclusion, this project recommends a list of actions to be taken in the implementation of the proposed framework and systems.

CONTENTS

EXECUTIVE SUMMARY	i
1. INTRODUCTION	1
2. SPECIAL CONSIDERATIONS ON THE FRAMEWORK AND MECHANISMS	3
3. TECHNOLOGY DEVELOPMENT AND COMMERCIALISATION	
3.1 Framework and Stakeholders	5
3.2 Technology Development and Revenue Generation	12
3.2.1 Technology offer and disclosure	
3.2.2 IP Protection	
3.2.3 Technology assessment	
3.2.4 Technology licensing	
3.2.5 Technology marketing and matchmaking	
3.2.6 Start-up company formation	
3.2.7 Participation in start-up company	
3.2.8 Revenue generation and sharing	
3.2.9 Sustainable development	
4. REVIEW OF COST PROGRAMME ACTIVITIES	24
5. ASEAN S&T MANAGEMENT AND COMMERCIALISATION SYSTEM (ASTMACS)	29
6. ASEAN-HELP-ASEAN PROJECTS	39
7. ORGANISATION AND MANAGEMENT STRUCTURE	40
7.1 Programme Management	
7.2 Managing the Future ASEAN S&T Enterprise	
8 CONCLUSION AND SUMMARY OF ACTIONS	44
APPENDICES	
A Project Inception Report and Terms of Reference	45
B List of Contact Persons	49
C ASEAN COST IPR Policy	51
D COST Project Activities	52
E Bibliography	63

1. INTRODUCTION

ASEAN has now grown to 10 with a total population exceeding 500 million. It is a diverse grouping offering opportunities for synergistic cooperation as the global marketplace becomes increasingly more crowded and competitive. Besides Taiwan and South Korea, ASEAN will need to contend with new major competitors, who are also neighbours, such as China and India. China attracts twice the foreign direct investment of ASEAN and her exports growth in the key electronics sector is an order of magnitude faster than ASEAN's. Indications are that China will soon overtake ASEAN as a major manufacturing base and eventually as a value-add design hub.

Given the above scenario, therefore, how shall the role of S&T and COST in ASEAN's competitiveness in the global marketplace be defined? COST has recognised the need for innovative ways of managing S&T programmes and developing a corps of entrepreneurial S&T personnel. In adopting its Plan of Action on Science & Technology: Implementation Framework 2001-2004, COST is well aware that, thus far, ASEAN S&T cooperation programmes have not culminated to any significant level in commercial application of programme output. Participation of the private sector in programme activities is starkly missing. It is therefore not surprising that little has been achieved in the area of technology transfer and commercialisation of research results.

The focus on commercialisation is ever more critical today as ASEAN is moving quickly towards increased intra-ASEAN trade through AFTA and the transformation of the region into a dynamic economic global competitor. COST is mindful of the fast dismantling of barriers to trade and the advantages this will bring in terms of flows of investment, technology and skilled human resource. At the same time, COST takes cognisance of the increasing competition from neighbouring NICs and the need to assist newer ASEAN member countries get up to speed on S&T development.

Since Hanoi 1998, ASEAN Ministers for Science and Technology have strongly endorsed plans to integrate experiences and country programmes to harness regional S&T cooperation to generate and exploit intellectual capital; develop human resources for a knowledge-based economy; develop innovative systems and enterprises; and harmonize practices in technology commercialization leading to increased R&D, public-private sector collaboration, and sustainable development. This direction was further reinforced by ASEAN Plan of Action on Science and Technology: Implementation Framework for 2001-2004, which sets down strategies for managing the regional S&T enterprise, collaborating with the private sector and dialogue partners, developing S&T human resources, generating income, and providing mutual assistance so as to achieve sustainability and expedite economic development and ASEAN integration.

Subsequently, Ministers at the First Informal ASEAN Ministers Meeting on Science and Technology, Genting Highlands, April 2000, reviewed the concept of an ASEAN Science and Technology Community for Innovation, Competitiveness and Knowledge (ASTICK). Ministers requested COST to develop a programme to realise ASTICK to support and enhance regional cooperation.

More recently, in 2001, COST obtained funding from the Perres Guerrero Trust Fund (PGTF) to develop a proposal for revenue-generation mechanisms with the view to implementing the plan through a test case drawn from COST programmes and dovetailing the implementation of that activity with the ASTICK initiative. Clearly, COST sees an opportunity through this project undertaking to demonstrate that S&T has its role to play in the next phase of ASEAN's economic development. SCIRD was then tasked to undertake the project through the help of a consultant. The Terms of Reference of the project is given in Appendix A.

In developing the modes by which COST could generate revenue and undertake new initiatives for managing future S&T programmes and entities, reference is made to recommendations of COST's strategic planning discussions and the ASEAN Plan of Action on Science and Technology. The design of the eventual framework and mechanisms that will support such initiatives takes into consideration the functions of COST's Advisory Body for the ASEAN Science Fund (ABASF) and the Advisory Body for the ASEAN Plan of Action on Science and Technology (ABAPAST).

In the following section, the special considerations which underpin the execution of this project are presented. The proposed framework and mechanisms for revenue generation and management are then described. This is followed by a review of COST projects and potential for any commercial spin-offs. A business plan of a priority test case project, ASEAN S&T Management and Commercialisation System (ASTMACS), is thus proposed. The report also includes recommendations on potential ASEAN-help-ASEAN projects and actions to be taken.

2. SPECIAL CONSIDERATIONS ON THE FRAMEWORK AND MECHANISMS

The following key considerations take cognizance of the ASEAN Plan of Action on Science and Technology: Implementation Framework for 2001-2004 and recommendations of the meetings of ASEAN Ministers for Science and Technology in the past 3 years. The considerations form the basis of the present project development.

- (i) The Framework is to support a range of initiatives for participation in and management of revenue generating projects and ventures with special consideration on the need to differentiate the commercial and non-commercial aspects of COST activities, facilitate integration of programmes, and avoid conflict of interest situations that may arise.
- (ii) An equitable basis for estimating the share in and revenue from a spin-off arising from any contributions such as intellectual property, technology and know-how, counterpart funding, and in-kind support, whether made by an institution or an individual, need to be established.
- (iii) On the non-commercial aspects of COST activities, it is imperative that ongoing efforts in information dissemination, technology diffusion, training, and the promotion of science and technology in ASEAN, and especially in meeting the S&T development needs of the newer member countries be continued.
- (iv) In compliance with the e-ASEAN Framework Agreement, the development so undertaken should facilitate member countries' access into the e-information network and application of information and communications technology for improved competitiveness of ASEAN's private sector.
- (v) Provisions will need to be made from revenues generated to augment the ASEAN Science Fund and to support research in ASEAN's centres of excellence, the development of core competencies, and S&T manpower development, especially in the newer members of ASEAN.
- (vi) Strong links with the private sector need to be forged so as to facilitate collaboration in research, technology development and commercialization, and investment.
- (vii) COST needs to fully realize the potential of regional S&T innovations and expertise by leveraging on and tapping into ASEAN's centers of excellence and the network of offices of technology transfer and licensing.
- (viii) Appropriate incentives and recognition are needed to fully commit and maximize ASEAN science assets such as natural resources, biodiversity, physical S&T infrastructure, and intellectual capital for the betterment of the ASEAN community and sustaining economic growth.

- (ix) Recognising the diversity of ASEAN 10, the eventual Framework will need to be robust and yet flexible enough to support ASEAN integration and harmonization of procedures, protocols, and standards so as to maximize efficiency and increase business competitiveness.
- (x) Identify gaps in intra-ASEAN cooperation and give priority to fast tracking ASEAN-help-ASEAN projects demonstrating integration, transfer of technology and experiences, and human resource development so as to enhance capacity-building leading to economic development and sustained growth.
- (xi) To maximize impact and outreach, a test case will need to be implemented on the new Framework by mobilizing existing infrastructure and in-country support.
- (xii) With reference to the ASEAN Plan of Action on Science and Technology: Implementation Framework for 2001-2004 and the recommendation of the ASEAN Ministers of Science and Technology Meeting, a new structure is needed to manage the future ASEAN S&T enterprise for research, innovation, service and knowledge (ASTERISK) within an ASEAN S&T community for innovation, competitiveness and knowledge (ASTICK).
- (xiii) In the pursuit of wealth creation, public interest should not be compromised for the sake of income generation.

3. TECHNOLOGY DEVELOPMENT AND COMMERCIALISATION

3.1 Framework and Stakeholders

ASEAN has several established tertiary institutions and centres of excellence. Besides these, ASEAN COST's subsidiary groups have strong networks of researchers and academics, and possess a wealth of experience and domain knowledge. Collectively, these resources represent the knowledge base into which ASEAN's industry and SMEs can tap. Thus, the Framework being developed will need to facilitate institution-industry or public-private sector collaboration for research and technology development.

The Framework should also facilitate the harmonization of practices so as to ensure efficiency, minimize costs, and maximize benefits in translating intellectual property contributed by institutions and individuals into useful products and applications. Therefore, in establishing the Framework on which technology development and commercialisation can flourish, COST will need to adopt a regional position on management of intellectual property, formulate basic rules of engagement in collaborative activities between public institutions and the private sector, recognize diversity of practices in enterprise development, and set up guidelines for accounting of direct and indirect costs, procurement of services, fee charging, and the sharing of revenue.

Figure 1 shows the generic stages in the transformation of knowledge and intellectual property derived from work performed in ASEAN institutions and centres of excellence into commercialisable products and start-up enterprises.

At Stage zero, research results are essentially institution-bound or are "spoken for". Commercial use of IP is not intended but beneficial transfer of IP/technology can be made via training and special arrangements between donor and recipient. Table 1 shows a list of key country institutions that possess skilled S&T manpower and have significant capability to develop S&T human resource, contribute know-how and technology, and collaborate with the private sector in research, development and engineering.

In Stage 1, IP is application-bound and intellectual property and know-how are disclosed and offered by parties that possess them either through the intervention of the institutions' technology transfer/licensing office or directly by individual researchers, inventors or consultants.

Stage 1 agents for technology flows are university technology licensing offices, government departments, and individuals. Technology information and directories of expertise are ideally in the form of searchable databases accessible through internet portals.

Table 2 provides a list of ASEAN institutions of higher learning and research centres that are potential early nodes of an ASEAN network of technology transfer offices. These institutions will be among the first to be invited to contribute to the technology databases to be developed by COST. The list will be expanded over time as ASEAN institutions learn from the experiences of others

and from training workshops and seminars on management of research and technology commercialisation.

In Stage 2, value-adding technology development takes place. The potential intervention key players are industry sponsors, dialogue country agencies, technology licensees, and ideally the institutional researchers and inventors. The enhanced value of the technology represents a revenue potential for the institution/inventor and the sponsor.

Sometimes, Stage 2 can also be effected by the researchers themselves through a direct spin-off from the institution. In this approach, it is common to negotiate a release, through a licence, of the invention/technology to the technology start-up founded by the researcher(s).

In all the above cases, the institution and researcher/inventor are deemed to remain stakeholders of the technology. It is assumed that they continue to contribute intellectual input into the technology and therefore also become stakeholders of the results.

At Stage 3, the technology or completed product is eventually released into a technology enterprise or venture. New money beyond seed funding is needed to grow the fledgling company. As stakeholders of the useful technology/results, benefits will accrue to the institution and inventor/researcher in the form of a combination of transfer/licensing fees, royalties, and equity in the start-up.

Table 3 shows a range of instruments that may apply in research collaboration and technology development and commercialization activities. Table 4 depicts the Stage activities and stakeholder participation in the technology transformation process.

Figure 1 Technology flow from source to end-users

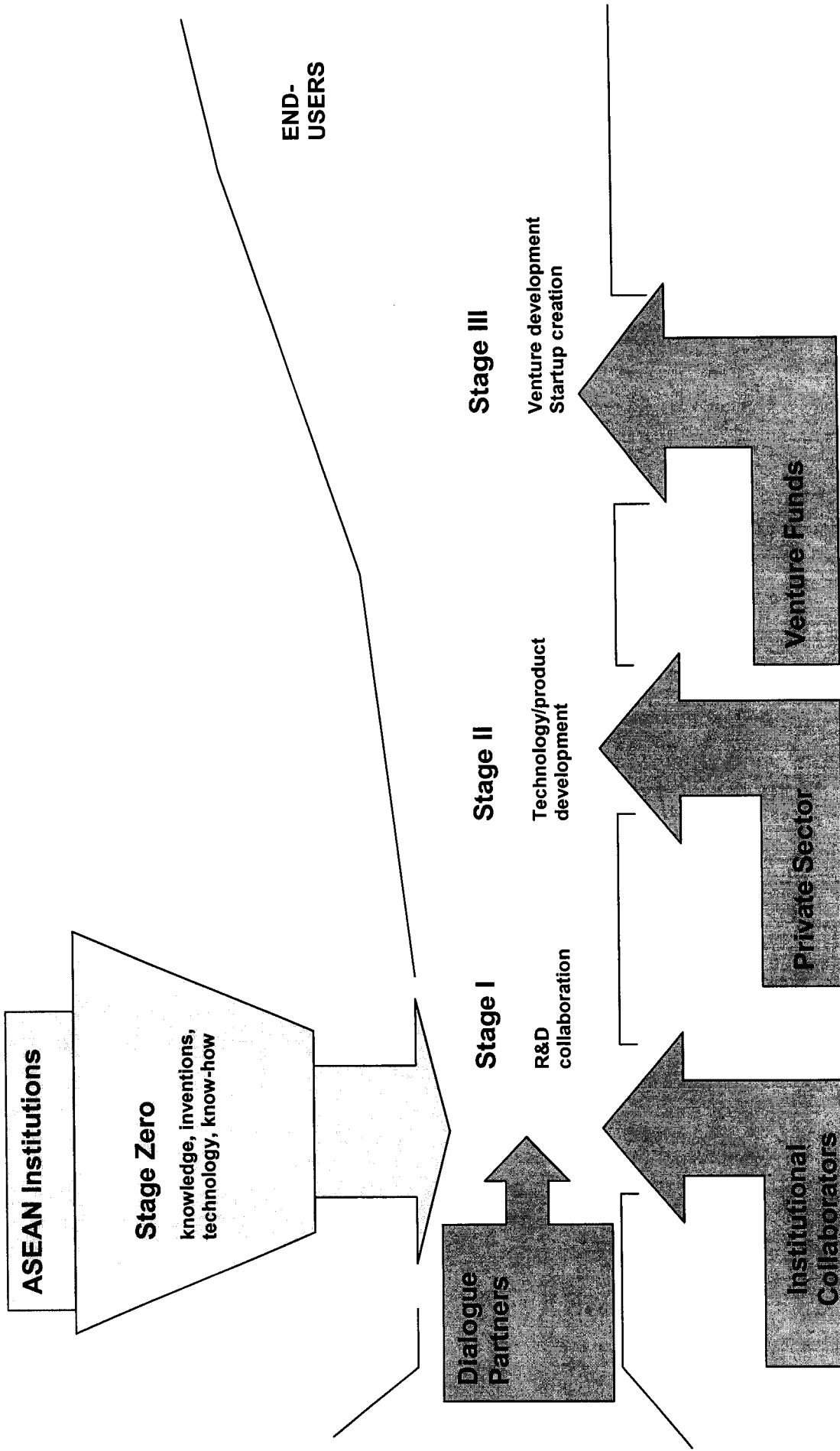


Table1 Examples of key ASEAN S&T institutions with capability for R&D collaboration and technology transfer

Countries	Institutions
Brunei Darussalam	Ministry of Development
	University of Brunei Darussalam
Cambodia	Ministry of Industry, Mines and Energy
	Royal University of Phnom Penh
Indonesia	Indonesian Institute of Sciences/Ministry of Research and Technology
	Agency for the Assessment and Application of Technology
	University of Indonesia
	Institute of Technology Bandung
Lao PDR	Science, Technology and Environment Agency
	National University of Laos
Myanmar	Department of Technology and Promotion/ Ministry of Science and Technology
	Yangon Technological University/Mandalay Technological University
Malaysia	University of Malaya
	Universiti Sains Malaysia
	Universiti Technology Malaysia
	Universiti Putra Malaysia
Philippines	Department of Science and Technology
	Philippines Council for Advanced S&T Research and Development
	University of the Philippines
	De La Salle University
	University of Santa Tomas
Singapore	Agency for Science, Technology and Research
	National University of Singapore
	Nanyang Technological University
Thailand	Ministry of Science and Technology
	National Science and Technology Development Agency
	King Mongkut's University of Technology Thonburi
	Chulalongkorn University
	Mahidol University
Viet Nam	Ministry of Science and Technology
	Vietnam National University-Ha Noi
	Vietnam National University-Ho Chi Min City
	National Institute for S&T Policy and Strategy Studies

Table 2 Nodes of ASTNET and the ASEAN network of technology transfer offices

Countries	Institutions
Brunei Darussalam	Ministry of Development
	University of Brunei Darussalam
Cambodia	Ministry of Industry, Mines and Energy
	Royal University of Phnom Penh
Indonesia	Indonesian Institute of Sciences/Ministry of Research and Technology
	Agency for the Assessment and Application of Technology
Lao PDR	Science, Technology and Environment Agency
	National University of Laos
Myanmar	Department of Technology and Promotion/ Ministry of Science and Technology
	Yangon Technological University
Malaysia	Science & Technology Division, Ministry of Science, Technology and the Environment
	Malaysian Science and Technology Information Centre
Philippines	Department of Science and Technology
	Philippines Council for Advanced S&T Research and Development
Singapore	Agency for Science, Technology and Research
	National University of Singapore
Thailand	Ministry of Science and Technology
	National Science and Technology Development Agency
Viet Nam	Ministry of Science and Technology
	National Institute for S&T Policy and Strategy Studies

Table 3 Types of agreements in the various stages of the technology flow

Types of agreements	Purpose
Non-disclosure or Confidentiality agreement	Technology evaluation
Option agreement	First rights to evaluate technology limiting licensor's ability to freely grant rights to others
License agreement and Field-of-Use licensing	Granting licensee rights to use and make products/apply technology from patents, knowhow and materials owned by licensor
Biological material transfer agreement	Make available tangible proprietary materials for research purposes with limitations on use or liability
Software license agreement	A suite of agreements to suit specific purposes
Research collaboration agreement	Any agreement among parties spelling out the terms of research collaboration. May be executed between sponsor and public institution or among institutions in a consortium in a jointly funded project.
Memorandum of Understanding	Non-binding agreement among parties spelling out the general spirit and principles of collaboration in generic areas of interest leaving possibility of specific agreements to be developed when required on a case by case basis. Helps to open doors and facilitates discussions.

Table 4 Stage activities and stakeholder participation

Stage	Activities	Stakeholders and contributions
I	Technology disclosure	Inventor/researcher discloses novel and useful research results
	Technology assessment	Technology transfer officer/manager performs due diligence
	IP protection/patenting	Technology manager/IP committee makes decision on IP protection. Patent filing, copyright or trade secret.
	Dissemination and marketing	Technology manager and inventor develop fact sheet and update ASTNET database. Marketing and direct selling.
II	Research collaboration	Researcher/inventor, collaborating parties and sponsor pursue further research at pre-competitive stage
	Technology development	Researcher/inventor and licensee sponsor pursue development with application in mind
	Market survey, technology scanning/mapping	Technology transfer office and inventor perform market survey, gather intelligence and develop road-map for technology exploitation
	Technology licensing	Technology manager negotiates license agreement
	Marketing, negotiating and direct selling	Technology manager and inventor/researcher continue to pursue marketing of technology
III	Creating a start-up company	Technology manager with/without participation of inventor/researcher develops business plan
	Seeking institutional support and seeding the start-up	Institution/technology transfer office perform due diligence and makes decision on providing seed funding for the start-up
	Seeking venture funding	Technology manager makes pitches and solicits venture support for the start-up.
	Developing memorandum and articles of association and shareholders' agreements	Technology manager, start-up founders, shareholders and legal counsel, agrees on terms for creating and operating start-ups.

3.2 Technology Development and Revenue Generation

With reference to Figure 1 and Table 4, we set out below the basic mechanisms and instruments required to effect the desired Stage outcomes described above. The mechanisms span the entire technology development and commercialization process starting from first disclosure of the technology or invention through IP protection, technology licensing and development, to creating a spin-off company and revenue generation. Some, if not all, of these activities reside with institutions from where IP originates. It is recommended that COST not only assumes responsibility for those activities that fall through the gaps across the overlapping diverse practices of ASEAN institutions but also plays a leading role in technology transfer transactions and the creation of new technology start-ups.

3.2.1 Technology offer and disclosure

When something deemed novel and useful has been conceived and developed, or when unusual, unexpected or non-obvious useful research results have been obtained, the employee or researcher can offer/disclose the technology to the parent institution (in ASEAN, the majority of its public and private institutions own the intellectual property derived by their employees) for protection and potential licensing for commercial development. Via these institutions and their respective technology transfer offices, the technology may be offered to COST for commercialization. In this regard, it is recommended that COST establishes a technology transfer office called the ASEAN Innovation Management (AIM) Office as the hub of a network of ASEAN technology transfer offices.

Referring to Figure 2, technology offers or disclosures can be made from researchers/institutions independently or from COST's subsidiary groups. After an initial assessment by the COST AIM Office, or COST AIM, the technology may be conveyed to the ASEAN Science and Technology Network (ASTNET) for direct posting to the databanks. Such offers of available technology can be readily advertised to catch the attention of technology brokers, entrepreneurs and potential industry users. The technology supplier can deal directly with the requester or potential user or request COST AIM for assistance in the transaction. Revenue can accrue to the technology supplier and COST AIM .

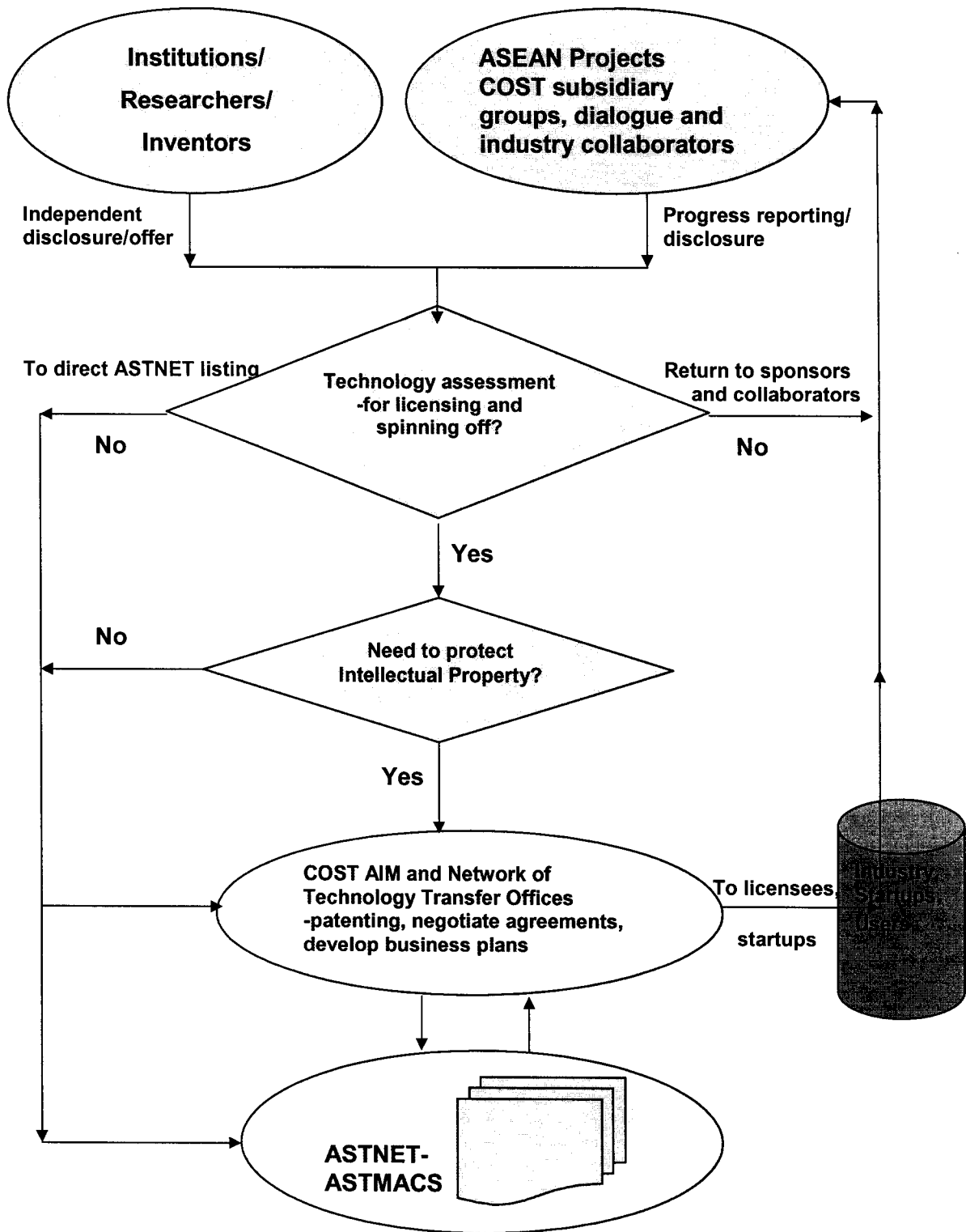
For those offers that COST AIM considers as having a greater potential for higher returns through licensing and spinning off to form startups, it will undertake to ascertain if patenting is necessary or desired.

It is thus in COST's interest to do the following:

- (i) make the process of technology offer and disclosure a procedural necessity for its subsidiary groups that are undertaking funded projects;
- (ii) create COST AIM, the ASEAN Innovation Management (AIM) Office, as a hub of a network of ASEAN technology transfer offices;

- (iii) develop parallel memoranda of understanding with key ASEAN institutions and technology transfer offices to link up technology offer databases and services; and to cooperate on technology assessment and commercialization activities; and
- (iv) operate a technology information deposition, dissemination, and marketing system riding on ASTNET.

Figure 2 COST AIM technology development flow chart



3.2.2 IP protection

Once a technology is offered to COST/AIM Office for commercialization, steps will need to be taken to ascertain if protection through patenting is necessary. The AIM Office will apply due diligence but its decision would be strongly influenced by commercial reasons and the need to manage the commercialization process more closely. The step to protect the intellectual property assumes that the institution of origin or the owner of the technology has not taken steps to file a patent. Guided by agreed principles and procedures on IP protection, and working with technology transfer offices in the network, AIM Office can initiate steps to file patents or otherwise protect the IP, as part of its strategy to develop and commercialise any invention/technology offered to it.

Thus, COST will need to play an active role in facilitating the creation of a regional IPR framework for intellectual property protection and commercialization, even though it may not get involved directly in patent filing and prosecution. The IPR framework should cover R&D collaboration, licensing and franchising, and distribution of tangible research property. Ultimately, it is hoped that the IPR framework will encourage technology disclosure and promotion, and equitable collaboration among institutions, COST's subsidiary groups, the private sector and other agencies.

More specifically, the following actions are recommended for COST:

- (i) work with relevant bodies to establish a basic understanding on IPR and a model for IP management using as a starting point COST's developed Policy on Intellectual Property Rights in Collaborative Research Projects (see Appendix C);
- (ii) develop guidelines for researchers in COST's subsidiary groups and technology managers to increase awareness and acquire skills on IP protection and management;
- (iii) organize regular workshops on management of research and protecting, marketing, and licensing of intellectual property; and
- (iv) operate an IP protection mechanism leveraging on available resources in the network of technology transfer offices (TTOs) in ASEAN.

3.2.3 Technology assessment

As soon as a technology/know-how is offered to COST for commercialization, a series of actions begins. There are at least two levels of engagements COST can take with regard to the offers received and their subsequent deployment. The first level of intervention concerns technology that is destined for public offer and requires no further action on IP protection. These offers (regardless of whether the technology is patented or not) will be placed in the technology databases for public dissemination after an initial verification process is completed and without seeking to protect the offered technology/know-how. Seekers of technology can

access the ASTNET databases and initiate appropriate actions to acquire any available offers direct. COST can take a share of the commercial transactions through at least an upfront advertising fee and/or a membership subscription.

The second level is to perform due diligence on select technology offers and those that have been targeted by potential licensees. This level is when COST AIM intends to take an active part in the licensing negotiation and share the risks involved, and substantially increase the revenue returns. In this action, COST AIM will take steps to protect the invention/technology if it fits the strategy for its commercialization.

In addition, COST AIM will undertake the due diligence assessment, which will most likely be conducted in cooperation with the originating institution/inventor/researcher and/or a designated technology transfer office, with the view to marketing and licensing the invention/technology.

Thus, the full assessment process of the invention/technology seeks to ascertain the following:

- (i) need/adequacy of protection for the technology/invention;
- (ii) technical feasibility and possible applications;
- (iii) standing of other competing technology in the market, in proposed field of use;
- (iv) potential capacity for follow-up in technology development;
- (v) market need and size for the technology; and
- (vi) who is likely to invest in that technology or market;

3.2.4 Technology licensing

Referring to 3.2.3, COST AIM has at least 3 possible choices for action. For those technology/inventions that it does not wish to manage, they will be sent to the ASTNET databases to be marketed. Transactions can be direct between the happy buyer (licensee) and happy seller (institution and/or individual). COST AIM stands to benefit from an upfront subscribing and/or advertising fee and possibly from an agreed share of the royalty income.

In those IP that COST AIM wishes to deal, two possible actions can be envisaged. One is to negotiate a license for use of the technology with a combination of fees. The other is to explore the injection of the IP into a startup with the participation of the institution/inventor and private venture partner. More on the latter course of action is given in the next section.

In both scenarios above, COST AIM will need to work within the ambit of respective technology transfer procedures if not on an agreed harmonized

ASEAN platform. The latter is highly recommended in view of the need to bring newer members of ASEAN up to speed on this and a common basis will be an excellent starting point for increased integration of efforts and experiences.

On licensing of technology, COST AIM will need to operate a technology assessment mechanism either centrally or in collaboration with technology transfer offices in ASEAN so as to combine and pool resources and technology to increase effectiveness and add value. Actions in technology assessment are already described in 3.2.3. Harmonization of procedures would ensure that COST will not have to set up its own technology assessment functions but will have access to the capability offered by technology transfer offices and resource centres across ASEAN.

3.2.5 Technology marketing and matchmaking

Leveraging on ASTNET and the various e-tools for Internet searches and transactions, technology managers can effectively reach out to technology buyers and potential licensees in the region and beyond. Technology managers can also look for opportunities in the network to bundle and package technology offers that can increase their marketability. COST could consider setting up an IP exchange (IPX) for the trading of intellectual property.

Besides using ASTNET, COST AIM could employ direct marketing through its networks of technology transfer offices and institutions linked to its subsidiary groups. Direct marketing is extremely crucial in ASEAN as Internet access is still not totally convenient to all.

Technology road shows can also be organized in conjunction with COST's regular meetings, scheduled conferences and workshops, meetings of ASEAN Science and Technology Ministers, and the ASEAN Science and Technology Week. Institutions in COST's networks and technology transfer offices can get together during these regular technology fairs to showcase their offers and conduct matchmaking sessions and seek out private-sector partners for technology licensing and development.

COST could facilitate buyer-seller meetings and also make use of business venture platforms to seek investments for its own stable of startups. A system of charges and fees need to be developed to reward successful interventions and transactions.

3.2.6 Start-up company formation

ASEAN projects undertaken by COST's subsidiary groups may produce patentable or unpatentable technology or know-how of commercial value to industry. Such commercialisable technology could be owned by any one or more institutions in the networks of COST's subsidiary groups. Institutions have a choice of offering any technology/invention in their portfolio for commercialization locally or in the region.

If collaborators in two or more countries are involved, it is imperative that a lead party be identified to assume responsibility of marketing and managing the commercialization of the technology. Furthermore, it would be expedient to work out a system for cost and revenue sharing. It is in the interest of COST to facilitate the above activities.

Technology licensing described in Section 3.2.4. above is one option available. The other is to create a technology start-up with the participation of COST AIM, the institution/inventor, and the private sector venture partner. Such start-ups may be involved in training, consultancy, information dissemination and publication utilizing both conventional and electronic means, technology brokering such as “technomart” activities and testing services, and contract R&D.

Furthermore, owing to the public nature of COST and its sustained role in ASEAN-help-ASEAN programmes and the development of S&T human resource, it is envisaged that select not-for-profit ASEAN S&T foundations will be included in the line-up of COST’s future start-ups. Such corporatised foundations, which may have funding support of dialogue partners, may deal in a variety of issues of national and regional significance, for example, in environmental protection and the application of “green credits”, and non-commercial application of technology.

It is recommended that COST, leveraging on its networks in ASEAN, create a wholly owned technology holding company (THC) to:

- (i) exploit for commercial purposes all forms of intellectual property derived from activities engaged in by COST and its subsidiary groups solely or in conjunction with other parties in joint ventures or projects;
- (ii) enter into commercial ventures and transactions of all types on a global basis with a view to securing markets for products and processes arising from research, product development, and innovation;
- (iii) hold shares and investments in companies and entities in ASEAN and worldwide; and
- (iii) carry out technology development and commercialisation in all scientific fields and to enter into technology joint ventures and/or collaboration projects on a commercial or non-commercial basis.

COST could tap the ASEAN Science Fund and other funds to provide early stage support to the new startups thus lowering the barriers to successful exploitation and application of inventions and research results. In return, COST’s THC could take an equity stake in the new entities.

Thus, the main activities of COST THC are:

- (i) to assist COST’s subsidiary groups commercialise their inventions through spin-off companies in which THC will have an equity position. THC activities cover technology assessment, business plans development and

market research, identifying suitable joint venture partners from industry, and the sourcing of finance;

- (ii) to exploit for commercial purposes intellectual property arising from work of COST subsidiary groups and individuals in the networks. This will involve the transfer from the outset all the intellectual property rights not “spoken for” or owned by institutions to the THC;
- (iii) to enter into joint ventures either of an equity or contractual nature with external parties to exploit technology in return for equity stakes in the joint ventures or for cash payments. The THC can in certain instances sell outright the technologies it owns;
- (iv) to engage in technology transfer and/or acquisition of technologies through COST AIM; and
- (v) to undertake other activities which will support its technology transfer activities.

COST THC will ensure expeditious and successful commercial exploitation of research results arising from COST projects. Ultimately, it hopes to contribute actively to ASEAN's economic development through the creation of high-technology SMEs that will grow to become ASEAN's future industries. THC's activities will complement the activities of technology transfer offices across ASEAN.

COST would not normally seek to create a spin-off company for a technology in which there is a suitable commercial partner willing to undertake its exploitation. In such cases, a direct licensing or technology transfer arrangement with the potential business licensee should be negotiated.

To achieve its objectives, COST through COST AIM will need to be proactive in identifying and evaluating commercially viable research and resources for exploitation on its own or in conjunction with other suitable partners.

3.2.7 Participation in start-up companies

In the scenario described in Section 3.2.6 above, the founding members of a technology start-up can include the researcher-inventor, the institution, COST THC, the private sector collaborator, and the venture fund. Equity in the start-up can accrue to the parties due either to intellectual, in-kind or cash contribution as shown in Table 5 below.

Table 5 Equity participation in start-up companies

Participants/beneficiaries	Contributions
researcher-inventor	intellectual input, technology development
the institution	intellectual property injection, in-kind and/or cash contributions
COST THC/AIM Office	Management and value-adding services, in-kind and/or cash contribution
private sector collaborator	technology development, services, funding
venture fund, angels	cash, expertise, market development and linkages

While it may not be possible to have a fixed formula for working out the respective shares each will hold, or apply a fixed proportion to the parties in the venture at startup, it is recommended that the equity in the startup be made available either at formation or held in reserve for subscription by the following parties:

- (i) The inventors/researchers to acknowledge their intellectual input and subsequent contributions in technology development. A portion of the shares may be offered free in lieu of their contributions and continued engagement, while the rest may be offered as an option to purchase.
- (ii) COST THC for its seed funding and value-adding services.
- (iii) The institution from which the invention is created. The shares allocated will be based on the valuation of the IP contribution.
- (iv) The private sector collaborator in technology development. Here, as is the case of the institution, the shares allocated will be based on the valuation of its IP contribution.
- (v) The venture fund, angel investors, and other sources of investment.

The above is a guide and is based on the premise that COST THC has full assigned rights of the IP and can structure the company as it makes its pitches to investors.

Should a notional distribution of equity be used as a starting point for negotiation, the following distribution at formation is suggested:

- (i) A third of the equity in the startup may be set aside for the inventor/researcher to acknowledge the intellectual input and subsequent contributions in technology development.

- (ii) Up to a third of the equity may be made available to COST THC and the institution in which the invention is created.
- (iii) The remaining third may be available for subscription by the venture fund.

Should the invention and subsequent development involve the private sector collaborator, such a collaborator may share the equity with the institution and COST THC. The above is a rough guide as the proportion shared by the institution, THC and the private sector sponsor may vary. So will the portion destined for the venture fund.

3.2.8 Revenue generation and sharing

In view of what has been described above, the main revenue streams and beneficiaries can be identified and are shown in Table 6 below.

Table 6 Revenue streams and beneficiaries

Revenue streams	Description	Beneficiaries
subscription to databases	Annual fee paid by subscribing members to access databases	COST
advertising in ASTNET	Paid by technology managers, technology transfer offices, public and private-sector users	COST
fees from innovators	Charges for posting technology offers in the database	COST
Brokerage fees	Charges paid for successful transactions conducted through ASTNET and through COST networks of technology transfer offices.	COST and network institutions
technology licensing fees	Include option fees, upfront fees, and annual fees paid by licensees.	COST and technology transfer offices and ASEAN institutions. Also extends to inventors/individuals.
royalties	Paid by licensee and derived from successful commercial exploitation of products/application of technology arising from licence.	COST and technology transfer offices and ASEAN institutions. Also extends to inventors/individuals.
sale of technology/invention	Paid by buyer and derived from successful sale of technology/invention.	COST and technology transfer offices and ASEAN institutions. Also extends to inventors/individuals
equity in startups	Derived from IP licence and technology development, from cash and seed funding.	COST THC, ASEAN Science Fund, ASEAN institutions, inventors/researchers.

3.2.9 Sustainable development

To ensure sustainability of the above innovative systems and entities, it is crucial that there be revenue streams on tap and a good return on investments is achieved in those projects seed-funded by COST. To this end, it is recommended that COST creates a seed fund, the **ASEAN S&T Enterprise Seed Fund (ASSET)**, to support technology and business venture development. ASSET could negotiate a release of a first tranche from the ASEAN Science Fund (ASF) and/or invite venture investments from the public.

To take equity in the new spin-offs, COST will incorporate the Technology Holding Company (THC), which will operate the ASSET fund, and COST AIM to implement the plans on technology transfer and revenue generation. COST AIM will be responsible, from the time of disclosure and offer to the successful application of the invention/technology, for every due diligence and financial decisions to be taken with the view to implementing promising projects with a good ROI and seeding new startups from research performed by COST subsidiary groups.

In the longer term, innovative ideas on S&T programme management and commercialization must evolve towards an ASEAN best practice model. The entire framework and its constituent systems and mechanisms need to be sustained by highly trained and experienced technology managers. Such personnel should ideally have gained relevant experience in managing S&T development programmes in institutions of higher learning and research centres, and have been involved in public-private sector collaboration as programme managers or coordinators. It is highly recommended that training programmes be designed for such professionals so as to build up a pool of technology managers for COST's future R&D and technology commercialization efforts.

As key stakeholders, the cooperation and participation of ASEAN institutions in establishing the Framework mechanisms and operating principles are absolutely crucial. COST will need to work through its ASEAN coordinating agencies to reach out to key institutions and technology transfer offices. The support of COST subsidiary groups and their networks will be invaluable.

Ultimately COST will need to realize the augmentation of the ASEAN Science Fund; while making effective use of ASEAN'S natural assets and facilities and human resource, and working in synergy with the private sector and its dialogue partners.

4. REVIEW OF COST PROGRAMME ACTIVITIES

In reviewing COST projects undertaken by its subsidiary groups, reference is made to the status reports submitted for consideration at COST Meetings. Table 7 lists the status of projects under of purview of COST's subsidiary groups, covering the 33rd COST Meeting in 1996 to the 44th Meeting in 2002. The details are given in Appendix D.

Table 7 Summary of COST activities

	Subcommittees	Completed projects	On-going projects	Projects pending implementation /funding support /reformulation***	Aborted projects
1	Food Science & Technology	8	5	13	4
2	Meteorology & Geophysics	8	5	11	7
3	Microelectronics & Information Technology	8	0	8	5
4	Materials Science & Technology	6	0	4	2
5	Biotechnology	7	3	12	3
6	Non-conventional Energy Research	4	4	5	4
7	Marine Science and Technology	4	0	8	2
8	S&T Infrastructure and Resources Development	11	9	6	12
9	Space Applications and Technology	5	0	5	1
10	ASEAN Help ASEAN (not covered under subcommittees)	3			
	TOTAL	64	26	72	40

* Summarised from Reports of COST Meetings (33rd, 1996 to 44th, 2002)

*** Some of these projects were modified substantially and over many times to meet various funding interests

Over the last 7 years, there have been more than 202 COST projects and activities of which 64 were completed, 26 still ongoing, 72 either pending funding or in various stages of reformulation, and 40 were aborted. Based on a broad assessment of the 90 ongoing or completed projects, the following inferences can be made:

- (i) Five are ASEAN-help-ASEAN projects, of which 4 are training programmes and one is on training and technology transfer. There is potential contribution of expertise and know-how to solving problems in SMEs.
- (ii) Some 54 projects are capacity building activities, such as workshops, conferences, training programmes, networking and establishment of linkages. Potential exists for expertise and know-how transfer to the private sector and in further extending manpower training activities.
- (iii) Three are publications (not counting publications that arise as information dissemination activities as part of project activities).
- (iv) Nine are feasibility or policy studies.
- (v) The remaining 19 projects have activities with elements of research, demonstration, training and information dissemination. The notable features of these projects are summarized under the respective sub-committees in the following paragraphs.
 - Under SCFST, two projects implemented under AAACP III are undertaken jointly with other ASEAN bodies for which COST is not the lead agency.
 - Under SCMG, the ASEAN Specialised Meteorological Centre may have some activities, particularly special services relating to meteorological surveys and weather forecasting, and preparation of special reports, that can be implemented as a private sector venture. However, the nature of ASMC's activities tend to be rather specialized as the Centre generates meteorological data for the region that has strategic more than commercial value. Therefore, the Centre may not lend itself well as a showcase commercial outfit. Moreover, the ASMC is not a typical ASEAN project in that the host of the Centre provides the infrastructural requirements. The Centre's expertise and capability can be advertised on ASTNET.
 - Under SCMIT, the contents of the ASEAN India Digital Archive may have commercial value and can be linked to ASTNET.
 - Under SCMST, there was some discussion on the possibility of commercialising any technology developed from the ASEAN-India Project on Development of Raw Materials and Neodymium-Iron-Boron (Nd-Fe-B) Magnets and Application Engineering. The last Workshop on this project agreed that a market survey in India and ASEAN be conducted and that India would provide ASEAN with a project proposal on market survey. India has informed ASEAN that the Technology Information, Forecasting and Assessment Council (TIFAC) of the Department of Science and Technology of India has indicated its interest to be the nodal point for preparing the market survey but no further information has been received. This is still outstanding. It is unlikely that any commercialisable technology

will come out of this project in the near term although the long-term potential is there. The sub-committee's network of experts can be offered to ASTNET's database.

- Under SCMST, a completed ASEAN-New Zealand Cooperation project in Materials Science and Technology: Corrosion Prevention in Infrastructure and Equipment successfully demonstrated the potential benefits to be gained from preventive maintenance which would reduce the long-term cost of infrastructure by improving construction material selection procedures. Pilot studies on corrosion monitoring and life-cycle analysis activities were implemented with participating private sector organisations. Although the project did not develop new technology, expertise and know-how of this sub-committee can be similarly offered to the ASTNET database.
- Under SCMSAT, four large scale marine science projects were completed which had elements of training, information gathering for database development and some research. The last of these projects was completed in 1998 with AAACP support, and there was no known recommendation of activities for commercial development. Again, the sub-committee's expertise and know-how in this field may be contributed to ASTNET.
- Under SCNCER, the nature of the current COGEN programme is such that there will be no ready commercial activity for COST as the project is to achieve closer links between European suppliers and ASEAN customers to enable European technologies, equipment and services to penetrate the ASEAN market. An earlier solar drying project, which ended in the mid-90's helped in the training and technology demonstration. Some heat pump drying expertise was also developed then. These capabilities and know-how, which would be dated if not renewed, are potential contributions to ASTNET.
- Under SCIRD, a number of activities could contribute to the development of ASTNET, namely, the ASEAN-ROK Cooperation: Establishment of Network on Investment and Technology Transfer Information (ITTIN), Development of Technology Competitiveness Indicators in ASEAN (and its predecessor indicators project), and ASEAN Foresight Exercises in Selected Strategic Technology and Application Areas. The continued development of ASTNET itself represents the ongoing efforts to bring the infrastructure and contents closer to the private sector. ASTNET cannot go on depending on public funding and will have to reach a self sustaining plateau while ensuring that a key objective is to act as a major information hub for ASEAN public institutions and organizations.

The large number of training programmes and publications arising from COST activities could perhaps be better disseminated if they were packaged for e-learning delivery under the planned AVIST. ASTNET can be COST's e-learning and professional training portal. Similarly, the output of all activities under COST should be disseminated through the same ASTNET channels.

From the above assessment, it can be seen that arising from COST project activities of the past 7 years, a large number of outcomes relate to skills upgrading and institution building. A select group of projects did help to produce specialized expertise and know-how that can be useful to industry. COST will need to look into ways of improving its technology dissemination channels and implementation strategies that will facilitate public-private sector collaboration leading to technology transfer.

Clearly, to turn any of the above specific projects into a viable business venture, let alone a successful regional and global enterprise, would require a demonstration of market demand, support of a team of enthusiastic individuals, availability of funding, and most of all, a solid business execution plan. By the nature of COST's implementation strategy up till now, it has not been a focus to develop such autonomous enterprises.

However, at the meeting of ASEAN Ministers of Science and Technology in 1998, COST agreed to review its projects with the view to identifying potential spin-off enterprises and using them to demonstrate viability and create public awareness. Subsequently, COST agreed to develop a business plan for spinning out the commercial aspects of ASTNET, while at the same time recognising that ASTNET also serves as an institutional network for ASEAN S&T development and cooperation.

In the interim, ASEAN has resolved that it needs to develop and strengthen institutions and mechanisms to enable ASEAN to realise its vision and respond to the challenges of the new millennium. Besides S&T networks, ASEAN has resolved to support the development of content for the ASEAN Information Infrastructure (AII).

Furthermore, ASEAN Heads of Government signed an e-ASEAN Framework Agreement in November 2000 aimed at reducing the digital divide and allowing members to plug into the global network in the information age. The e-ASEAN Agreement commits members to a schedule of implementation covering connectivity, content development, e-commerce, market for goods and services in information and communications technology, human resource development and e-governance.

In view of these latest enunciations and initiatives, and the above assessment of COST project activities, it is recommended that COST picks a generic platform to launch its spin-offs and thereby facilitating an aggressive and systematic promotion of its technology and know-how. Among the shortlist, it is recommended that COST develops ASTNET into a business entity. When fully ready, ASTNET will form the backbone of COST's S&T e-business and e-learning infrastructure. As an e-hub, ASTNET will have intra-ASEAN connectivity to S&T and human resource databases, COST subsidiary groups, the business communities, centres of excellence, dialogue institutions and international S&T and research agencies and organisations.

In the next section, a business plan for the ASEAN S&T Management and Commercialisation System, ASTMACS, is presented. The plan is to turn ASTNET into a viable business through a novel management and commercialisation system. The ASTNET portal will cater to the public and private sector seeking S&T indicators, expertise, goods and services, technology transfer, business and technology venture development, trade and business networking, advertising, research data, and specialist human resource information. It will be a veritable technology and expertise treasure chest, a toolkit for business venturing, a training and learning platform, and an invaluable portal to ASEAN's rich heritage and human resources.

5. ASEAN S&T MANAGEMENT AND COMMERCIALISATION SYSTEM (ASTMACS)

5.1 The Need for ASTMACS

There is a need within the ASEAN region to increase the utilisation of its S&T capabilities. The objective of ASTMACS is to contribute to the economic growth of ASEAN Member Countries by improving access to strategic and enabling technologies and facilitating the commercialisation of their own research and development outputs. Some constraints at the moment include the inefficient and in some cases non-existent, communication channels between ASEAN S&T agencies and between S&T agencies and sources of venture capital and potential users of technology. The result is that much of ASEAN's capability to produce and apply technology is not taken up.

Technology required to drive economic development is then imported or is replicated several times either through national efforts or through the many development assistance programs implemented over the years with the assistance of ASEAN Dialogue Partners. This situation persists despite the very large investment over many years in enhancing the capacity of ASEAN S&T agencies and institutions to carry out research and create technology across a wide variety of disciplines. This proposal aims to establish a systematic, regional approach to managing and commercializing ASEAN's internal S&T capabilities to serve as the first step in addressing this situation.

5.2 Implementation of ASTMACS

ASTMACS will provide one of the fundamental building blocks for the innovative systems for programme management and revenue generation for Science and Technology. ASTMACS will provide improved information flows within ASEAN on sources of technology and R&D expertise and a mechanism to attract seed or startup capital from the private sector. ASTMACS also has the potential to generate revenue to support itself and the technology commercialisation framework described above. As such it is high on the list of priorities to achieve COST's objectives.

The strategy for implementing ASTMACS covers:

- (i) Upgrading the existing internet based ASEAN Science and Technology Network (ASTNET) to provide ready access by ASEAN S&T agencies to existing and future S&T databases in ASEAN;
- (ii) Injecting ASTNET into ASTMACS and determining equity participation of key ASEAN institutional partners and investors;
- (iii) leveraging on COST AIM to provide a technology brokering facility so that S&T agencies that wish to commercialise their technology can seek commercial and technical partners;

- (iv) Increasing the institutional capability in ASEAN to understand the role of Intellectual Property Rights (IPR) and venture capital in developing and commercialising technology; and,
- (v) Implementing a business plan for generating a revenue stream from ASTMACS.

5.3 Upgrading ASTNET:

Science and Technology information within ASEAN is still not well organized. COST and the ASEAN Secretariat do not have ready access to information within each ASEAN member country. The sub-committees of COST deal with specific areas of science and technology and their operation and activity level vary temporally and across disciplines. Many of the sub-committees are still in various stages of planning and establishing information networks to serve their own needs in manpower development and technology transfer. As COST functions primarily through its sub-committees, ready access to updated information is vital to decision-making and improved effectiveness.

To address the above deficiency, the ASEAN Science and Technology Network (ASTNET) was proposed as a priority project to create an ASEAN-wide Internet-based technology information network. In October 1998, in conjunction with the 5th ASEAN Science and Technology Week in Ha Noi, Viet Nam, ASTNET was presented to the Ministers of Science and Technology with a launch of the COST website at <http://www.astnet.org> at their 8th Meeting.

ASTNET is envisaged as an overall regional effort to network S&T information resources and databases on S&T institutions, expertise, centres of excellence, and technology requests and offers. It is also intended that ASTNET will result in the development of an information management system to support the activities of COST and its subcommittees and to act as an institutionalized mechanism for exchange of information on S&T in ASEAN. The basic framework and implementation plan for ASTNET was developed, with the S&T Indicator databases as its first content. However, progress has been slow due to the lack of funding. In September 2001, with secured funding from the ASEAN Science Fund, COST agreed to revive the Internet-based ASTNET comprising the following components:

- (i) Basic information on ASEAN S&T Cooperation
 - a. ASEAN COST history, structure and goals
 - b. The ASEAN Plan of Action on S&T 2001-2004
 - c. The sub-committee's programmes and priorities
 - d. Contacts of National COST chairs, sub-committee chairs, focal points and national COST secretariats
- (ii) Databases and search engines
 - e. Projects database
 - f. Technology offers and requests database
 - g. S&T indicators of the ASEAN countries

- h. Database of experts in the 9 sectors covered by the sub-committees with short biographies on each expert
- i. Database of R&D institutions/research laboratories and similar facilities in the member countries with short descriptions of their mandates and functions
- j. Database of related ASEAN and international links
- k. Any offers and relevant databases to support the ASEAN S&T Plan of Action.

Work to achieve the basic function of ASTNET needs to be completed quickly. New functions, including the addition of a search engine and modification of existing databases and a secure financial and commercial in-confidence transaction capability need to be added as the first step in creating ASTMACS.

5.4 Intellectual Property Rights

In developing and commercialising technology, ASEAN institutions need to increase their institutional capability to understand the role of Intellectual Property Rights (IPR) and venture capital. In order to encourage ASEAN S&T agencies and individuals to promote their innovations and seek to commercialise them, there is a need to increase their understanding of the processes of commercialisation and specifically the role of IPRs in that process. This is best done through a series of workshops on these topics held in ASEAN capitals and targeted at government and private sector S&T agencies, financiers and potential users of technology.

5.5 Business Plan for Generating a Revenue Stream from ASTMACS

Implementation of ASTMACS will be the responsibility of a sub-group to be appointed by the Sub Committee on Infrastructure and Resource Development (SCIRD). An ASEAN Secretariat officer will be included in the sub-group. The implementation group will report directly to SCIRD.

ASTMACS will be implemented in the following stages:

- (i) *Identify sources of funding to initiate and sustain the ASTMACS project*

There are two tracks to the business development of ASTMACS. The first track involves injection of ASTNET into ASTMACS and seeding its growth and helping ASTMACS achieve the milestones as an information dissemination and technology marketing portal. This track seeks to develop ASTMACS's mode of operation in technology commercialization and mechanisms for equity participation and revenue sharing within the network of ASEAN institutions and centres of excellence. Funding for this first track, which carries a heavy component of public service, will be sought from a dialogue country.

Concurrently, as the first track develops and the proof of concept is being established, the second track riding on the first will be launched to fuel and sustain the growth of ASTMACS into a viable business on its own as a company capable of spawning technology start-ups from its technology pool. This track will

be funded by private funds and will be launched in Year 1 as soon as investment funds are secured.

In the second track, additional functions of ASTMACS over and above those specifically intended to operate ASTMACS as a public service portal will need to be ensured. These additional functions include business development and promotion, IP assessment and protection, legal and contracts, and spin-off company formation.

The ASTMACS implementation schedule is shown in Table 8. The first track estimated costs and income projections for implementing ASTMACS are set out in Table 9a below. The estimated cost is approximately USD 335,000. This is unlikely to come from sources within ASEAN (eg the ASEAN Science Fund). Dialogue Partner contributions are however an appropriate alternative with one candidate, the recently announced ASEAN Australia Economic Development Program (AADCP) Regional Partnership Scheme, being highly suitable.

An ASTMACS Implementation Group, Vietnam and Singapore, has completed its work with a suitable Australian counterpart to prepare a project proposal for submission to the AADCP Regional Partnerships Scheme in mid 2003. This timing is ideal in terms of getting the necessary preparatory work done and seeking COST approvals for the launching of the ASTMACS development.

The financial plan below (Table 9a) shows that, in operating the first track, with modest projections of income, ASTMACS will be self funding after Year 3, and thereafter will generate a small surplus even if investments were not forthcoming to launch the second track of ASTMACS's development.

Table 9b shows the second track financial projections over 3 years of ASTMACS operation. A 3-year investment from ASSET, using funds raised from private funds and investors and/or from ASEAN institutional investors, of \$450,000 for equity in ASTMACS is projected. Investors are also welcome to participate directly in the ASTMACS spin-offs. At the end of Year 3, it is envisaged that COST THC will begin to divest of its interests in some of its start-ups as it makes its exit progressively from them. Revenue generated will be shared among stakeholders and a portion will be retained to seed and fuel new technology start-ups.

- (ii) *Gain the cooperation of participating institutions and agencies in ASEAN to make their existing databases accessible through ASTNET.*

ASTNET will be redeveloped into a powerful internet portal. The architecture of ASTNET (see below) is such that participating institutions remain responsible for the content and quality of their databases. However, they will need to agree to adopt standard protocols and metadata to enable their databases to be accessed through ASTNET. Access to the databases would be free so as not to stifle free flow of data exchange and interaction between researchers and technologists.

Preliminary studies indicate that there are many databases and other S&T support resources (technology directories, lists of experts, catalogues of equipment etc.) in each of the nine S&T areas covered by the COST sub-committees. While some of these are in electronic format they are not accessible by people outside the group that created them. Many of the databases are not in electronic format.

Each ASEAN member will be surveyed through its National COST and sub committee structures to determine the nature and status of databases that are suitable for inclusion in the ASTMACS stable. Each ASEAN member will be asked to nominate a person or persons who will be responsible for ensuring that data standards and data quality in these databases are maintained. It is important to note that ASTMACS does not intend to take ownership of the data; rather they will remain the property of the institution that created them. There will however need to be agreement to standardise the data in some way and to make them available through ASTMACS.

In parallel with this, ASTNET will be upgraded to create a database driven portal with a powerful search function. This will enable ASTNET users to find the data sources they need and to make contact with the owner of the data. Other enhancements to ASTNET to allow it to perform a technology brokering role and to support advertisers will be done at the same time.

(iii) Develop standard access protocols and procedures for the technology brokerage role.

The technology brokerage function will enable the owners of technology to advertise their system or process and to attract the attention of potential partners to further develop the technology, investment houses that can provide start-up or mezzanine financing and manufacturers who may wish to license the technology. The owners would prepare a synopsis of their technology and an indication of where they are in the development cycle. This synopsis would be posted on an ASTNET page that is accessible only to subscribers. Owners would pay a small fee (US\$50) to post their entry; subscribers would pay a similar fee (US\$50) to be able to access the page. The identity of the owner would be hidden on the first page. When a potential partner or financier is sufficiently interested to go to the next step, they would pay an additional fee (US\$250) to be told the identity of the owner and to receive a longer (10 pages) description of the technology. After that the seller and buyer deal directly.

(iv) Develop procedures and rules for advertising on ASTNET.

ASTNET may prove to be an attractive vehicle for ASEAN institutions and businesses to advertise their wares. ASTNET could include a page for these at a modest rate. Industry standards suggest a fee of US\$50 per annum is generally acceptable. There would need to be a set of standards and procedures for advertisers e.g. who can advertise, can they conduct business on the ASTNET

site, etc. These will be developed by the implementation group and submitted for clearance by SCIRD.

(v) Develop procedures for revenue raised from ASTMACS

Revenue generated by ASTNET will need to be accounted for and used in ways acceptable to COST. For example, monies could be deposited into the ASEAN Science Fund or ASSET Seed Fund and used to provide continuing support for ASTMACS. Surplus funds could be available to support other COST activities under the direction of COST's Advisory Body for the ASEAN Science Fund. Procedures will be developed by the implementation group and cleared by SCIRD and ASEAN Secretariat.

(vi) Launch ASTMACS and promote it to potential users.

Once the upgraded ASTNET is operational, a series of workshops would be held in ASEAN capitals to promote ASTMACS. The workshops will be conducted by ASEAN and Dialogue Partner experts and will be targeted at government and private sector S&T agencies, financiers and potential users of technology. These promotional workshops will have a session, or sessions on the role of intellectual property rights and venture capital in technology development and exploitation. Areas to be covered will include characteristics of various IPRs, non-disclosure agreements, forms of licensing, royalty and other payments, potential sources of venture capital and how capital is used to develop or adapt technology. These sessions will be targeted at the S&T Agencies and institutions in all ASEAN member countries.

Once ASTMACS is launched, responsibility for on-going operations and future upgrades could be passed to the proposed ASEAN THC which would use the revenue generated by ASTMACS to support its own operations.

Figure 3

ASTMACS implementation framework

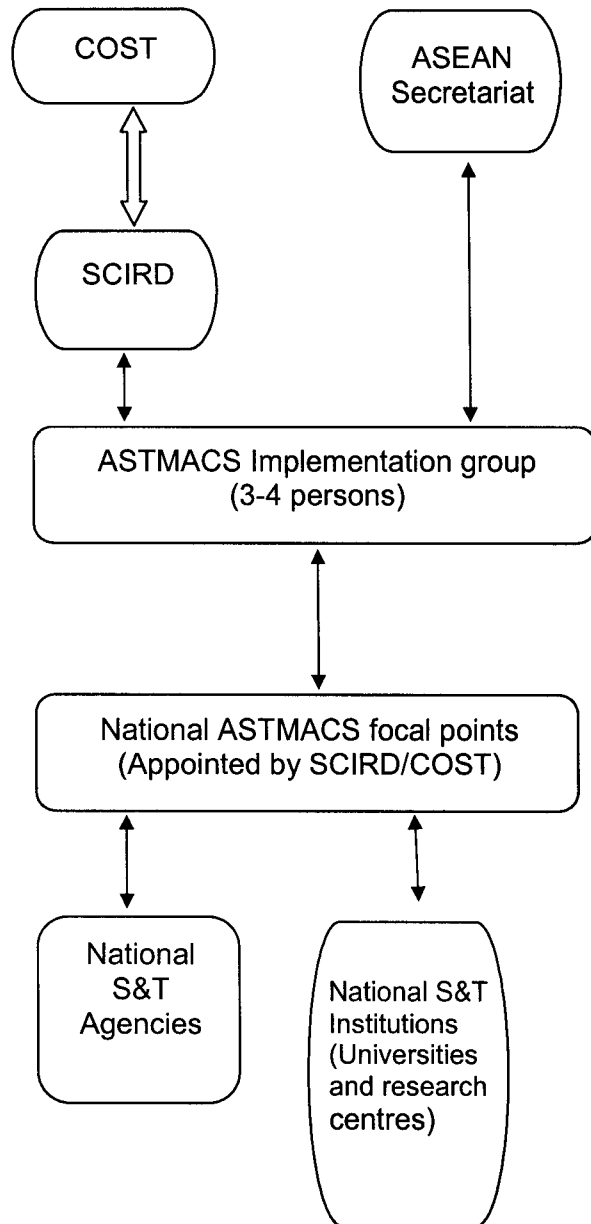


Table 8. ASTMACS implementation schedule

Action item	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
1. Establish ASTMACS Implementation Group	xxxx	x										
2. Prepare project proposal for Dialogue Partner funding of track 1 activities	xxxx	x										
3. Confirm national ASTMAC contacts	xxxx	x										
4. Project Implementation Workshop		xxxx										
5. Develop standards for database contents		xxxx	xxxx									
6. Develop protocols for revenue raising		xxxx	xxxx									
7. Marketing and promotion of ASTMACS		xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
8. Commission upgrade of ASTNET		xxxx	xxxx	xxxx	xxxx	xxxx						
9. Upgrade databases			xxxx	xxxx	xxxx	xxxx						
10. Set up technology brokering pages and launch service				xxxx	xxxx	xxxx						
11. Set up advertising pages and seek users				xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
12. Workshops on ASTMACS and IPR in ASEAN capitals				xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
13. Refine ASTMACS operations in light of experience			xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
14. Investment promotion - raise funds for ASTMACS track 2 activities				xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
15. Assessment of technology for IP protection and licensing				xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
16. Business plan development and start-up formation				xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx

Table 9a. Track 1 ASTMACS cash flow projections

Estimated Costs	Units per year			Unit cost (US\$)	Year 1	Year 2	Year 3	Total 3 years
CEO/Project Director	0.5	0.2	0	\$50,000.00	\$25,000.00	\$10,500.00	\$0	\$35,500.00
Project and Business Manager	1	0.75	0.5	\$30,000.00	\$30,000.00	\$23,625.00	\$16,500.00	\$70,125.00
Admin and Website Manager	1	0.75	0.5	\$25,000.00	\$25,000.00	\$19,687.50	\$13,750.00	\$58,437.50
Admin Support	0.2	0.5	1	\$12,000.00	\$2,400.00	\$6,300.00	\$13,200.00	\$21,900.00
Portal development, search engine, web design, hosting, maintenance and support					\$25,000.00	\$7,500.00	\$5,000.00	\$37,500.00
Promotion/IPR workshops	3	2	2	\$10,000.00	\$30,000.00	\$20,000.00	\$20,000.00	\$70,000.00
Initial incorporation cost					\$5,000.00	\$0	\$0	\$5,000.00
Admin, legal and operating costs+					\$12,000.00	\$12,500.00	\$13,000.00	\$37,500.00
TOTAL COSTS					\$154,400.00	\$100,112.50	\$81,450.00	\$335,962.50
Revenue Sources:								
Fees from innovators	5	50	150	\$50.00	\$250.00	\$2,500.00	\$7,500.00	\$10,250.00
Subscription to databases	5	25	300	\$50.00	\$250.00	\$1,250.00	\$15,000.00	\$16,500.00
Brokerage fees	1	2	20	\$500.00	\$500.00	\$1,000.00	\$10,000.00	\$11,500.00
Advertising	10	30	150	\$30.00	\$300.00	\$900.00	\$4,500.00	\$5,700.00
Funds from Dialogue Partners	0.5	0.3	0.2	\$300,000.00	\$150,000.00	\$90,000.00	\$60,000.00	\$300,000.00
TOTAL REVENUE					\$151,300.00	\$95,650.00	\$97,000.00	\$343,950.00
Net Cash Flow					\$(3,100.00)	\$(4,462.50)	\$15,550.00	\$7,987.50

Assumption 1 Part of the above costs are expected to be met from dialogue partner funding. A proposal has been submitted for consideration under the AADCP Partnership Programme.

Assumption 2 Assumes that host country of ASTMACS will provide rent free office and basic operating facilities.

Table 9b. Track 2 ASTMACS cash flow projections

Estimated Costs	Units per year			Unit cost (US\$)	Year 1	Year 2	Year 3	Total 3 years
	0.5	0.8	1					
CEO/Business Director	0.5	0.8	1	\$50,000.00	\$25,000.00	\$42,000.00	\$55,000.00	\$122,000.00
Business and Technology Transfer Manager	0	1.25	1.5	\$30,000.00	\$0	\$39,375.00	\$49,500.00	\$88,875.00
Admin and Website Manager	0	0.25	0.5	\$25,000.00	\$0	\$6,562.50	\$13,750.00	\$20,312.50
Admin Support	0.8	0.5	2	\$12,000.00	\$9,600.00	\$6,300.00	\$26,400.00	\$42,300.00
Patenting Costs					\$7,500.00	\$15,000.00	\$20,000.00	\$42,500.00
Business Development, Marketing, Promotion Activities					\$25,000.00	\$30,000.00	\$45,000.00	\$100,000.00
Admin, legal and operating costs+					\$25,000.00	\$29,012.50	\$30,000.00	\$84,012.50
TOTAL COSTS					\$92,100.00	\$168,250.00	\$239,650.00	\$500,000.00
Revenue Sources:								
Technology Licensing fees					Assumes no cash returns in Year 1	Assumes cash returns at 15% of operating expenditure	Assumes cash returns at 25% of operating expenditure	
Royalties								
Sale of Technology/Invention								
Equity in Start ups								
TOTAL REVENUE					\$0	\$25,237.50	\$59,912.50	\$85,150.00
Investments, Grants and External Revenue Required					\$100,000.00	\$150,000.00	\$200,000.00	\$450,000.00
Net Cash Flow					\$7,900.00	\$6,987.50	\$20,262.50	\$35,150.00

Note 1 : Technology Licensing fees Fees earned are subject to sharing with inventors/institutions in a fee sharing arrangement to be negotiated on a case-by-case basis.

Note 2: Royalties ASTMACS once operational will lead to increased commercialization and, as noted in Section 3 above, this has the potential to produce a royalty stream of which a portion may accrue to COST. However, the above figures do not include any provision for royalty income pending resolution of IPR issues within ASEAN.

Note 3: Sale of Technology/Invention Fees earned are subject to sharing with inventors/institutions in a fee sharing arrangement to be negotiated on a case-by-case basis.

Note 4: Equity in start ups Fees earned could be in the form of equity in new start ups; such equity may have no realisable cash value in the early years.

6. ASEAN-HELP-ASEAN PROJECTS

The success and sustainability of the above innovative systems for revenue generation and enterprise creation will require optimized efforts of collaborating parties in achieving long-lasting positive economic impact for participants. ASEAN's full potential needs to be mobilized over time so as to reach optimum performance. The crucial leveraging of experiences of in-country programmes holds promise for the newer members of ASEAN. In this regard, it is imperative that as ASEAN moves forward and experiment with new and innovative systems, the weaker economies can get hands-on experience through ASEAN-help-ASEAN projects. The following projects are therefore proposed for COST's consideration for implementation immediately and in the near future.

- (i) Assist in setting up the framework and mechanisms for institution-industry collaboration covering R&D, technology transfer, creating technology start-ups and human resource development.
- (ii) Develop and organize training workshops on intellectual property protection, working with research sponsors, technology development and commercialization, and creating and managing technology start-ups.
- (iii) Provide assistance for attachment of staff members of technology transfer and industry liaison offices in the more established technology transfer offices in ASEAN.
- (iv) Assist newer member countries perform a technology and expertise audit at either the institutional or country level.
- (v) Organise strategic planning sessions to identify and prioritise technology development and commercialization programmes and projects.
- (vi) Organise technology foresighting activities.
- (vii) Assist the development of in-country capability to operate an S&T indicator system.
- (viii) Establish a scholarship programme for e-training to fast-track learning.

The above proposals focus on the development of human capital at different levels and S&T intelligence, which are crucial elements to the creation of a knowledge-based regional economy. Focused efforts in manpower development supported by enhanced S&T networking will provide member countries with opportunities to share resources and leverage on each other's strengths for sustainable economic growth.

7. ORGANISATION AND MANAGEMENT STRUCTURE

7.1 Programme Management

Given the above activities being proposed, COST will have to develop a management structure that will facilitate creation and management of innovative systems and modes of operations of autonomous and semi-autonomous entities under the ambit of ASEAN S&T Cooperation. In the latest ASEAN Plan of Action on Science and Technology: Implementation Framework for 2001-2004, COST is committed to:

- (i) creating a system of governance of COST spin-off companies;
- (ii) strengthening the administrative support to COST; and
- (iii) establishing an ASEAN science and technology enterprise for research, innovation, service and knowledge (ASTERISK).

It is envisaged that the corporate entities and semi-autonomous bodies will have interests covering information dissemination and technology brokering, development of research results for commercial applications, delivery of professional update training and virtual learning programmes, and providing services on market assessment, and technology scanning and foresighting.

As described in Section 3.2.6 and 3.2.7 above, it is evident that COST's spin-offs would be best governed through COST THC. Representation on the THC board will be selected/approved by COST assuming that THC is a wholly-owned company of COST. That implies that COST is a legitimate corporate body and that there are no other shareholders in the THC. At the firm level, the shareholders may include researchers/inventors, the institutions, ASEAN government agencies, the private sector collaborator, and the venture fund.

Administrative support to COST will need to be beefed up. In assuming its destined role of implementing the ASEAN Plan of Action on Science and Technology, COST will need to operate "at arm's length" from its myriad commercial interests. However, COST will need to be more entrepreneurial and adaptive as projects and programmes increasingly involve private-sector interventions and support.

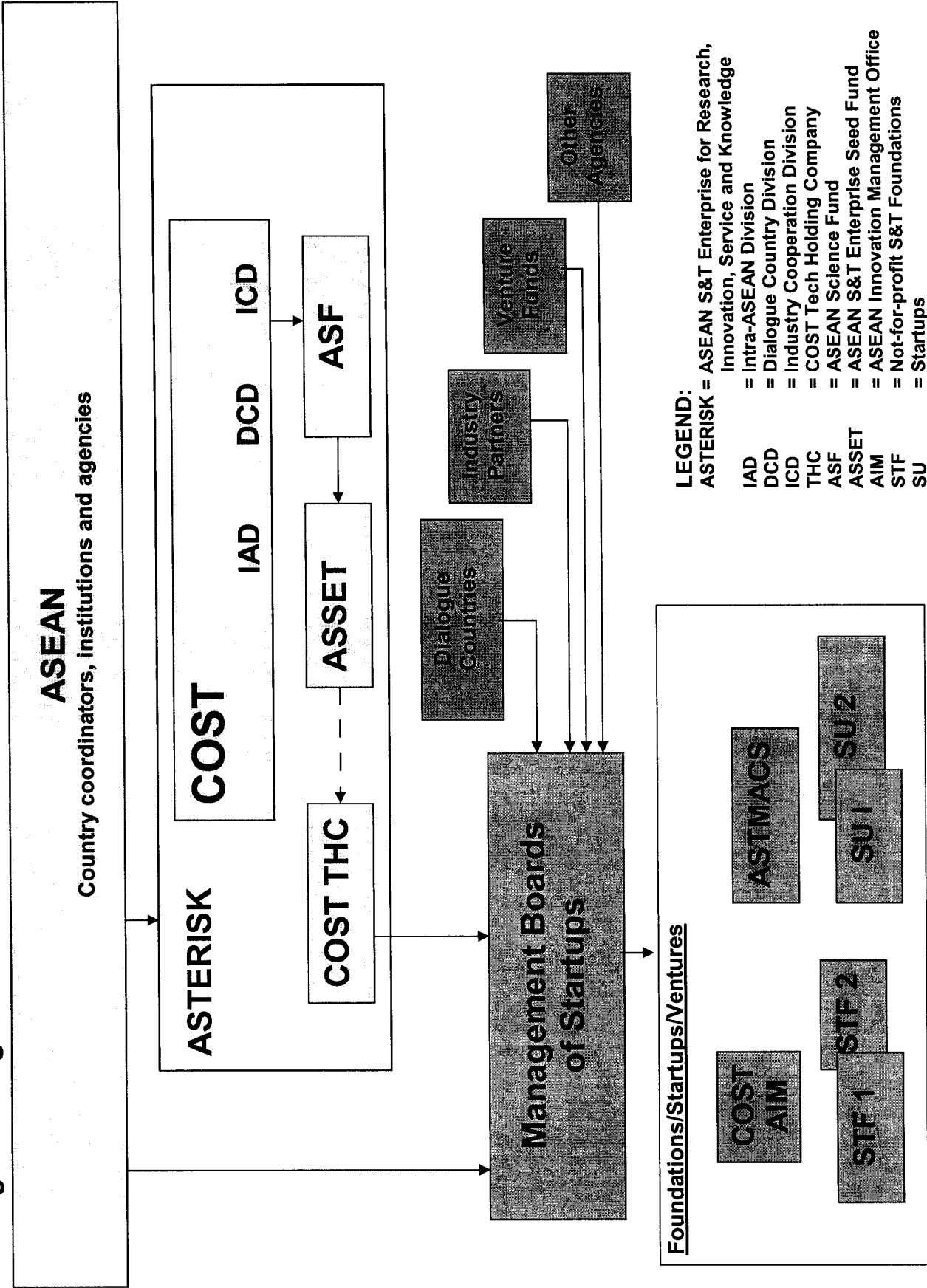
COST will need to monitor performance of its projects and adopt more stringent timelines and milestones achievements. Ultimately, sustainability of the projects and programmes will depend on achieving the required deliverables and ROIs. Therefore, it is imperative that provisions be made to increase the administrative support to COST, including to COST's subsidiary groups and the ASEAN Secretariat.

Figure 4 shows the proposed management structure for a future COST in relation to the entities to be formed and potential stakeholders. The structure is adapted from the one presented to the 8th Meeting of ASEAN Ministers for

Science and Technology. Referring to Figure 4, the following mechanisms and operating procedures apply:

- (i) COST is structured to respond multi-laterally to programmes undertaken by its divisions such as IAD (Intra-ASEAN Division), DCD (Dialogue Country Division), and ICD (Industry Cooperation Division).
- (ii) Each Division, led by a Division Head, will be responsible for its programmes, which will be managed by their respective Programme Steering/Management Committees (PSC/PMC).
- (iii) All the activities pertinent to innovative systems for revenue generation, including technology commercialization, enterprise creation, technology assessment and technology scanning, and ASTNET development fall under the purview of ICD.
- (iv) A COST technology holding company (THC) is formed to hold equity in the entities on behalf of COST. The THC can also operate COST AIM. COST will inject ASTNET into ASTMACS and help it establish its links into the various ASEAN institutions and centres of excellence. Board members of THC can be drawn from COST, ASEAN governments and public institutions.
- (v) Each entity or start-up company will have its own management board. Board members may be drawn from COST, ASEAN government agencies, industry, venture funds and others who can contribute to the growth of the startup.
- (vi) To be more proactive and responsive, it is recommended that COST creates its Executive Committee (EXCO). It will be a smaller punchier COST and can be made up of ABAPAST, ABASF, and possibly members from the private sector. The EXCO will oversee much of the day-to-day and ICD activities.
- (vii) Equity participation in a startup can be effected through: in-kind contributions from non-investing institutions or member countries and inventors/researchers, direct investments from the private sector and dialogue partners, and collaborators in the technology development.
- (viii) COST will operate “at arm’s length” from the entities and appropriate mechanisms and instruments will be developed to effect transfer and procurement of services and technology. Due diligence will apply in determining appropriate costs, rewards, equity positions and returns on investments.
- (ix) An entity may be created in and operate from any ASEAN member country based on the submission, examination and execution of the business plan.

Fig.4 Management structure of future COST-ASTERISK



7.2 Managing the Future ASEAN S&T Enterprise

ASEAN Ministers for Science and Technology, at its meeting in Kuala Lumpur in 2000, endorsed the shared vision of achieving an ASEAN S&T community for innovation, competitiveness and knowledge (ASTICK). With the above plans in mind and the challenges that lie ahead, COST will need to be entrepreneurial and adaptive. COST will also need to be fleet-footed and responsive, and be prepared to breach conventional thinking in managing the future S&T enterprise. Therefore, in keeping with the recommendation of the ASEAN Plan of Action on S&T: Implementation Framework for 2001-2004, COST should begin planning on assuming the responsibilities of an ASEAN S&T enterprise for research, innovation, service and knowledge (ASTERISK).

Figure 4 shows the constituents of the future ASTERISK. The constituents of ASTERISK include: a multi-sectoral multi-functional COST and its subsidiary groups, the ASEAN Science Fund and the ASSET Seed Fund , a technology holding company (THC), COST AIM with an ASTNET core and IP exchange (IPX), and a stable of technology start-ups and select not-for-profit S&T foundations.

The multi-functional COST has close links to ABASF and ABAPAST and ASEAN country coordinators. COST will have a lean EXCO for day-to-day operations and decision making.

In moving towards establishing ASTERISK, a number of steps and decisions will need to be taken. A strong endorsement is imperative. Then, incorporating ASSET, COST THC, and COST AIM are the key issues that need to be tackled. A reorganization of COST and its subsidiary groups is a priority given the future thrusts and tasks being proposed.

8. CONCLUSION AND SUMMARY OF ACTIONS

The proposed framework and mechanisms for revenue generation and programme management offers excellent opportunities for COST to move onto a higher plane of intra-ASEAN and public-private sector cooperation on science and technology. The proposed commercialization of ASTNET, and yet retaining its public service role, will allow COST to demonstrate integration of experiences and application of best practices for the betterment of ASEAN's industry.

In embarking on this project, COST looks forward to pioneering a regional undertaking that will spawn new technology SMEs that have the potential to become ASEAN's new industries in 2020. In turn, such successful startups will encourage more of the young to seek a career in S&T, promote further collaboration between the public and private sectors and with dialogue firms, and create a demand for research manpower.

Granted that this is a pioneering effort, with multi-agency interests and participation, coordination and organization tasks do appear intimidating and seemingly insurmountable. But this is a challenge well worth the effort.

In conclusion, the following recommended actions are proposed for prioritization:

- (i) Prioritise and implement the recommended ASEAN-help-ASEAN projects shown in Section 6 above.
- (ii) Develop an IPR framework to promote collaboration among institutions and between public and private sector organizations, and protect and commercialise ASEAN's knowledge capital and natural assets.
- (iii) Develop a phased plan for reorganization of COST moving towards the model of ASTERISK.
- (iv) Develop plans to incorporate the various key constituent entities such as ASSET, COST THC, COST AIM, and ASTMACS, which will include ASTNET and the IPX.
- (v) Create a network of ASEAN technology transfer offices.
- (vi) Support creation of e-learning infrastructure and develop a business plan for an e-learning virtual S&T institute.
- (vii) Develop a strategic plan for research engagement by COST subsidiary groups with a view to supporting technology commercialization and application in SMEs.
- (viii) Create larger COST subsidiary groups along multi-disciplinary thematic areas and support development of enabling core competencies.
- (ix) Strengthen capability on technology scan and foresighting and carry out systematic exercises.
- (x) Develop a programme for continued learning for ASEAN S&T managers.

Appendix A. Project Inception Report and Terms of Reference

DEVELOPMENT OF INNOVATIVE SYSTEMS FOR PROGRAMME MANAGEMENT AND REVENUE GENERATION FOR ASEAN SCIENCE AND TECHNOLOGY

1. Background

Since the decision taken at the 8th Meeting of ASEAN Ministers of Science and Technology in Hanoi in September 1998 and the declaration of the Ha Noi Plan of Action in December 1998, ASEAN COST is committed to creating a framework and supporting mechanisms to promote the development of innovative systems for S&T programme management and revenue generation. This direction was further reinforced by the adoption of the ASEAN Plan of Action on Science and Technology 2001-2004, which sets down strategies for managing the regional S&T enterprise, collaborating with the private sector and dialogue partners, developing S&T human resources, generating income, and providing mutual assistance so as to achieve sustainability and expedite economic development and ASEAN integration.

Subsequently, in 2001, COST obtained funding from the PGTF to develop an operational plan for revenue-generation mechanisms with the view to implementing the plan through a test case drawn from COST programmes and dovetailing the implementation of that activity with the ASTICK/ASTERISK initiative. SCIRD was then tasked to undertake the project through the help of a consultant. The Terms of Reference of the project is attached.

In developing the modes by which COST could generate revenue and undertake new initiatives for managing future S&T programmes and entities, reference will need to be made to recommendations of COST's strategic discussions and the ASEAN Plan of Action on Science and Technology 2001-2004. The design of the workable system will also need to take into consideration the functions of COST's Advisory Body for the ASEAN Science Fund (ABASF) and the Advisory Body for the ASEAN Plan of Action on Science and Technology (ABAPAST), and the proposed plans under the ASTICK/ASTERISK initiative.

2. Methodology

The above operational plan for revenue generation based on one test case is envisaged to incorporate elements of technology licensing and commercialization, creation of technology startups, venture development, revenue sharing, equity participation by individuals and corporates, and human resource development. Therefore, in order to develop the operational plan, the project consultant will undertake to:

- (i) review COST projects and identify those with potential to be spun-off as revenue-generating enterprises taking into account the concept of ASTICK/ASTERISK and the actions prescribed by the ASEAN Plan of Action on Science and Technology 2001 - 2004;

- (ii) develop a business plan for one test case;
- (iii) compile outputs resulting from the above tasks into a single comprehensive draft report and present it at an Experts Group Meeting;
- (iv) revise the draft report taking into consideration comments and recommendations of the Expert Group Meeting;.

In performing the above tasks, the consultant will rely heavily on records of recommendations of COST/SCIRD strategic planning discussions and reports and updates of existing and recently completed projects of COST's subcommittees. Reference will also be made to the project document on the development of ASTNET.

Specifically, the conduct of Task (i) will be through a paper review of consolidated reports of the ASEAN Secretariat, minutes of COST and COST Subcommittee meetings, and submissions from Subcommittees. The review of COST projects should not place any constraints in or preempt the development of any workable plan and model for any spinoff that COST will undertake in the future. The consultant will endeavour to draw upon experience in ASEAN other than relying solely on inputs from COST subsidiaries to support the case of any eventual business model that will be developed. This is in the event that a review of COST projects does not show up any potential viable spinoff.

In performing Task (ii), the consultant will address the need for a sustainable model for revenue generation and revenue sharing. A new management structure will also be proposed to support the process of enterprise creation, participation in spinoffs and managing the new entities and programmes of the future COST and its subsidiary groups. The proposed new structure will also help COST become ASTERISK-ready.

It is envisaged that the consultant will be furnished with the required documentation and reference materials by the ASEAN Secretariat on request. Should specific questions require answers during the conduct of the project, the consultant will enter into discussion with identified subcommittee chairs and country representatives, and certain other individuals who may from time to time be called upon to provide expert opinions, information and data.

Information gathering on country practices on technology transfer and commercialization, and S&T infrastructure and country support mechanisms and incentives to promote commercial development in science and technology will be done through websites, information portals, and discussions with relevant persons.

At the completion of the draft report of the project, the consultant will present his report at an Experts Group Meeting. The Meeting will be convened at a date to be fixed. He will revise the draft taking into consideration comments and recommendations of the Experts Group Meeting and prepare a final report for submission to SCIRD Chairman within 2 weeks after the Experts Group Meeting. The consultant will be notified of the approval of the final report within 4 weeks of the submission of the final report.

3. Schedule

The project will be undertaken in accordance with the following activities and schedule. It is envisaged that the project duration will be 2 months after commissioning and acceptance of this Project Inception Report. The Experts Group Meeting to discuss the draft report will be convened subject to SCIRD obtaining a consensus on a mutually acceptable date.

Table of Activities and Project Schedule

No.	Activity	Time Line (weeks)								
		1	2	3	4	5	6	7	8	9
1.	Commission project	x								
2.	Identify sources of information and databases and acquire information and coordinates of useful contacts.	xxxxxxx								
3.	Review COST projects and records of discussions and meeting reports.	xxxxxxxxx								
4.	Develop a business plan for a test case.	xxxxxxxxxxxxxxxxx								
5.	Propose a revenue generation system.	xxxxxxxxxxxxxxxxx								
6.	Propose a COST management structure for revenue generation.	xxxxxxxxxxxxxxxxx								
7.	Prepare draft report						xxxxxx			
8.	Present draft plan to Experts Group								xx	(date to be fixed)
9.	Revise draft plan and submit final report.								xx	(within 2 weeks after Activity no. 8)

TERMS OF REFERENCE

Development of Innovative Systems for Programme Management and Revenue Generation for ASEAN Science and Technology

Title of assignment : Consultant on development of operational plan for revenue-generation mechanisms for ASEAN science and technology

Expected outputs :

1. A compilation of examples of COST projects with potential as a spin-off enterprise;
2. A business plan for one test case.

Required tasks :

1. To prepare an inception report outlining his proposed methodology and approach to the assignment, for approval by the SCIRD Chairman;
2. To undertake duty travel to selected ASEAN countries as needed for conducting interviews and gathering information within the conditions prescribed in the project proposal;
3. To review COST projects and identify those with potential to be spun-off as revenue-generating enterprises taking into account the concept of ASTICK and the actions prescribed by the ASEAN Plan of Action on Science and Technology 2001 - 2004;
4. To develop a business plan for one test case;
5. To compile outputs resulting from tasks 1 and 2 into a single comprehensive draft report and present it at an Experts Group Meeting;
6. To revise the draft report taking into consideration comments and recommendations of the Expert Group Meeting;.

Reporting

The consultant will submit the inception report, draft report and final report to the SCIRD Chairman.

Qualifications :

1. Expertise in business plan development including experiences in setting up business development;
2. Familiarity with ASEAN in general and COST programmes in particular;
3. Proven track record in short-term consultancy work in his field of expertise;
4. Excellent writing and communication skills in English;
5. Must be an ASEAN national.

Timeframe :

Equivalent to 30 man-days of work

Location :

May work at home base except for duty travel to selected ASEAN countries as may be necessary (for briefing with SCIRD Chairman, attendance at Experts Group Meeting, maximum of 2 trips of 7 days each to ASEAN capitals for interviews with key persons)

Appendix B. List of Contact Persons

Philippines

1. Dr Ida F. Dalmacio, Executive Director, Philippine Council for Advanced Science and Technology Research and Development, Department of Science and Technology, Manila.
2. Dr Corazon T. Aragon, Director, Center for Technology Exchange & Training for Small and Medium Enterprises (ACTETSME), Manila.
3. Dr Ceferino L. Follosco, Chairman, Follosco Manufacturing & Industrial Corporation, Manila.
4. Mr Danilo P. Manayaga, President, Secura International Corporation, Manila.
5. Mr Alex S.E. Sy, Electronic Industries Association of the Philippine, Inc, Manila.
6. MA Lourdes P. Orijolo, Director, Technology Application and Promotion Institute, DOST, Manila.
7. Dr Nuna E. Almanzor, Deputy Director, Administration and Technical Services, DOST, Manila.

Thailand

1. Prof Dr Yongyuth Yuthavong, Director, Thailand Graduate Institute of Science and Technology, National S&T Development Agency, Bangkok.
2. Prof. Dr Chanchanat Thebtaranonth, Vice President, National Science and Technology Development Authority (NSTDA), Bangkok.
3. Dr Suvit Tia, Head, PDTI, King Mongkut's University of Technology Thonburi (KMUTT), Bangkok.

Malaysia

1. Prof Dr Mohd Ali Hashim, Director, Science and Technology Division, Ministry of Science, Technology and Environment, Putrajaya.
2. Professor Dr. Mansor Ahmad, Head of Advanced Materials Laboratory, Institute of Advanced Technology, University Putra Malaysia.
3. Professor Dr Khairun Azizi Bte Mohd Azzizli, Dean, School of Materials and Mineral Resources Engineering, Universiti Sains Malaysia, Penang.

Vietnam

1. Dr Le Dinh Tien, President, National Institute for S&T Policy and Strategy Studies, Hanoi.

2. Dr. Bach Tan Sinh, Head, National Institute for S&T Policy and Strategy Studies, Hanoi.

Indonesia

1. Dr Ir Sulaeman Kamil, Advisor for the Minister of Research and Technology, Ministry of State for Research and Technology, Jakarta.
2. Dr Ir.Ichsan S.Putra, Director for Education and Head, Aeronautics & Astronautics Dept, Institute Technology Bandung, Bandung.

Appendix C ASEAN COST IPR Policy

The guidelines developed and subsequently adopted by COST for implementation are as follows:

Policy on Intellectual Property Rights in Collaborative Research Projects

Arrangements for ownership and exploitation of intellectual property generated from collaborative projects are designed to maximise the opportunities for its use and successful commercialisation. The following are proposed guidelines for sharing of IPR in collaborative research.

1. All background information and know-how used in connection with the Project shall remain the property of the party introducing the same.
2. All rights and title to intellectual property (including trademarks and servicemarks, copyrights, patents, designs, confidential information), the subject of such intellectual property, inventions and innovations, arising out of the Collaborative Project, will be governed by the following principles:
 - (i) the Collaborating Parties shall have joint title to and the right to determine jointly the disposition of all such intellectual property, inventions and innovations;
 - (ii) the Collaborating Parties shall be entitled to make joint applications for registration of trademarks, servicemarks and designs and joint applications for patents in respect of such intellectual property.
3. Both parties shall have the rights to manufacture, sell and/or use all such intellectual property on such terms and conditions as may be mutually agreed upon.
4. All income, upon deducting such costs that may have been reasonably incurred, which may arise from commercialisation of the results of the Collaborative Project or disposition of all such intellectual property, inventions and innovations arising from this Project shall be shared equally between the Parties.
5. The collaborating parties will execute, if necessary, a project agreement based on terms and conditions to be agreed upon and in line with the above policy; and
6. The collaborating parties will agree on a lead party responsible for commercialisation of the results of the collaborative project.

Appendix D COST Project Activities

D1: Subcommittee on Food Science and Technology

Completed	On-going	Pending	Under Formulation	Aborted
6 th ASEAN Food Conference, 24-27 November 1997, Singapore	Establishment of a Training Network for Accelerated Development of the Food Industry, since 1996	ASEAN-ROK - Value-Added Products from Fish Processing Materials	Natural Food Flavours and Food Colouring	ASEAN-ROK Development of Shrimp Feed Technologies in ASEAN - aborted in 1998
ASEAN Foods Workshop 1995 - Creation of the First ASEANFOODS Food Composition Database	Technology Transfer of Soy Protein Nuggets and Meat Analogs as Food Supplement	AADCP - Quality Assurance Systems for ASEAN Fruit, Fresh and Minimally Processed Foods Phase II	ASEAN Food Science and Technology Information Service Network	ASEAN Pakistan Workshop on Technical Capability and HRD in Food Technology
AAECP III - Quality Assurance Systems for ASEAN Fruit, Fresh and Minimally Processed (in collaboration with ASEAN Horticulture Working Group)	MOU between SCFST and FIFSTA, since mid 1999	Upgrading SME's in ASEAN to meet International Standards for Quality	ASEAN ROK Value Added Products from Fish Processing Materials	Food and Industrial Waste Management
AAECP III - Waste Water Treatment Technology Transfer and Cleaner Production Demonstration (1997-2001) in collaboration with ASEON	ASEAN Food Science and Technology Information Service (AFTIS) - part of the SCFST home page	Strengthening ASEAN Capability in Risk Assessment in support of Food Safety Measures (Application of S&T in Risk Analysis for Food in AMCs)	ASEAN+3 Cooperation in Food Safety including Training and Manpower Development	Utilisation of Tamarind Seeds
Intra-ASEAN project : Manpower Training in Food Microbiology in CLMV, completed Nov 2002	8th ASEAN Food Conference	Strengthening ASEAN Capability in Risk Assessment, Risk Management and Institutional Framework for Biosafety	ASEAN+3 Exchange of Information on Cleaner Production Technologies	Establishment of Linkages with Canadian Institutions (on hold)
7 th ASEAN Food Conference, Manila, Philippines, 20-22 November 2000		Cleaner Production Technology for Sustainable Development of the Food Industry in ASEAN		
ASEAN Workshop on Functional Food		Strengthening Functional Food Utilisation and Production in ASEAN Countries		
Training Course on High Protein Food Development for CLMV				

D2: Subcommittee on Meteorology and Geophysics

Completed	On-going	Pending	Under Formulation	Aborted
Plate Motion and Crustal Deformation from Space Geodetic Measurements for the Assessment of Related Natural Hazards in South East Asia (GEODYSSEA Project)	ASEAN Specialised Meteorological Centre (ASMC) - permanent centre since 1993	Establishment, Development and Coordination of Long-Term Marine Meteorological and Physical Oceanographic Monitoring, Assessment, Modelling and Prediction Capacities of ASEAN Countries	Study on Active Fault in Northern Thailand, the Malay Peninsula and the Sumatra Island	Air Mass Experiment over ASEAN Region
ASEAN Network for Rapid Exchange of String Earthquake Data (ASTNET-RESED)- (i) Training on Computer for Seismic Data Exchange, Jakarta (ii) Training on Seismology (iii) Courses by the Japan Meteorological Agency.	Updating of ASEAN Climatic Atlas and Compendium of Climatic Statistics (initial project completed in 1983, updating commenced in Jan 2001)	South East Asian Centre for Atmospheric and Marine Prediction (SEACAMP) Module 1: ASEAN Network for Exchange of Data for Marine Meteorology and Oceanography	Study on Earthquake Prediction and Earthquake Disaster Prevention	SEACAMP Module 4: Establishment of a Centre for Development and Coordination of Long-Term Marine Meteorological and Physical Oceanographic Monitoring, Assessment, Modelling and Prediction Capabilities
Feasibility Study on Climate Monitoring and Impact	ASEAN Earthquake Information Centre	SEACAMP Module 2: Numerical Model Products for Marine Meteorology and Oceanography	ASEAN Networking on Agroclimate	ASEAN Cooperative Weather Modification Project
Capacity Building in Seasonal Climate Prediction in the ASEAN region - Workshop on regional climate forecast methodology.	Rainfall Estimation for Monitoring of High Risk Fire Areas in SEA (commenced in December 2001, expected completion end of 2002)	SEACAMP Module 3: ASEAN Enhanced Observation Network for Marine Meteorology and Oceanography	Attenuation of Solar Radiation in the Atmosphere and its Application to Solar Radiation Mapping in the ASEAN Region	ASEAN-China: Research on Monsoon Mechanism and Prediction of South China Sea and Surrounding Areas
ASEAN China Workshop on Seismology, 22 - 26 October 2001, Beijing	Seasonal Climate Prediction in the ASEAN Region	Workshop on Application of Hygroscopic Pyrotechnic in Rainfall Enhancement	Data Rescue for ASEAN Long-term Climatic Studies	ASEAN China Cooperation: South China Sea Monsoon Experiment, SCSMEX
Programme to Address ASEAN Regional Transboundary Smoke (PARTS)			Tropical Maritime Continent Monsoon Research	ASEAN Workshop on Climate Change
Training Workshop on Monsoon Rain Prediction Schemes, 16-19 July 2002 (ROK)				
ASEAN-China Workshop on Earthquake Prediction Techniques, 23-25 October 2001, Beijing, China				

D3: Subcommittee on Microelectronics and Information Technology

Completed	On-going	Pending	Under Formulation	Aborted
ASEAN-Canada: Study Tour/Visit to Canadian Institutions on Microelectronics		ASEAN-India Digital Archive Phase II	ASEAN - India High-end Networking Training Course (ERNET)	ASEAN Networking through Internet
ASEAN-India Workshop on Information Technology		ASEAN ROK Workshop on Radio Frequency Microelectronics		ASEAN-ROK Workshop on Supercomputing and Networking Service
Workshop on ASEAN-India Digital Archive		ASEAN ROK Microelectronics Process Training		Seminar on Silicon Processing Technology
AAECP III – Telecommunications Cooperation Training Project		ASEAN ROK Training on Integrated Chips (IC) Design		ASEAN-India Informatics Training Centre
ASEAN-India Digital Archive Phase 1 (formerly named ASEAN-India: Multimedia in Education), 1999		ASEAN ROK Cooperation in Microelectronics Fabrication Services		ASEAN India High Level Seminar on Sharing of Software Development Experiences
ASEAN ROK Workshop on Microelectronics Technology, 21 – 23 February 2000		Internet Access for Persons with Disabilities - Computer Access		
Seminar on Internet Accessibility and Persons with Disabilities: an ASEAN Perspective		ASEAN-ROK: Technology Network for Multi-Robot Cooperating System Development		
National Institute of Information Technology Course for ASEAN, June - Aug 2000				

D4: Subcommittee on Materials Science and Technology

Completed	On-going	Pending	Under Formulation	Aborted
ASEAN-India Workshop on Advanced Materials			ASEAN-India Development of Thermally Sprayed Ceramic-Based Coatings [Phase II of ASEAN-India Cooperation on Surface Engineering)	ASEAN-ROK: Development of Advanced Coating Material for High Performance Engineering
Brainstorm meeting on Ferroelectronics Thick and Thin Films Processing for Electroceramic Devices			ASEAN-India Cooperation on Development of Raw Material and Neodymium-Iron-Boron (Nd-Fe-B) Magnets and Application Engineering [Phase II of ASEAN-India: Development of Permanent Magnet)	Development of Porous and Membrane Ceramics for Industrial Applications
ASEAN-India: Development of Raw Materials and Permanent Magnet (Nd-Fe-B) for Industrial Application			ASEAN Joint Research Project on Ferroelectric Thick and Thin Films Processing for Electroceramic Devices	
ASEAN India: Wear Resistant and Thermal Barrier Coatings for Automotive and Other Applications (Surface Engineering), June 2001			Workshop on the Development of New Materials and Technology for Fuel Cells	
ASEAN-NZ: Corrosion Prevention in Infrastructure and Equipment, June 2002				
ASEAN-Pakistan Workshop: Industrial and Composite Design Applications, 29 - 31 Oct 02				

D5: Subcommittee on Biotechnology

Completed	On-going	Pending	Under Formulation	Aborted
ASEAN-India Workshop on Biotechnology	ASEAN India Cooperation in Plant Biotechnology for Crop Improvement and Better Utilisation of Natural Resources	ASEAN-NZ : Regional Training Workshops on Biocontrol Technology	Sustainable Development and Utilisation of Tropical Rainforest Plants of I, M, P, T and V: Chemical Prospecting of Plants	ASEAN-Japan: Collaboration Project on Biotechnology of Infectious Diseases
Workshop on Biosensor	ASEAN China: Agricultural Biotechnology Workshop for New Member Countries	ASEAN-Canada Biotechnology Information Network (ACBIN)	Human Resources Development Programme in Biotechnology for CLMV: Short-Term Training Fellowship Phase II	ASEAN India Cooperation in Animal Biotechnology for Embryo Transfer Technology
ASEAN-ROK Workshop on Formulation of Biotechnology Atlas	ASEAN-Japan: Agricultural Biotechnology Training for CLMV	ASEAN China: Publication of Book on Transgenic Cotton	Strengthening Capability of ASEAN in Biosafety, Scientific, Technical, Institutional and Legal Aspects (AADCP)	ASEAN UNESCO Biotechnology Strategies: Development of New and Improved Biocontrol Agents for Pest and Insect Control in SEA
ASEAN-India Workshop on Biotechnology – Phase II		ASEAN China Workshop on Bioinformatics	ASEAN China Workshop on Transgenic Bt Cotton, Hybrid Rice and Disease resistant Banana	
ASEAN China Workshop on Transgenic Plants		ASEAN India Workshop on Bioinformatics	ASEAN ROK Workshop on Bioprospecting and Bioinformatics	
Policy Option and S&T Capacity Building concerning Genetically Modified Organisms for member countries, June 02			India ASEAN Institute of Biotechnology	
Human Resources Development Programme in Biotechnology for CLMV: Short-Term Training Fellowship			ASEAN India Animal Vaccine	

D6: Subcommittee on Non-Conventional Energy and Research

Completed	On-going	Pending	Under Formulation	Aborted
ASEAN-Canada Solar Drying Project	ASEAN-EU Cooperation on Technology Transfer for Energy Cogeneration from Biomass in ASEAN (COGEN Phase III)	ASEAN Pakistan Workshop on Renewable Energy Technologies	Micro-Hydropower and Photovoltaic System for Rural Electrification	Utilisation of Vegetable Oils and their Derivatives for Compression Ignition Engines
AAECP III – Energy from Biomass Residues	ASEAN-New Zealand Project on Natural Gas Technology - Training and Technology Transfer in Natural Gas Distribution Systems	Solar and Convective (including steam) Drying of Agricultural and Marine Products	Workshop on Biomass Technology (Japan)	Capacity Building in Landfill Gas Utilization
ASEAN-EU Cooperation on Technology Transfer for Energy Cogeneration from Biomass in ASEAN (COGEN Phase II)	ASEAN Japan: Regional Workshops on Drying Technology		Fuel Cell: Application of Natural Gas as a Fuel in Solid Polymer Fuel Cell for Transportation	ASEAN-Pakistan Workshop on Renewable Energy Technologies
ASEAN-NZ Cooperation Programme on Natural Gas Utilisation in Transport (NGUT) Phase 1	Intra ASEAN: Manpower Training and Technology Transfer on Drying of Agricultural Products for CLMV			Solar and Convective (Including Steam) Drying of Agricultural and Marine Products

D7: Subcommittee on Marine Science and Technology

Completed	On-going	Pending	Under Formulation	Aborted
<p>ASEAN-EU: Inter-disciplinary Scientific Methodologies for the Sustainable Use and Management of Coastal Resource System – Phase I</p>		<p>AADCP IV: Future Marine/Coastal Focussed Project [Previously AAACP IV: Marine Science Project – Coastal Zone Environment and Resources Management Project (CZERM)]</p>	<p>Study on the Impact of Marine Protected Area in Cojoining Ecosystems (for China)</p>	<p>ASEAN-Japan: Training Workshop on Multi-Species Resources and Multi-Gear Fisheries</p>
<p>ASEAN-EU: Inter-disciplinary Scientific Methodologies for the Sustainable Use and Management of Coastal Resource System – Phase II</p>		<p>ASEAN-Canada Cooperative Programme on Marine Science (CPMS) Phase III: Coastal and Environmental Management for Economic Development, Human Health Protection and Resource Sustainability in ASEAN</p>	<p>ASEAN China Workshop on Marine Science and Technology</p>	<p>ASEAN-Japan: Training Workshop on Taxonomy and Ecology of Marine Organisms</p>
<p>CPMS II – Establishment of Environmental Criteria for Development and Management of Living Marine Resources and Human Health Protection</p>		<p>ASEAN-ROK Cooperation on Industrial Uses of Marine Biological Resources: Assessment of the State of the Art of Marine Biotechnology in the ASEAN Region</p>	<p>Regional Cooperation in Integrated Coastal Management (Fast Track Programme)</p>	
<p>AAECP III – Coastal Zone and Environment Resource Management Programme (CZERM)</p>		<p>ASEAN-EU: Inter-disciplinary Scientific Methodologies for the Sustainable Use and Management of Coastal Resource System – Phase II</p>		
		<p>Assessment on the Functionality and Impacts of Marine Protected Areas in Sustaining Marine Resources and Ecosystems. (Previously - Rebuilding and Sustaining Fisheries Resources through Functional Marine Protected Area Networks)</p>		

D8: Subcommittee on S&T Infrastructure and Resources Development

Completed	On-going	Pending	Under Formulation	Aborted
Roundtable on Technology Scan	ASEAN-ROK: Establishment of Network on Investment and Technology Transfer Information (Preliminary study completed)	ASEAN Science and Technology Network (ASTNET) - the contents		ASEAN Science, Technology and Innovation in the Regional and Global Contexts—A Proposal for a Series of High Level Conferences
ASEAN-Canada S&T Networking Seminar and Workshop	Development of Competitiveness Indicators in ASEAN (ROK)	ASEAN Science and Technology Management Information System Phase 2		ASEAN-Canada: The Strategic Information Management Programme
ASEAN-NZ Cooperation on Technology Transfer and Commercialisation of R&D Results	Science and Technology Human Resource Development (HRD) Programme (Japan)	Development of an Innovative System for Programme Management and Revenue Generation for ASEAN S&T		ASEAN Convention on the Performance and Prospects of Technology Incubators and Science Parks
ASEAN-UNDP, ASP-5, Element II: ASEAN S&T Management Information Systems (ASTMIS), Phase 1	Public-Private Collaboration in Regional Science and Technology Development (Japan)	ASEAN Virtual Education Consortium as Preparation for the ASEAN Virtual University on Science and Technology (AVUST)		ASEAN ROK Exchange and Training Programme on Technology Management: Theories and Best Practices
ASEAN-UNDP, ASP-5, Element III: Public-Private Collaboration in Regional Science and Technology Development	Development of Innovative Systems for Programme Management and Revenue Generation for ASEAN Science and Technology	ASEAN Technology Foresight and Scan [Previously: Development of a Technology Scan Mechanism: ASEAN Technology Scan (ATS)] ASEAN Foundation		A Study on the Promotion System for Collaborative R&D among Industries, Universities, and Research Institutes: A Comparative Study between ROK and ASEAN
ASEAN-UNDP, ASP-5, Element IV: Technology and Environment	Formulation of a Programme Framework for the concept of an ASEAN S&T Community for Innovation, Competitiveness and Knowledge (ASTICK)	ASEAN Foresight Exercises in Selected Strategic Technology and Application Areas		ASEAN-ROK: Exchange and Training Programme on S&T Policy and National R&D System
ASEAN-ROK: Supporting the Establishment of S&T Manpower Development System	ASEAN Journal on S&T for Development			Courses on Technology Management
COST Brainstorm Session	ASEAN Science and Technology Week			ASEAN-Japan Experts Meeting on S&T

Special Task Force Meeting	ASEAN Science and Technology Network (ASTNET) - the Website			Public-Private Sector Collaboration in Regional S&T Development
ASEAN India Workshop on Technology Management and Competitiveness				ASEAN NZ Cooperation on Technology Transfer and Commercialisation of R&D results
Formulation of ASEAN Plan of Action on S&T				Cooperation with Canada: Technology Foresight
Networking of S&T Centres and Academic Institutions, Phase I: Industrial Research Institutes				

D9: Subcommittee on Space Applications and Applications (Previously, Experts Group on Remote Sensing)

Completed	On-going	Pending	Under Formulation	Aborted
ASEAN-EU Improvement of Natural Resources Management and Environmental Monitoring through the Use of ESA ERS-1 Capabilities in ASEAN Countries" completed in 1996.		ASEAN-EU: ASEAN Earth Observation Applications Programme	ASEAN-Canada Workshop on Remote Sensing and GIS for Sustainable Management of Natural Resource and the Marine Environment	ASEAN-China: Application of Remote Sensing and Geographic Information Systems (GIS) to Ecosystem Investigation and Management of Lan Chang-Mekong River
Caravan Training Program 2001: Workshop on Watershed Management Using Remote Sensing and GIS			ASEAN India Collaboration on Space Technology and Applications	
ASEAN-Australia: Technology for Updating Maps Using Remote Sensing			ASEAN China Precision Farming	
ASEAN-China Workshop on Remote Sensing Cooperation, 19 - 23 July 2000			Space Technology and Applications Directory (Fast Track Programme)	
Publication of "ASEAN from Space Book", Sept 2001				

D10: ASEAN help ASEAN Projects

Country	Project 1	Project 2
Indonesia	Training Course on Technology Management, Nov 01	Training Course on IT Applications on Hydrology, Nov 2001
Malaysia	Training course on Risk Analysis and Food Safety for AMCs, May 2002	
Singapore	Training in Food Microbiology (Nov 2000 to Nov 2001)	Manpower Training and Technology Transfer on the Drying of Agricultural Products (Nov 2002 to date - still on-going)
Thailand	Biotechnology fellowship project for CLMV, May 01	
Total (excluding Singapore projects implemented under SCFST and SCNCER respectively, and Thai project implemented under SCFST/SCB)	3	

Appendix E. Bibliography

1. Report of ASEAN COST Meetings – from 33rd COST in 1996 to 44th COST in 2002
2. ASTNET Experts Meeting, 3-4 July 1997, Singapore
3. ASEAN Brainstorm Session, January 1998, Phuket
4. Report of 8th Meeting of ASEAN Ministers of Science and Technology, September 1998
5. Special Task Force Meeting, 7-8 August 1999, Phuket, Thailand
6. Report of 1st Informal Meeting of ASEAN Ministers of Science and Technology, April 2000
7. Report of 9th Meeting of ASEAN Ministers of Science and Technology, September 2001
8. Report of 2nd Informal Meeting of ASEAN Ministers of Science and Technology, January 2003
9. ASEAN Plan of Action on Science and Technology: Implementation Framework for 2001-2004