

Science, Technology and Innovation Policy (STIP) for Lebanon

EXECUTIVE SUMMARY

Objective

Lebanon runs the risk of losing out on two of its most valuable assets: many of its young highly educated people wander abroad or are unemployed; capital, too, wanders abroad in search for profitable investment opportunities. This STIP Plan for a new Science, Technology and Innovation Policy for Lebanon aims at creating high quality jobs and investment opportunities, in line with the desire of the Lebanese government, the private sector, and organizations such as NCSR and the universities to make Lebanon part of the worldwide move towards a knowledge-based society.

The first objective of the STIP Plan is to increase and focus the national efforts in science, technology and innovation.

Secondly, to strengthen the STI institutions and gear them to create high-quality jobs and economic growth, improve the quality of life, and strengthen the position of Lebanon as a regional centre for high-quality learning, economic development, trade, tourism and health care.

Thirdly, the STIP Plan aims at strengthening partnerships between universities, NCSR and institutes; and between these organizations on one hand and private enterprise, other private organizations, and public agencies on the other.

Fourthly, it purports to strengthen Lebanon's embedding in regional and wider international networks in science, technology and innovation, and to use those networks for the most effective and efficient implementation of the Plan.

Some 30 experts from Lebanon have worked in three task forces, together with Dr. Peter Tindemans and the NCSR, to prepare this plan. Substantial input has come from ESCWA, and financial support from UNESCO and ALECSO.

While prepared under the auspices of the Lebanese NCSR, it is a plan for Lebanon as a whole that addresses a number of key challenges and needs specific to Lebanon, and the weaknesses of Lebanon's present science, technology and innovation system. NCSR, the major universities and institutes, and of course the government and the private sector must play a key role to guarantee its successful execution.

Challenges for and needs of Lebanon

In view of the relatively young demographic composition, the growth rate, and the relatively high level of education of the Lebanese population, attractive jobs need to be created in the high added value branches of industry and services.

The use of technology more efficiently and in more creative ways is the only way to establish higher added value production and services. Through them, export capacity could be increased in order to reduce the huge trade imbalance.

Making the most of domestic and foreign technology and information is crucial to revitalize the industrial manufacturing sectors and building up stronger professional service sectors. Major inputs in R&D and entrepreneurial incentives are the way to bring about a jump in productivity, export performance, environmental sustainability of agriculture and attract private investment.

The medical and health care sector, as well as related industrial and service activities (e.g. in the field of ICT) can become a strong pillar in the Lebanese economy, if one steps up, in line with international practice, investments in R&D and the knowledge level of medical and para-medical staff.

Dedicated efforts in R&D and innovation will help greatly reduce energy and water consumption, use available resources efficiently and even create export potential.

Tourism will benefit from rehabilitation and preservation technologies, and from applying humanities and cultural sciences, ICT and marketing research. ICT and marketing research are key factors to advanced, innovative and efficient financial services.

All such efforts will contribute to reduce the national debt burden by boosting economic growth, and will offer investment options for capital that is now invested abroad by Lebanese banks.

In three vital domains for Lebanon, specific opportunities have been identified that should be grasped by addressing the following societal needs:

In basic science, industry (including services) and engineering:

- 1) Improve the management of energy, water, and other natural resources by adopting an integrated, sustainable approach
- 2) Reduce industrial operating cost (energy, equipment, and maintenance)
- 3) Harness information and communication technologies for development
- 4) Harness and strengthen scientific research for development
- 5) Improve productivity in industry, increase technology and information content
- 6) Establish new suitable industries for development and job creation
- 7) Increase share in international trade and export performance.

In environment and agriculture:

- 1) Stabilize (and eventually prevent) coastal deterioration through sustainable management
- 2) Integrated water management for an effective supply/demand balance
- 3) Grasping new agricultural economic opportunities
- 4) Improved nutritional food quality.

In medicine and health care:

- 1) Resume the position as a regional leader in the field of medicine and health care through improving higher medical and health science education, and through improving the quality and cost-effectiveness of medical and health care
- 2) Create an environment conducive to a flourishing biomedical industry and services sector.

Strengths and weaknesses of higher education and research in Lebanon

Lebanon has a long tradition in higher learning, research and science policy. There is an abundance of indigenous talent, the value of higher education is appreciated, and there is a high percentage of educated individuals with a relative gender un-bias. The environment to apply science and technology through developing individual initiatives exists, and the needed creative design skills and entrepreneurial and commercial drives are available. PC and Internet usage are wide-spread. There is a large network of Lebanese scientists abroad with many links to Lebanon. But there is another, negative side to the higher educational system in Lebanon. There are many un- or underemployed qualified graduates with much emphasis on degrees in arts and humanities and theoretical sciences, all contributing to a significant “brain drain”.

Most scientific research is being carried out by only a few institutions, and there is limited funding usually coming from a small number of sources, whether public or private. There are few institutional incentives to reward initiative, merit and performance. There is little collaboration. Outside of a few institutions, critical mass is lacking. The research institutes, the IRI maybe apart, have an urgent need for competent staff and equipment, and need to be re-positioned for new challenges, including stronger links to universities and stakeholders. Skilled technicians are often lacking, and infrastructure of technical systems underdeveloped. The gap between university research activities and industrial needs is large. Managerial and entrepreneurial skills are rather underdeveloped among scientists.

To improve this, a distinction should now be made between universities that have the ambition to do serious research and to link their teaching to research, and those who do not or cannot. For the first category, the research output should be part of their auditing. Teaching as well as research tracks should be provided. Collaboration should be encouraged; decision making and customs procedures accelerated; and international contacts made more easy. To achieve critical mass centres of excellence need to be set up, which will also assist in establishing partnerships with industry.

The initiatives of the STIP Plan

Experience and insights from those countries that have best and longest profited from science, technology and innovation show that a Science, Technology and Innovation system (STI system) that is up to the task displays several characteristics. Examples include setting of strategic priorities, a highly skilled workforce, strong universities and institutes, performance-oriented attitudes and procedures, a strong outward orientation and active pursuance of partnerships, mobility and technology transfer.

The STIP Plan cannot address all possible ways to improve the functioning of the STI system. A selection has been made, which together form the STIP Plan. By demonstrating that the activities of the Plan will lead to concrete progress in tackling the societal needs mentioned above, the STIP Plan will contribute to the conviction that STI Policies are vital. In this way of ‘developing STI Policy by demonstration’ the first 5-year STIP plan is meant to be supplemented by additional actions in 3 years time, and to evolve after 5 years into a structural approach, that might include institutional reforms as well.

A. Research Programmes targeting strategic priorities

Research Programmes are proposed in the following areas:

1. IT deployment in the enterprise sector
2. Web and Arabized Software Technologies
3. Mathematical modelling including financial/economic applications
4. Renewable energy resources (e.g. chemical, wind, hydroelectric, solar)
5. Materials / basic sciences for innovative applications
6. Sustainable management of coastal areas
7. Integrated water management
8. Technologies for new agricultural opportunities
9. Nutritional food quality
10. High quality research in subfields of molecular and cellular biology (one or two).
11. High quality research in clinical sciences (one or two programmes)
12. Forging links between the practitioners of medical and health sciences and technology, social sciences and paramedical professions.

B. Improving the Research Environment

To address several of the main weaknesses of higher education and research in Lebanon a variety of measures have to be taken.

Universities

- The functioning of universities needs to be improved by requesting a commitment to research and enforcing this by introducing new standards based on performance and auditing; by introducing more graduate, and in particular PhD programmes; and by making the funding of postdocs and centres eligible for support under the various STIP programmes.

Research Centres/Institutes

- A Virtual Centre for Instruments for Environmental Analysis coordinated by a properly staffed NCSR Centre for Marine Sciences should be established.
- A Nutrition Research Centre that could be hosted at one of the better equipped universities, should be established as a national centre.
- A Medical Research Institute should be set up with a core in molecular and cell biology, that would eventually serve the research needs of other sectors as well.
- The Ministry of Agriculture should develop long term funding, staff and governance policies for the ARI to enable it to participate in the STIP Plan and play a central role in a wider and innovative agricultural system .
- NCSR should develop long term plans for its Centres in conjunction with the implementation of the STIP Plan.

Incentives for collaboration

- Incentive programmes should be developed to stimulate collaboration with respect to research equipment and between people across disciplines, institutions, borders, and the public and private sector.

Streamlining of procedures

- NCSR should take the initiative to draft a White Book listing the major adverse regulations, procedures, administrative practices, and so on, for research, and seek to resolve them with the Interdepartmental Committee to be mentioned later.

A culture of responsibility and performance

- The arrangements on auditing, performance, careers for universities should be applied throughout the research system.
- NCSR should make sure that STIP management and funding decisions are highly transparent and responsible. It should also continue to improve its internal operations and grant procedures in the same direction.

C. Information and Communication Infrastructure

Here two activities are proposed:

- The scope and an implementation plan for an advanced Information and Communication Network for Higher Education and Research should be defined.
- An incentive programme for Innovative Information Products should be established.

D. Linking academia and institutes to the private sector and public agencies, NGO's and society at large

Exploiting and disseminating science and technology is envisaged in the STIP Plan by a number of initiatives:

- A Knowledge Gateway Industry Lebanon should be established. This consists of a database and Technology Promotion Units at each of the major universities and IRI to help especially SME's to articulate needs and benefit from university and IRI expertise and resources.
- Sectoral centres of excellence (real or virtual) should be set up for sectors such as clothes, shoes and furniture, with the aim to provide technical know-how and laboratory services. They could be based on the model for the wine industry.
- In a joint effort NCSR, IRI, LIBNOR and the Ministry of Industry should agree to set up teams to support the adaptation and adoption of technical standards.
- NCSR should take the initiative to set up a team to define the format of workshops and experiments with e.g. degree course requirements in the area of entrepreneurship and business development.
- Consideration should be given to the establishment of a small funding initiative, maybe linked to BERYTECH or other incubator initiatives to provide seed money very early on for ideas based on scientific work.
- A structured approach towards establishing new incubators should be established.
- A stronger representation of the outside world in steering committees and advisory boards of universities and institutes should be systematically pursued.
- Public and Professional Information Units should be created in four areas, based on existing centres or centres to be established:
 - Coastal Zone
 - Water
 - New agricultural opportunities
 - Food quality.

Their task will be to provide all strata of Lebanese society with the highly relevant information that will be accumulated by the STIP research programmes.

E. STI Policy system aspects

Two areas for strengthening the STI Policy System have been selected:

1. Getting better statistical data and indicators on STI:

- With the help of ESCWA and the UNESCO Institute of Statistics a unit should be established at NCSR that should develop into an STI Observatory.
- Its scope should be pragmatically defined and one needs therefore to identify an initially limited but structured set of indicators to monitor Lebanon's performance in STI and the knowledge society.

2. Strengthening the co-ordination role of CNRS:

- NCSR has, as reconfirmed by the recent circular 17/2003 of the Prime Minister on the coordinating role of NCSR vis-à-vis the various government departments, a national responsibility and thus should lead the implementation of the STIP Plan to the benefit of Lebanese society as a whole.
- Stakeholder meetings and an appropriate organization of the implementation should ensure that the enterprise sector, government departments, universities, institutes, and relevant societal bodies identify with and 'own' the STIP Plan.
- NCSR should conclude co-ordination agreements with international donors and ministries to ensure synergy between their financial efforts and the STIP Plan.
- An interdepartmental committee should be set up to involve in a more formal way relevant ministries in the implementation of the STIP Plan and in developing STI policies more generally.

F. National and international partnerships

- The STIP Plan will not only benefit from, but should explicitly aim to strengthen partnerships between the universities, CRNS, the institutes, and the private and public sector enterprises and organizations. Several mechanisms to achieve that goal have been identified.
- Cooperation in the region and in the Arab world are important too, but should be pursued on a case-by-case basis.
- More generally, the various activities under the STIP Plan should assist to incorporate Lebanese scientists and institutions in international networks. Using the contacts with the large Lebanese scientific community abroad, the EU Association Agreement, bilateral funding agreements, institutional partnership links with foreign universities, involving foreign experts in an advisory capacity, are all actions that can serve a useful purpose. Funding under the STIP Plan should make it obligatory for Lebanese partners to demonstrate international 'embedding', of course in ways suitable to the activities concerned.

Implementation, monitoring and evaluation

Expected outcomes and monitoring and evaluation

In order to chart the performance of the STIP plan in creating tangible results, a quantifiable metric is preferably needed. One, however, must be realistic in this respect. Proper overall economic and social stimuli and conditions, which are not the subject of the STIP Plan, need to be in place. Moreover, a single "5-year" STIP Plan must evolve into a continuous effort to lead to sustainable improvements.

The NCSR Programme Management Unit (see next paragraph) should work closely with those who will be responsible for managing the various activities to establish either genuine performance targets or 'proxy' or process targets. Approval of funding is conditional on verifying that such yardsticks are available. This Unit should also work with the other actors to establish a monitoring and evaluation mechanism to verify that yardsticks have been met.

For sectors such as Coastal Management, Water Management, Agriculture, Food Quality, or Energy Production and Use, genuine performance targets can be identified. For water management, for example, one might aim at an increase of 30% after 5 years of the expected available water supply in 2015 compared to the current estimates; and a reduction after 5 years of water consumption per household of 25%, and of 50% for the enterprise and the government sectors.

Measuring the contribution of the STIP Plan to an improved performance of the enterprise sector, however, can only be done by 'proxy', intermediate or process targets. For example, for an applied research programme (such as *IT Deployment in the Enterprise Sector*) that focuses on how small companies can get effective, yet easy-to-use ICT tools to enhance their 'internal' business processes and better manage the 'external' supply chain they are part of, two possible proxy performance targets could be, for example: that after 3 years at least 25 students per year will graduate at Masters level (by participating in applied research projects) in relevant degree courses; or that after 3 years average yearly increases of 10% can be found of the number of enterprises in relevant sectors that apply either the 'internal' business process improvement tools or the 'external' ones, or both.

Organization and responsibilities

A Programme Management Unit (PMU) will have overall responsibility to initiate activities, approve plans, allocate money, and establish a reporting, auditing and evaluation mechanism of the STIP Plan. For each activity or group of activities an organization (which may also be a consortium of organizations) will be identified as Primary Actor, to forward a detailed implementation plan and set up the actual implementation agents. Primary Actors report to and receive money from the PMU. A University Consortium comprising the main universities should be set up for some of the measures, implicating joint responsibilities.

A high level Steering Committee, including expatriate Lebanese scientists and industrialists, is to supervise and facilitate the work of the PMU. NCSR should establish financial, administrative and other guidelines for the PMU to be approved by the Steering Committee.

Budget

The STIP Plan aims to increase substantially the overall spending on STI, largely by creating a pyramid-like community of researchers 'bottom up', including a PhD, post-doc, junior and senior researcher positions. In contrast to present practice salary costs and costs of equipment will therefore have to be reimbursed.

On the basis of estimates of the costs of the various activities and their gradual ramping up to full scale, and taking into account preparatory costs and management costs of some 5%, the overall STIP budget is expected to be as follows (in thousands of US\$):

<i>Y0</i>	<i>Y1</i>	<i>Y2</i>	<i>Y3</i>	<i>Y4</i>	<i>Y5</i>
155	698	2620	4500	5098	5098

The small Preparatory Budget for Year 0, i.e. 2004, is to prepare for those activities that should start at the beginning of Year 1 (that is January 1, 2005, the expected date for the initial implementation of the STIP Plan) and for those activities that preferably should even precede the completion of the full formal decision process. The Plan of Action assumes that when the Cabinet decides to approve the STIP Plan, prior to Parliamentary approval, it decides to make that Preparatory Budget available.

The proposed budget does not include a separate budget for new PhD programmes. Even though part of the costs will be covered by STIP Research Programmes, the overall costs have to be considered in the context of total university funding. The costs of new Incubator initiatives and of the Higher Education and Research Computer Network have not been included, either.

Plan of Action

A Plan of Action has been drawn up that describes in great detail what needs to be done before and during the first year (2005) of STIP Plan Implementation. It proposes suggestions for actions needed to start carrying out the highest priority activities, which however need to be agreed upon by a National Seminar of the stakeholders. On that basis, formal approval by the government and the parliament has to be obtained for the STIP Plan: its budget, the mandates and the coordination structures at the government level. Also in 2004, the implementation organization has to be established, together with the cooperation agreements between the major parties. For later years similarly detailed plans can easily be derived.

A knowledge-based society

Finally, some international background is given about the reality and the pertinence of the concept of a knowledge-based society; the reasons why companies and countries invest in STI in order to increase prosperity and quality of life; and also about the concept of national or regional systems of innovation and associated concepts like economic clusters which underlie the current thinking about STI policies worldwide.