Ministry of Information and Communications Technology

RESEARCH & DEVELOPMENT STRATEGY FOR

INFORMATION AND COMMUNICATION TECHNOLOGY

2007-2010

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Forward

It gives me great pleasure to introduce the new and first ICT Research & Development strategy in the history of the kingdom.

Jordan has long realized the fundamental role of Information and Communications technologies as enablers of change, in a global economy where knowledge is becoming the primary engine of growth and development.

To that end, sufficient resources have not been spared, in facilitating Jordan's transformation into a full-fledged knowledge economy. This includes, among other things, developing our only asset as a country: Human Resources.

We have come a long way, producing a capable, deliberate and dependable workforce that is renowned throughout the whole region! But it is time to unleash more of our people's potential: their mind power to be exact.

This document is very timely, indeed!

It is research and development that will shift our collective way of thinking as a society into a methodical and innovation-based approach utilizing effective critical thinking and problem solving models. Knowledge workers will become the dominant factor in our labour pool, driving high value productivity.

This document is the outcome of a process that represents the very essence of institutionalized innovation: relevant data gathering & analysis as well as quality decision making. I would like to take this opportunity to extend my thanks to the R&D National Committee, headed by Dr. Suhair Al-Khatib for this great and involved effort.

Eng. Basem Fawaz Rousan

Minister

Ministry of Information and Communications Technology

Research and Development National Committee

Suhair Khatib, PhD, MOICT	Chairman
Jawad Afifi, PhD, MOICT	Member
Ahmad Khawaldeh, MOICT	Member
Omar Al Jarrah, PhD, MOHESR	Member
Salem Aqatesh, PhD, German Jordan University	Member
Edward Jaser, PhD, RSS	Member
Omar Hamarneh, HCST	Member
Saed Younis, PhD, Al Bahith	Member
Batoul Ajlouni, ITG, int@j	Member
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Acronyms and Abbreviations

AMIR Program	The AMIR Program is funded by the United States Agency for International Development (USAID)
CORFO	Chilean Economic Development Agency
CIO	Chief Information Officer
FDI	Foreign Direct Investment
FONDEF	Fund for the Promotion of Scientific and Technological Development (Chile)
HCST	Higher Council of Science & Technology
HR	Human Resources
ICT	Information and Communication Technology
ICSTI	Irish Council for Science and Technology
Int@j	Information Technology Association - Jordan
IP	Intellectual Property
IT	Information Technology
JIB	Jordan Investment Board
JUNET	Jordan University Network
MOHESR	Ministry of Higher Education and Scientific Research
MOICT	Ministry of Information and Communications Technology
NACTIB	National Consortium for Technology and Incubation of Business
NC	Research and Development R&D National Committee for the ICT Sector
NITC	National Information and Technology Center
NGO	Non-governmental Organization
PPP	Private Public Partnership
QRNEC	Queen Rania National Entrepreneurship Center

RSS	Royal Scientific Society of Jordan
S&T	Science and Technology
TRC	Telecommunications Regulatory Commission
UN-ESCWA	United Nations Economic and Social Commission for Western Asia
VC	Venture Capital
WEF	World Economic Forum

Executive Summary

Background and Introduction

This document presents a strategy framework for Research and Development in the Information and Communications Technology (ICT) sector in Jordan for the period 2007-2009. It is designed in line with Government's national priorities and needs, and its policy in scientific and technological research. The Strategy is intended to guide the efforts of government entities and other stakeholders, whose ownership and leadership are vital to the future and success of the scientific and technological research in the ICT sector of Jordan.

Jordan's ICT industry is thriving and has become a major contributor to Jordan's economy. The industry enjoys strong support from the government and His Majesty King Abdullah II. It is growing locally, respected regionally and is fuelled by a committed and talented pool of ICT professionals.

Scientific research and technology is critical to the future of the ICT sector of Jordan. Government recognizes the key role it plays in providing an enabling environment for innovation and research and in building the human capital that is required for the future knowledge economy. Since 2000, there have been important changes in the system of innovation in the country, specifically in the ICT sector. These have begun to strengthen technology diffusion and harness the entrepreneurship of the Science and Technology community.[1]

However, the challenges cannot be underestimated. In particular, growth of Jordan's ICT R&D industry is hampered by underdeveloped institutions of relevance to R&D and weak implementation. Jordan's telecommunications services remain relatively expensive. Despite technological advances and the diffusion of mobile telecommunications, there is a growing digital divide. ICT tools remain beyond the reach of many Jordanians. Jordan also suffers from legal shortcomings in technology related laws. Overcoming these challenges is key to effectively utilizing ICT as an integral part of Jordan's economy and society. It requires innovative solutions and a coherent national innovation system.

Jordan's research in the ICT sector has not been significant so far. In this regard, it is critical that Government develops a strategic view on future scientific and technological research for the sector to allow better governance, more effective resource allocation and utilization and better outcomes in the short, medium and long term. Accordingly, the Ministry of Information and Communications Technology (MOICT) embarked on the task of drafting a Research and Development Strategy for the ICT sector.

[1] An example of this is the iPARK ICT business incubator established by the HCST. iPARK has to date incubated firms that offer: B2B solutions, Security applications, Banking solutions, ICT consultancy, Mechanical design applications and services, Telecom CRM solutions, Entertainment and gaming suits, Online media management, Web based communities

The proposed strategy recognizes the importance of all stakeholders having a positive view of the value of scientific and technological research and their active participation in the implementation of this strategy to have a stronger system of innovation in the country. It proposes several institutional and funding mechanisms to secure such participation and promote public-private partnerships.

Strategic Vision and Goals

The vision is to develop a dynamic ICT sector through the development of innovative local research and development capabilities targeting economic growth, competitiveness, and providing challenging employment opportunities in the Jordanian job market. Accordingly, Jordan will be positioned to be a major regional ICT hub and a leader in ICT-enabled development. The two broad strategic goals for the R&D strategy are:

1. To accelerate the diffusion and improve the effective use of ICT by all key sectors of the economy; and

2. To accelerate the growth and secure the sustained competitiveness of the ICT sector.

International best practices suggest the basic rationale for the strategic goals and elements, and for the proposed implementation modalities:

- Most countries stand to benefit more from the effective use and wide diffusion of ICT among its key sectors than from mere production and export of ICT products.

- Taking advantage of ICT applications and realizing the potential benefits are not automatic; they require substantial R&D for adaptation, experimentation and localization.

- Incremental innovation and its contribution to continuous improvement of products and processes are critical to national competitiveness.

- A user-driven strategy for ICT sector development would favor promoting the software products and services segment of Jordan's ICT as this segment is critical to ICT adaptation and sustainability..

- Government's role should be primarily as enabler, not a substitute for private sector initiative.

- The enabling policy and business environment is the most critical element of ICT sector growth strategies and even more critical for ICT-enabled development strategies.

Key Strategic Elements

The following table summarizes the key elements of the strategy, which takes into consideration the above best practices and lessons learned:

Strategy Theme I: Improving the Enabling Environment
1. Establish a national R&D in ICT Committee, including: MOHESR, MOICT, JIB, HCST, RSS, NITC, private sector, championed by MOICT, in close coordination with R&D national body, HCST.
2. Develop incentives and regulation for Venture Capital company formation.
3. Improve Labor law to ensure recognition and benefits for persons working in R&D related projects and tasks.
4. Improve Government processes and procedures, particularly customs clearance procedures, in order to expedite product development iterations.
5. Increase awareness about intellectual property rights among concerned parties and citizens.
6. Harmonize interrelated policies and strategies with a focus on R&D: Ministry of Higher Education and Scientific Research Strategy, ICT sector strategy, small enterprise development, industrial and investment promotion, key ICT user sector strategies, and the National Agenda.
7. Promote competition among broadband telecommunications and internet providers to reduce their costs to ICT users.
Strategy Theme II: Developing R&D Human Resources and Tapping the Expatriates
1. Promote R&D skills in the educational system – secondary, high school, and university levels (pilot initiatives under e-HR innovation fund).
2. Reform higher education promotion policy to establish career path for researchers and use applied R&D work as criteria for promotion.
3. Increase cooperation with foreign universities in R&D in ICT.
4. Utilization of Jordanian expatriates to assist in developing Jordan as a regional research hub.
5. Attract researchers from the region: expanding and complementing Jordanian resources with regional (and, potentially, international) resources.
6. Consolidate efforts in universities and research centers in focusing research and directing activities.
7. Promote innovation culture and R&D partnership model (using e-HR, and/or e-incubation fund).
Strategy Theme III: Finance
1. Improve general policy and guidelines for financial resources available for R&D, in general, in the country.
2. Create an ICT innovation fund (e-ICT sector), which will focus on ICT innovation and adaptation, using both: a. Matching grants or shared costs b. Full grants
3. Promote incentives and new channels to complement the ICT Innovation Fund, to finance relevant R&D activities including: a. VC Fund

b. Fundraising activities c. Income tax credit/exemptions for ICT companies that invest in R&D.
4. Train investment officers in financial institutions to appraise innovative ICT enterprises and private investments in ICT products (e-HR fund).
5. Make information about funding options available to interested parties.
Strategy Theme IV: Strengthening Partnerships for innovation, particularly between academia and industry
5. Develop a culture of cooperation to encourage researchers and research institutes in the public and private sectors to work together (e-HR and e-sector funds).
6. Encourage academia, research institutions and private sector involvement in ICT innovation activities, venture capital funds and the commercialization of innovation through technology licensing and incubation (e-incubation).
Strategy Theme V: Promoting Private sector investment in R&D, including FDI
1. Increase knowledge about requirements for FDI and other forms of investments needed in R&D activities in Jordan, and disseminate it to concerned parties.
2. Design an innovation fund scheme (e-sector) and campaign to facilitate R&D partnerships between local and international companies in ICT.
3. Promote the commercialization of Jordan ICT locally developed products.
4. Develop incentives for enterprises to engage in or outsource R&D.
5. Promote innovation culture
Strategy Theme VI : Promoting Incubators, Shared Support Services and Grassroots Innovation
1. Improve the management of innovation within enterprises and NGOs, and R&D centers by disseminating best practices.
2. Create an e-incubator innovation fund to ncourage the establishment of technology clusters/incubators that facilitate sharing of resources for limited and pilot production of ICT products.
3. Promote the development of shared and specialized services for innovative ICT enterprises and start-ups.
4. Improve awareness of universities and private sector of grassroots needs (of NGOs, civil society organizations, and rural communities) and of barriers to ICT diffusion and the digital divide (create the e-society innovation fund)
5. Increase collaboration among grass roots organizations, smallenterprises and universities through joint R&D to develop local content and low cost products and to support high grassroots priorities (use the e-society fund).
6. Increase incentives for collaboration among public CIOs, government leaders and industry to adapt ICT products and services to local government agencies and services. The objectives are to improve public ICT acquisition, standards and interoperability; to promote interoperability within industry; and to encourage ICT adaptation for local public services and rural areas (create an e-gov innovation fund).
Strategy Theme VII: R&D ICT Infrastructure and Access to Information
1. Build a repository of existing infrastructure and laboratories, and setting criteria for better utilization of these facilities.
2. Ensure effective and affordable infrastructure for R&D in the ICT sector.
3. Facilitate access to information, particularly university libraries and other research centers.

Implementation Mechanisms

The partnership model for the implementation of R&D strategy in ICT involves three major stakeholders:

- **Government**, with MOICT as the focal point and champion for government entities concerned with R&D in ICT;
- **Higher Education**, represented by universities and research institutions dealing with ICT related education and research; and
- **Industry**, mainly the ICT industry and intensive ICT user enterprises. .

The proposed partnership model can be best promoted and implemented by cost sharing and stimulating incremental bottom up initiatives from those private associations and enterprises and universities that respond to jointly agreed priority programs arising from the key elements of the R&D strategy. An ICT Innovation Fund will be created for co-financing or providing initial grants for initiatives that respond to the jointly agreed priority programs. Rather than specifying opportunities upfront or top down, or by selecting a university or designating a Center of Excellence, this fund would seek proposals from all potential partners and encourage open competition for initiatives that best respond to priority programs.

The following are the proposed priority programs and their corresponding innovation funds—they are in line with the strategic themes and should be validated by key stakeholders:

1. Promoting ICT products and services innovation (e-ICT sector or e-sector)
2. Partnering for innovations in developing the ICT workforce (e-HR)
3. Promoting incubators and shared services (e-incubators)
4. Promoting innovation for e-government (e-gov innovation)
5. Promoting innovation to bridge digital divide (e-society)

An umbrella ICT Innovation Fund will be established to cover these five programs. Alternatively, a separate innovation fund may be created for each program, with its own governing and management mechanisms. The Innovation Fund(s) will be governed by a board and will be contracted out to a managing agent who will be selected through international competitive bidding. The aim is to ensure competition, transparency and the institutionalization of innovation activities.

A feasibility study will be launched to design these innovation funds, as the effectiveness and sustainability of such funds will depend on their strategic focus, proactive marketing, and the transparency of their governance and procedures. This design study will identify the priority programs and key initiatives on which competitive proposals will be sought, in full consultation with relevant key

stakeholders. It will also specify the operational modalities, eligibility criteria, and evaluation processes to be used for competitive funding. It will develop the role and terms of references for the managing agents and the boards. It will propose systems for risk management and knowledge management and for scaling up and diffusion of successful innovations.

Conclusions and Recommendations

Jordan should seize the opportunity to take its place in the vanguard of the global knowledge economy and information society. Critical success factors, which will determine the overall framework for implementation of this strategy include:

- Commitment by three stakeholder groups (Government, Academia and Private Sector) to implement strategy, including dedication of resources, including both personnel and financial resources, to embrace the partnership model to implement the strategy and its components and to champion/advocate for action.
- Promotion of incremental R&D as well as disruptive R&D
- Market-driven approach, whereby the private sector takes the lead in identifying R&D opportunities that can be commercialized. Government is an enabler, and academia is a partner to support market-driven innovations.
- Government should selectively intervene to complement market forces where the private sector and academia cannot and where the potential benefits/ spillovers are high enough to justify intervention

The initiative now lies with the relevant industries, the universities and the Government. The three major stakeholders are invited to endorse these developments and to reflect on the extent to which they can work together to develop further the proposed implementation modalities and partnerships to boost Jordan's development.

Strategic plans are only valuable to the extent that they are implemented. Next steps to move this strategy to full implementation would be to:

1. Convene a national workshop that will involve the key stakeholders to reach consensus on the above-stated strategy;
2. Launch a study to design each of the proposed 5 innovation funds in line with international best practices and the full involvement of relevant stakeholders.
3. Develop detailed action plans in coordination with stakeholders;
4. Establish monitoring and evaluation mechanism;
5. Identify and approach external resources for funding and technical assistance.

1 Introduction

1.1 Objectives of Strategic Plan

This document presents a strategy framework for Research and Development in the Information and Communications Technology (ICT) sector in Jordan for the period 2007-2009. It is designed in line with government's national priorities and needs and its policy in scientific and technological research.

The document is a product of a series of strategic planning exercises, collected lessons learned and best practices. It provides a broad based strategy to translate investments in scientific and technological research into innovative products that, in turn, will lead to sustainable outcomes and economic growth.

The Strategy is intended to guide the efforts of government entities and other stakeholders, whose ownership and leadership are vital to the future and success of the scientific and technological research for the ICT sector of Jordan.

1.2 Introduction

Jordan's ICT industry is thriving and has become a major contributor to Jordan's economy, boasting one of the more developed and advanced ICT sectors in the developing countries. Jordan's network readiness has been improving, ranking 44 out of 104 countries in 2004.[2]

The industry enjoys strong support from the government and His Majesty King Abdullah II, progressive regulatory and policy reform, and is undergoing an ambitious privatization plan. It is growing locally, respected regionally and fuelled by a committed and talented pool of ICT professionals.

> **"We have followed a path that will allow the technological revolution to harness our available talent into productive sectors that can fuel and sustain economic growth."**
>
> *His Majesty King Abdullah II*

Highly qualified human resources, the availability of world-class infrastructure, and the success of Jordanian IT companies contribute to positioning Jordan as a major regional IT hub. Jordan's dynamic and growing ICT environment presents attractive opportunities for investors and ICT businesses.

Scientific research and technology is critical to the future of the ICT sector of Jordan. Government recognizes the key role it plays in providing an enabling environment for innovation and research and in building the human capital that is required for the future knowledge economy. Since early 2000 there have been important changes in

[2] World Economic Forum, "Global Information Technology Report" 2004 – 2005. The Network Readiness Index (NRI) is the degree of preparation of a nation or community to participate in and benefit from ICT developments.

the system of innovation in the country, specifically in the ICT sector. Jordanian institutions and their programs are better aligned with national needs. Innovation programs, particularly technology incubators were established in Jordan to encourage innovative solution development in partnership with private sector. These have begun to strengthen technology diffusion and harness the entrepreneurship of the Science and Technology community.[3]

Innovation needs well-trained people, scientists, engineers and technologists. There is increasing evidence that progress in producing scientists, engineers and technologists is not yet satisfactory.[4] Therefore, a number of interventions are needed to strengthen the transformation of scientific research and technology capacity to achieve increased numbers of people working in key ICT fields that are of importance to the future.

Jordan's contribution to global research in the ICT sector has not been significant so far. This will require strengthening Jordan's linkages with global research networks, and developing Centers of Excellence in specific areas of R&D. In addition, the protection of intellectual property, and the support of products development from idea inception to business commercialization has to be facilitated.

In this regard, it is critical that Government develops a strategic view on future scientific and technological research for the sector and address the above-mentioned issues effectively to allow better governance, more effective resource allocation and utilization and better outcomes in the short, medium and long term. Accordingly, the Ministry of Information and Communications Technology (MOICT) embarked on the task of drafting a Research and Development Strategy for the ICT sector.

It is critical to recognize that addressing these areas effectively will require new partnerships and new commitments from the science, engineering and technology community. The proposed strategy recognizes the importance of all stakeholders having a positive view of the value of scientific and technological research and their active participation in the implementation of this strategy to have a stronger system of innovation in the country.

1.3 Strategic Planning Process and Participants

A process for drafting the R&D Strategy for the ICT sector was established, through which private public partnership (PPP) prevailed, and all stakeholders were involved in the process as follows.

A national committee (R&D NC) was formed, comprised of representatives from the following: MOICT; Ministry of Education and Scientific Research (MOHESR); Higher Council of Science and Technology (HCST); Royal Scientific Society (RSS); Int@j; National Information and Technology Center (NITC); private and public

[3] An example of this is the iPARK ICT business incubator established by the HCST. iPARK has to date incubated firms that offer: B2B solutions, Security applications, Banking solutions, ICT consultancy, Mechanical design applications and services, Telecom CRM solutions, Entertainment and gaming suits, Online media management, Web based communities

[4] e-Readiness Assessment of the Hashemite Kingdom of Jordan 2006, conducted by the AMIR Program.

universities; and those from the private sector engaged in ICT R&D. The R&D NC was created to:

- Provide subject information and expert opinion.
- Advise on strategy drafting (strategy outline, content, methodology, etc.)
- Review and approve Strategy before presenting to the Minister of MOICT and Stakeholders.
- Acquire external expertise from the United Nations Economic and Social Commission for Western Asia (UN-ESCWA) and Bearing Point Consulting Firm.
- Hold several meetings, including a three full-days workshop (14-16 September 2006) to discuss, the strategy outline, themes' objectives and expected accomplishments as per each objective, and conduct a SWOT analysis exercise.
- Review the first draft of the strategy, and provide feedback which was incorporated.
- A stakeholder's workshop was also held and comments were incorporated in the strategy document.
- The strategy document was posted for two weeks on MOICT's website for public consultation. Feedback was incorporated into the strategy document.
- The strategy was presented for approval to the Minister of MOICT.
- Cabinet of Ministers' approval.

While drafting the R&D Strategy for the ICT sector, the team benefited from the use of some highly valuable qualitative and quantitative data from different sources:

- Results of an e-Readiness Assessment of the Hashemite Kingdom of Jordan 2006, conducted by the AMIR Program.
- Ministry of Higher Education and Scientific Research Strategy 2005-2010
- Scientific Research in Higher Education institutions conducted by the MOHESR.
- Jordan ICT Sector Strategy, an Action Plan for Growth, 2006, AMIR Program.
- Increasing Research and Development in Jordan - Opportunity and Human Resources, 2006, Dr. Saed Younis, Al Bahith.
- Interviews with concerned public and private entities.
- Desktop research and expert opinions on Jordan's overall situation.

1.4 Organization of Strategy Document

This document consists of five main sections:

Chapter 2: Background, which positions Jordan's R&D sector and discusses its key players

Chapter 2: Strategic Vision and Goals describes Jordan's vision for ICT sector R&D and its twin goals of promoting ICT as an enabler for the whole economy and as a dynamic sector.

Chapter 3: Key Strategic Elements presents the strategy, categorized according to seven main themes, as follows:

- Improving the Enabling Environment
- Developing the R&D Human Resources and Tapping the Expatriates
- Enhancing Access to Finance
- Strengthening Partnerships between Academia and Industry
- Promoting Private Sector R&D/Promoting FDI in R&D
- Supporting Incubators and Grassroots Innovation
- Improving Information Infrastructure for Knowledge Sharing

Chapter 4: Implementation Model describes a partnership model for the implementation of R&D strategy in ICT. It involves three major stakeholders and a number of external supporting entities: Government, with MOICT as a focal point; Higher education, dealing with ICT related education and research; and Industry, mainly the ICT industry and its key local users. Also describes implementation mechanisms that promotes such partnerships and address the above strategic elements.

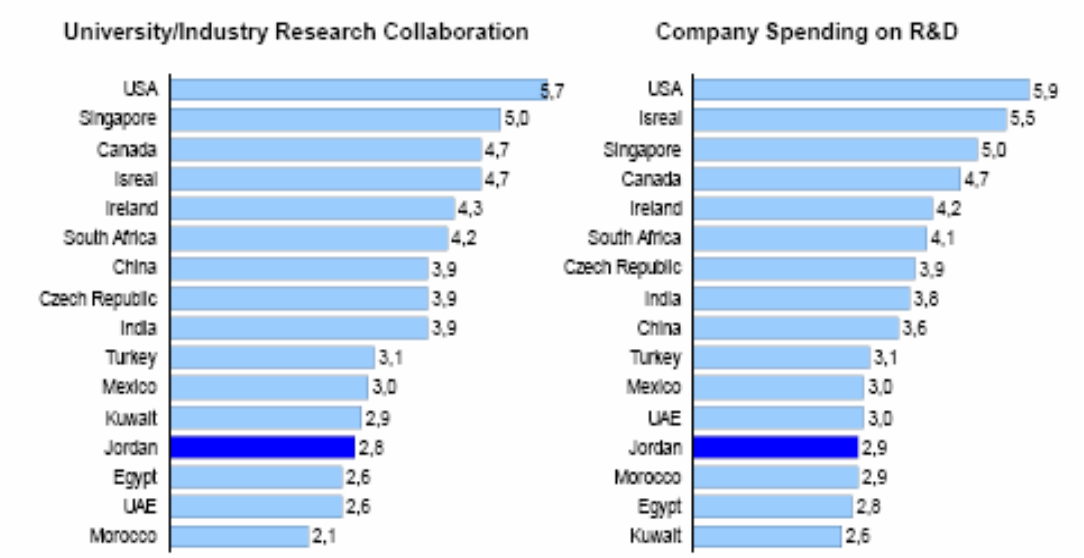
Chapter 5: Conclusions and Recommendations outlines major conclusions and recommendations for the Government to ensure the successful implementation of the proposed strategy and attaining its objectives.

2 Background: Positioning Jordan

2.1 Status of R&D in Jordan

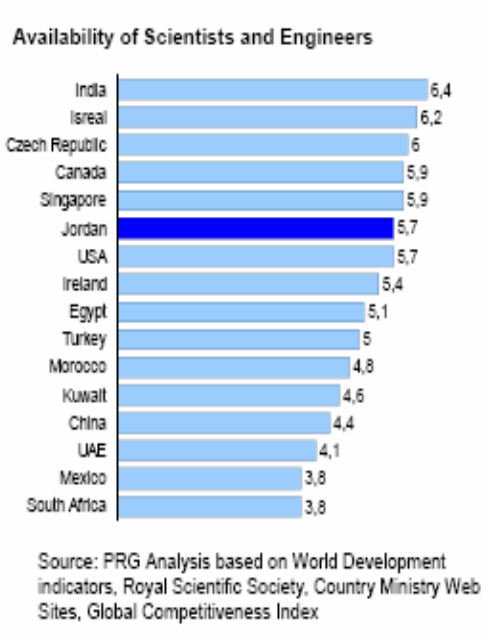
Jordan's situation in terms of research, development and innovation is mixed. Authorities are making large efforts in the domain of education, with good results in terms of instruction and a rather remarkable rate of university access in certain disciplines (science, mathematics and technology). The country possesses 10 public and 14 private universities which constitute an essential element of the basic R&D infrastructure. The ICT student population totals 8,000 at the university level. In addition, Jordan has a higher proportion of university graduates in technological fields than any other country in the region. Jordan ranked 14th out of 110 countries for the number of engineers and scientists according to the Global Competitiveness Report 2004-2005 (WEF).

The number of Jordanians involved in pure R&D activities is low, compared with other countries. Furthermore, university/industry collaboration and R&D expenses are also low as shown in the figures below:



Source: Global Competitiveness Index

Researchers in R&D (per million people)					
	1999	2000	2001	2002	CAGR
Singapore	3211	4140	4086	4353	11%
Canada	3250	3535	3709	3597	3%
Ireland	2101	2240	2316	2386	4%
Czech Republic	1317	1349	1461	1461	4%
Morocco	860	846	869	782	-3%
China	420	546	579	627	14%
Turkey	299	338	328	341	5%
Mexico	222		254	268	7%
Jordan		180	190	194	3%
Kuwait	89	81	74	69	-8%



Number of Patents Registered in the USA, 1976-2002

Yemen	3
Lebanon	4
Syria	16
Jordan	**22**
Tunis	23
Morocco	65
Kuwait	75
Egypt	104
Saudi Arabia	225
Israel	11,071
Sweden	26,318
South Korea	27,298
Source: US Patent & Trade Mark Office	

2.2 Key R&D Policy-making Institutions

Three entities currently play a major role in the creation and implementation of a national R&D policy:

The Ministry of Higher Education and Scientific Research (MOHESR), established in 1985, is the organ of government which defines and monitors, and steers the implementation of scientific research within Jordanian universities. In 2005, the Ministry issued a National Strategy for Higher Education for the period 2005-2010. The strategy includes a theme on scientific research and Higher Education which calls for the upgrading and provision of support for scientific research and higher education, and encouraging private sector participation in the development of R&D in the country and specifically in applied scientific research that is required for sustainable national development.[5]

The Higher Council of Science and Technology (HCST) was established in 1987 under Law Number 30 as a public independent institution acting as a national umbrella for all science and technology (S&T) activities in Jordan. The HCST sponsors and carries out activities and events which enforce and enhance the role of S&T in the socioeconomic development process in Jordan.

Since its inception the HCST has launched numerous initiatives. Those of relevance to R&D are described below:

- The HCST ratified the National Science and Technology Policy in early 1995. The policy formed the basis for executive programs for each of its four main elements: information, human resources, transfer of technology, and research and development (R&D).

- The HCST drafted the Strategy of The Higher Council for Science and Technology 2005 – 2010.[6] It is worth mentioning that the ICT sector is not considered a priority sector under this strategy.

- In realization of the objective for which the HCST was established, namely, building a national science and technology base, the HCST offers financial support to R&D projects. These projects are chosen in accordance with national R&D priorities and implemented by Jordanian researchers.

- The Jordan Science week is an annual event, which has been convening since 1993. This important event represents a forum for dialogue and deliberation on national developmental issues, and involves the three major players of the socio-economic development, which are the government, the science and technology community, and production and services sectors. Latest developments in S&T worldwide are introduced, with specific themes related to the Jordanian economy.

- The Industrial Scientific Research and Development Fund was established by the HCST in 1994, with the overall objective of enhancing the competitiveness

[5] http://www.mohe.gov.jo/Conference_Events_Files_ar/1.pdf
[6] http://www.hcst.gov.jo/Uploads/pg_contents/Strategy_En.pdf

of Jordanian industries through utilizing the research and development capabilities available at national academic and research institutions. Since its establishment the fund provided financial support to 263 projects with a total amount of about 2 million JDs.

- The HCST established the National Consortium for Technology and Incubation of Business (NACTIB) by the end of 2002 to create an environment conducive to the development and growth of knowledge-based enterprises, and promote R&D activities in the private sector. This is in addition to improving success opportunities of start-up companies and assisting entrepreneurs through incubation and linking to technical and managerial know-how and financing.

The Ministry of Information and Communications Technology (MOICT), established in 2002, has the mission of developing ICT initiatives and stimulating FDI flows towards Jordan in this sector. In addition, and in accordance to Article 93 of the Statement of Government Policy on the Information and Communications Technology Sectors and the Postal Sector, its mandate (under Article 93) calls for the MOICT to take steps to encourage and support R&D activities in the ICT sector:

> "Government, through MoICT, will continue, in association with the private sector, to take steps that encourage the adoption of IT, e-Commerce, collaborative working, **research and development** and similar areas, within the general industrial and service sectors of the economy. MoICT will ensure that initiatives managed by it, should, to the extent that is feasible and practicable, and not in conflict with National interest or security considerations, be completed by, or outsourced to, the private sector."

In addition to the three key policy-making entities, there are currently a number of operational incubators in Jordan which were established to nourish innovation and entrepreneurship in the country. These are:

- Yarmouk University
- Jordan Innovation Centers Network
- iPark incubators
- Jordan Innovation Center
- Philadelphia University
- JIC – University of Jordan
- Al-Hassan Industrial Zone

3 Strategic Vision and Goals

3.1 Vision for Developing Jordan's R&D Activities in ICT Sector

The vision is to develop a dynamic ICT sector through building innovative local research and development capabilities targeting economic growth, competitiveness, and providing challenging employment opportunities in the Jordanian job market. Accordingly, Jordan would be positioned to be a major regional ICT hub and a leader in ICT-enabled development.

3.2 Strategic Goals and Objectives

The two broad strategic goals for the R&D strategy are:

1. To accelerate the diffusion and improve the effective use of ICT by all key sectors of the economy; and

2. To accelerate the growth and secure the sustained competitiveness of the ICT sector.

The first broad goal is articulated in terms of the national Agenda and stakeholders beyond the ICT sector. The ICT sector is viewed as an enabler and infrastructure for a knowledge-based and innovation-driven economy. The R&D strategy adopts a holistic approach to realize this transformation. It aims to improve the competitiveness of key economic sectors through harnessing ICT potential, and thus promote employment and sustained growth. It also addresses regional inequalities in access to information, knowledge, public services, educational services, financial services and employment opportunities through applying ICT and bridging the digital divide.

Thus, the R&D strategy addresses the barriers to ICT use and diffusion in key sectors of the economy and society:

- Small and medium enterprises
- Government agencies
- Key user sectors like education, tourism, agriculture, infrastructure and financial services
- Rural areas and civil society institutions (digital divide)

The second goal is to use R&D to accelerate growth and competitiveness of the ICT sector, in promising niches and markets, again in support of holistic national development. Given the limited resources available and the nascent state of development of the ICT sector in Jordan, the aim is not to contribute to global research in general or to become a center of excellence in all segments of ICT production. Rather, it is to guide and harness (and in some cases augment) scarce R&D resources (private and public) to capture key opportunities, exploit current strengths, and address key barriers and weaknesses to ICT sector growth.

In particular, R&D will be mobilized and harnessed to address the following sectoral weaknesses and barriers (see Annex 1 for SWOT analysis):

- Inadequate polices and enabling environment for developing the ICT sector, exporting high-value software products, adapting products to local government needs, and attracting FDI in ICT, and in particular in R&D.
- Shortage of human resources appropriately developed in the ICT sector in universities and private sector, and in particular in dedicated R&D functions.
- Weak incentives and limited financial resources for local enterprises to move up the value chain, and in particular, to provide appropriate training and skill upgrading opportunities, take the necessary risks to adapt and innovate new ICT products and services and to partner with ICT multinationals on R&D.
- Weak connections and partnerships between academia and industry, to prepare the necessary human resources for the ICT sector, to carry out timely and relevant R&D for the sector, and to promote dissemination and commercialization of relevant R&D results.
- Weak and fragmented institutional and physical infrastructure and support services for start up ICT ventures, for knowledge sharing and for marketing overseas.

The last point in particular is critical, since two thirds of local ICT enterprises are small sized, and most of them are specialized in software development. Addressing the needs of these enterprises require shared infrastructure and support and an active role for the government to enable them to insert themselves into regional and global supply chains.

3.3 Rationale and International Best Practices

International experience and best practices suggest the basic rationale for the strategic goals, strategic elements, and for the proposed modalities for implementation.

First, most countries stand to benefit more from the effective use and wide diffusion of ICT among its key sectors than from mere production and export of ICT products.[7] Hence, the primary focus of R&D should be to maximize the exploitation of ICT as an enabler for the whole economy. Public funds for R&D in ICT should be driven by local adaptation needs in the user sectors of most promise or importance to national development.

Second, taking advantage of ICT applications and realizing the potential benefits is not automatic and requires substantial R&D for adaptation, experimentation and localization. Mainstream ICT systems have been designed almost wholly for the OECD markets, which are better endowed with physical capital and educated human capital than in developing countries. These designs do not generally reflect the capital mix of lower-income groups in such markets, including Jordan, and so present major barriers to adoption of such applications as e-business for small enterprises. R&D can

[7] See, for example, Hanna (2003). World Bank.

play a critical role in lowering the ICT complexity barrier and increase affordability and sustainability of ICT uses for SMEs, educational institutions, NGOs and government agencies. R&D is also essential for improving access and use by the poor and rural population.

Third, incremental innovation and its contribution continuous improvement of products and processes is critical to national competitiveness. The cumulative and pervasive impact of incremental innovation is likely to outweigh major "disruptive" innovations in ICT production. Although disruptive innovation stimulates demand for the highest engineering skills and world class talent, it is risky and costly. It may divert scarce research resources and talents away from the challenges of ICT adaptation that address the pressing needs of the overall economy. Its impact may also be limited in view of the absence of forward and backward linkages within the local economy. International best practice therefore suggests that governments be cautious in financing flagship projects that focus on complex and disruptive innovations. Government role should be primarily aimed at incremental innovations for adaptation of ICT to local needs and for overall upgrading of ICT education. To capture opportunities of leading-edge products and disruptive innovations, the government will facilitate R&D partnerships between local and international companies.

Fourth, some key niches of the ICT sector provide attractive opportunities for developing countries to participate in the global production chain. Few countries have been able to become global players in this field and the success of those who have can be attributed to unique factors: Ireland, with the large presence of multinationals (subsidiaries) as potential users; Israel, with large demand from its military; Finland, with the present dominance of Nokia as a driver for the whole sector; India, with a huge supply of low cost ICT professionals; and Mexico, with its closeness to the USA. There are many examples of failures of activist governments in providing R&D and investment support for high-technology. Jordan's R&D strategy is therefore cautious in subsidizing ICT production, including R&D, except where demonstrated comparative advantage is demonstrated. Government support will be highly selective.

A user-driven strategy for ICT sector development would favor promoting the software products and services segment of Jordan's ICT. This segment is critical to ICT adaptation and sustainability for the local market. It depends on intensive producer-user interactions. It is composed mainly of small enterprises as it involves low entry barriers and can compete in diverse local niches.

Fifth, best practices also suggest that government's role should be primarily as enabler, not a substitute for private sector initiatives. R&D initiatives should be private-sector driven, market-facilitating, and based on clear comparative advantage. A key role for government is to help private enterprises and universities to partner, to bridge the common gap between researchers, educators and practitioners. This ensures that investments in R&D and higher education would be market-driven and the results would be translated into increased competitiveness and socio-economic benefits. This often requires strong incentives and institutional mechanisms to ensure that universities and research institutions function as a part of a national innovation

system and are driven by market forces and national priorities. The proposed implementation mechanisms and funding priorities must reflect these lessons.

Finally, lessons of international experience indicate that the enabling policy and business environment is the most critical element of ICT sector growth strategies and even more critical for ICT-enabled development strategies. There is undoubtedly a role for government in supporting R&D and training for ICT and other high-technology. There is also a role for governments to induce and facilitate the formation of clusters, incubators and shared support services for innovative ICT enterprises—promoting innovation, external economies and joint action. But the most pervasive impact will come from improving the policies and business environment to promote ICT adoption, to promote ICT innovation among local enterprises, and to encourage franchising, joint ventures, collaborative research and exchanges among local and international companies.

Jordan's R&D strategy for ICT draws on these lessons and best practices from comparators and more broadly, globally. The selected goals of the strategy, key elements, and modalities of implementation are consistent with the best practices.

Reflecting best practices, presented below are highlights of some of the incentives used by the governments of Finland, Ireland, Israel, India (focus on Bangalore), Singapore, Czech Republic and Chile in promoting R&D development and innovation – in many cases, this includes specifics of policies particularly within the ICT sector. Annex 4 provides more details.

While some of the countries highlighted here use tax incentives to promote R&D, it should be noted that such incentives should be administered with caution in order to ensure against abuse and fraud. Tax credits or double deductions are the most typical mode of concession, and are the least distortionary. They are generally more effective in environments where R&D is more prevalent and somewhat less effective in environments, such as Jordan, where private sector R&D is not well developed. The administration of such incentives also needs to be closely monitored to ensure against abuse/fraud. In Australia, for example, R&D tax concessions are granted only for qualified expenditures that have been approved by an R&D Board to ensure that the expenditures are really being used for R&D. A company can go through a "pre-registration" process to pre-qualify R&D expenditures for tax concessions. This is done on a project-by-project basis.

Promoting R&D Development: Highlights of Global Incentives

Country	Fiscal Incentives/Policies	Non-Fiscal Incentives/Policies
Finland	▪ Selective technology programs used to finance projects of companies, research institutes and universities with subsidies and loans. ▪ Incubator programs financed through TEKES ▪ Research funding for research institutes and universities	▪ Various non-fiscal support measures provided by Tekes, through its use of technology programs, incubators, etc. ▪ Facilitation of R&D partnerships locally and internationally.
Ireland	▪ Range of tax and other fiscal incentives to encourage R&D ▪ Considerable funding to be allocated for basic research in ICT ▪ Research funding for research institutes and universities	▪ Focused on and highly successful in attracting foreign companies, and building from this influx of FDI. Irish R&D for local adaptation. ▪ Facilitation of R&D partnerships locally and internationally
Israel	▪ Yozma venture capital program ▪ Technological Incubators Program ▪ MAGNET program, for funding of generic research; promotion of incremental innovation. Competitive selection. ▪ Research funding for research institutes and universities	▪ Focus on wide diffusion of ICT ▪ Intense promotion of academic research capabilities ▪ Facilitation of R&D partnerships locally and internationally ▪ Advisory council to advise on R&D
Singapore	▪ Grants and tax incentives ▪ Promoting Finance and Investment for new enterprises ▪ Primary emphasis on improving quantity and quality of scientific and technological manpower, both at the tertiary level, and for science and engineering courses. ▪ Research funding for research	▪ Building up and nurturing a conducive environment for 'technopreneurship' ▪ Making greater use of international cooperation, including new operations in overseas hi-tech nodes ▪ Strengthening the Technology Infrastructure ▪ Facilitation of R&D partnerships locally and

	institutes and universities	internationally
India (Bangalore)	▪ Host of fiscal incentives for R&D/ICT development, largely channeled through technology parks. Through "single-point contact" for all regulatory functions, the sponsor can get duty-free imports of equipment, custom-bonded warehouses for materials, income-tax exemptions for five years, repatriation of know-how fees and royalties, in order to develop and export software (domestic sale up to 50 % of software exported). Global connectivity also provided. ▪ Research funding for research institutes and universities	▪ Highly successful in development of IT Parks, which foster development by offering companies a host of fiscal and non-fiscal benefits. ▪ Government support of venture capital initiatives ▪ Facilitation of R&D partnerships locally and internationally
Czech Republic	▪ Strengthening tax breaks for R&D spending ▪ Expansion of the venture capital market ▪ Improved allocation of research funding ▪ Research funding for research institutes and universities	▪ Reform of the governance framework for public R&D ▪ Additional support for innovative SME ▪ Strengthening of science-industry links. ▪ Facilitation of R&D partnerships locally and internationally
Chile	▪ Solid innovation programs, including the Fundacion Chile and Economic Development Agency (CORFO) programs, offering both fiscal and non-fiscal incentives. ▪ Successful fund, FONDEF that aims at encouraging business innovation and fostering competitiveness in joint ventures with universities and technological institutes. Fiscal and non-fiscal incentives. ▪ Research funding for research institutes and universities	▪ Various incentives supported through programs including Fundacion Chile, CORFO and FONDEF. ▪ Facilitation of R&D partnerships locally and internationally.

Jordan's R&D strategy for ICT is in line with the policies and programs implemented by many of the world's leaders in not only R&D generally, but more specifically key players in ICT development. That said, Jordan recognizes that there is no single prescription for promoting R&D with the ICT sector and has taken careful consideration to develop a strategy based on Jordan's specific environment and circumstances. Further, an essential element of any strategy is that it must remain an evolving process, one which is constantly being upgraded and refined.

4 Key Strategic Elements

This is the main section of the strategy and covers the following key elements:

- Improving the Enabling Environment
- Developing the R&D Human Resources and Tapping the Expatriates
- Enhancing Access to Finance
- Strengthening Partnerships between Academia and Industry
- Promoting Private Sector R&D/Promoting FDI in R&D
- Supporting Incubators and Grassroots Innovation
- Improving Information Infrastructure for Knowledge Sharing

4.1 Improving the Enabling Environment

Improving the policy, institutional and business environment is the most effective and pervasive of any strategy to promote innovation in the overall economy, and particularly for R&D-intensive sectors like ICT. This strategy element also has the distinctive advantage that it is the least demanding in terms of capital or budgetary resources—except for the commitment and attention of government and industry leaders.

Jordan will create a best practice enabling environment for R&D in ICT. It has already made notable progress, but competitors are also advancing and improving their environment as fast rates. Thus, there is a need for continual innovation and re-evaluation of priorities. A national committee of the key stakeholders will be established, representing both suppliers as well as potential users of R&D and ICT products and services to guide the evolution of the enabling policies and monitor the incentive, regulatory and institutional framework of Jordan vis a vis benchmark countries such as Singapore, Finland, Israel, Ireland and Chile. Indeed, many countries are establishing informal advisory committees that link to industry and academia. One such example is Ireland's Irish Council for Science, Technology and Innovation (ICSTI), which was established in 1997.

Case Study: Bangalore illustrates a cluster-based development process based on a business environment and a special legal framework that promotes scientific businesses. State and central government have successfully removed bureaucratic hurdles to encourage ICT innovation.

One key element of the enabling environment is a competitive and dynamic information infrastructure. Hence, a key element is to ensure the telecommunications regulatory framework is evolving in line with the fast changing communication technologies and that telecommunications services and Internet access are provided at internationally-competitive prices to users in general, and to R&D and academic institutions in particular.

ICT is a fast moving and globally-linked sector, and intensive users of ICT products and services are typically time sensitive and globally connected as well. Hence, improving customs procedures must be modernized to meet these needs.

A host of other policies and regulations impact on the overall incentives and dynamism of the ICT sector and its contribution to the rest of the economy. The strategy singles out intellectual property protection practices, incentives to mobilization of private venture capital, labor laws that reward personnel working in R&D, remaining e-policy barriers to ICT diffusion, and overall, harmonization of interrelated policies across sectors that impact ICT use and innovation.

Strategy Theme I: Improving the Enabling Environment		
Specific Objective: Create an enabling environment and effective policy and legal frameworks for research and development in the ICT sector and for ICT adoption and diffusion in the Jordanian economy.		
Expected accomplishments	**Indicators of achievement**	**Responsibility**
1. A national R&D in ICT committee established, including: MOHESR, MOICT, JIB, HCST, RSS, NITC, private sector, championed by MOICT, in close coordination with R&D national body, HCST.	▪ Committee formed	▪ MOICT
2. Development of incentives for Venture Capital company formation.	▪ Venture capital included under the new investment law.	▪ NC ▪ JIB
3. Labor law: Ensure recognition and benefits for persons working in R&D related projects and tasks.	▪ NC to review existing law and recommend appropriate action.	▪ NC ▪ MOL ▪ MOHESR
4. Improving Government processes and procedures, particularly customs clearance procedures, in order to expedite product development iterations.	▪ Guidelines recommended by NC. ▪ Customs are implementing guidelines.	▪ NC ▪ Customs Department ▪ MIT
5. Create awareness about IP, in collaboration with the National Library, among concerned parties and citizens.	▪ Awareness campaign carried out. ▪ Targeted training programs developed and implemented (e.g. filing patents).	▪ int@j ▪ National Library ▪ IP Civic Societies

6. Harmonize key interrelated policies and strategies with a focus on R&D: Ministry of Higher Education and Scientific Research Strategy, ICT sector strategy, small enterprise development, industrial and investment promotion, key ICT user sector strategies, and the National Agenda.	▪ NC and proposed national R&D in ICT committee to develop mechanisms for review and harmonization of policies and strategies with strong links to R&D.	▪ NC ▪ MOHSER (RD Committee)
7. Promote competition among broadband telecommunications and internet providers to reduce their costs to ICT users.	▪ NC, TRC, MOICT and others concerned to review the policy and regulatory environment for telecommunications and their impact on the ICT sector in general and intensive ICT users like R&D centers universities and software services. ▪ Adopt policy recommendations.	▪ NC ▪ TRC ▪ MOICT

4.2 Developing the R&D Human Resources and Tapping the Expatriates

Human resources are the second most important element in any R&D strategy for Jordan. These resources must be developed within the educational system, particularly at the higher education level. They must also be nurtured within the private sector. As ICT is the most globalized and networked industry, it also thrives on networking, collaboration with international centers of excellence, and tapping the Expatriates.

Mobilization of human resources for R&D will start with creating a competitive career path for researchers in universities and using applied research work as a key criterion for promotion within universities. U.S. universities excel in such practices. Jordanian universities can also greatly benefit from cooperation with leading foreign universities in R&D in ICT. This cooperation can be facilitated through catalytic funding of the Jordanian partner—provided that proposals for cooperation would meet clear criteria in terms of addressing local R&D priorities and long term capacity development. Other measures should be explored based on a systematic review of barriers to research and innovation

Case Study: Singapore is among the countries that have made a strong commitment to education, including subsidization of training schemes for employees and regulation of tertiary-level enrolments to line up with expectations of demand, and university partnerships with selected international institutions.

within the university system.

Universities will be invited to compete in making proposals on creating a PhD program, introducing innovative undergraduate courses on R&D for ICT, and other such measures to experiment with new ways to improve R&D skills of their ICT graduates. This program may extend its assistance to selected secondary and high school levels, but it should start first with the university level.

Many countries have sought to induce their expatriates to contribute to their home country. This has been critical to the growth and technological deepening of the ICT sector in many leading countries such as India, Ireland, Israel, China, and Korea, among others. This effort could be complemented by attracting Arab researchers from the region and the U.S., who would complement Jordanian R&D resources in the short term and help augment them over time to deal with region-specific adaptation priorities.

A key initiative under the R&D human resources theme is to establish an innovation fund to be called the e-HR innovation fund. This fund can support innovation and experimentation in all R&D HR areas: cooperation with foreign universities; offering R&D courses and PhD degrees in ICT; supporting partnerships for a Center of Excellence in R&D for ICT; facilitating partnerships between Jordanian and Arab researchers, and so on. Further, the fund will stimulate other bottom up innovative measures beyond those specified and its evaluation will be based on its responsiveness to the overall objectives of the R&D HR program. This fund will be complemented by measures to raise awareness and promote an innovation culture.

Strategy Theme II: Developing R&D Human Resources and Tapping the Expatriates		
Specific Objective: Mobilizing and raising the level of R&D-based human capital for identified niches and national research priorities in ICT and for ICT adaptation to key local needs.		
Expected accomplishments	**Indicators of achievement**	**Responsibility**
1. Promoting R&D skills in the educational system – secondary, high school, and university levels (pilot initiatives under e-HR innovation fund).	▪ Introducing research-based intensive courses in undergraduate curricula in at least one university. ▪ Introduction of project-based learning in discovery schools. ▪ PhD program in ICT in at least one university in cooperation with an internationally recognized university. ▪ Integration of effective project oriented training programs within two universities in coordination with the industry and the Government. ▪ Guidelines for enhancing research culture and documenting research work and publication are produced and disseminated through the Internet. ▪ Create an innovation fund for promoting innovative schemes to upgrade ICT workforce (e-HR Fund).	▪ MOE ▪ MOHESR ▪ JEI ▪ Universities ▪ int@j ▪ ICT Private Sector
2. Higher Education promotion policy reform to establish career path for researchers and use applied R&D work as criteria for promotion.	▪ Promotion scheme that accepts applied research work as criteria for promotion within universities. (ref: Evaluating & improving undergraduate teaching) will be adopted by MOHESR and universities. ▪ Establishment of a competitive career path for researchers in research institutions and universities to encourage educators to undertake R&D.	▪ MOHESR ▪ NC ▪ Universities

3. Increased cooperation with foreign universities in R&D in ICT.	▪ Establish a funding scheme to facilitate such partnerships in R&D in ICT (using e-HR Fund).	▪ MOHESR ▪ NC ▪ Universities
4. Utilization of Jordanian expatriates to assist in developing Jordan as a regional research hub.	▪ A network for expatriate researchers is constructed with an incentive scheme to ensure their active involvement.	▪ NC ▪ Universities ▪ int@j ▪ NITC
5. Attracting researchers from the region: expanding and complementing Jordanian resources with regional (and, potentially, international) resources.	▪ A regional network is established and hosted by Jordan. ▪ A significant number of Arab researchers are located in Jordan. ▪ Jordanian activities and requirements are publicized and promoted through the Internet.	▪ NC ▪ NITC ▪ int@j
6. Consolidating efforts in universities and research centers in focusing research and directing activities.	▪ Establishment of at least one center of excellence in ICT through collaboration between universities, research centers and industry.	▪ HCST ▪ MOHESR ▪ Universities ▪ int@j ▪ NITC
7. Promoting innovation culture and R&D partnership model.	▪ Awareness programs in the educational system (schools, universities) are established. ▪ At least one national conference is convened yearly on the topic. ▪ Innovation tours (see Theme V).	▪ MOE ▪ HCST ▪ NC ▪ QRNEC

4.3 Enhancing Access to Finance

Access to Finance

Innovation and adaptation of new technologies thrive when an appropriate financial system is in place. With seed and venture capital, ideas are given room to mature and reach possible commercialization. The ICT industry in particular involves substantial risks as well as rewards. Untrained investment officers and bankers typically shy away for funding ICT enterprises, their R&D and their product development.

> **Case Study**: In India, the Government of Karnataka recognizes that State's biotechnology industry is in its early stages, thereby requiring active monetary support. With this recognition, the Government, in its Millenium Biotech Policy, states that it will encourage setting up of venture capital funds for biotech industries with private participation.

Hence, this strategy calls for giving special attention to the financial needs of ICT enterprises and in particular to the high levels of R&D needed within the sector. General policies and incentives will be reviewed to assess the resources available for R&D in general and ICT and venture capital in particular. Incentives to encourage ICT enterprises to allocate additional resources for R&D will be given high priority. Making information about sources of funding available through the Internet should be a quick and simple measure. Financial institutions will also be provided assistance in order to improve their understanding of the dynamics of this sector and its special financing needs for R&D and product development and commercialization.

Financing Mechanisms

Throughout the strategic themes within this ICT R&D strategy plan, different funds/priority programs are presented. Further, Section 5.2 of this document provides more specific details on implementation mechanisms for each fund/priority program (including a discussion of the alternative that each fund may be brought under the control of an overall umbrella ICT Innovation Fund and thereby termed instead "priority programs".) Nevertheless, it is appropriate here to provide a brief summary of each of the proposed funds:

- e-ICT Sector Innovation Fund (also referred to as e-sector innovation fund): Promoting ICT products and services innovation and adaptation. Broad mandate to pilot such efforts and to support the sufficient mobilization and allocation of overall funding for R&D in the ICT sector. Ensure that appropriate financial channels and services are developed to support R&D in the ICT sector.

- e-HR Innovation Fund: Partnering for innovations in developing the ICT workforce. The fund's purpose would be to support innovation and experimentation in all R&D human resources areas, such as cooperation with foreign universities, promoting R&D skills in the educational system, offering R&D courses and PhD degrees in ICT, or promoting innovative schemes to upgrade the ICT workforce.

- e-Incubators Innovation Fund: Promoting the development of clusters, incubators and/or other shared services, thereby facilitating the higher collective efficiency available through external economies of scale and joint actions.

- e-Government Innovation Fund: Promoting innovation among government agencies and addressing barriers to ICT diffusion among them. Assist in procuring of appropriate ICT products and services and in capturing economies of scale among agencies.

- e-Society Innovation Fund: Promoting innovation to bridge the digital divide, focusing on ICT diffusion among grassroots organizations and the poor.

An additional fund proposed is a Venture Capital Fund, which would be created with a mandate to finance innovative ICT ventures. However, such fund may be financed through an alternate funding mechanism.

These funds will be tied to Jordan's national R&D fund for Jordan. In particular, a portion of national R&D funds should be allocated to the MOICT, who will be responsible for managing these ICT-specific R&D funds.

Strategy Theme III: Finance		
Specific Objective: Ensure sufficient funds are mobilized and allocated (foreign and domestic) and appropriate financial channels and services are developed to support R&D in ICT sector.		
Expected accomplishments	**Indicators of achievement**	**Responsibility**
1. General policy and guidelines for financial resources available for R&D, in general, in the country.	▪ Policy and guidelines finalized.	▪ NC
2. The creation of ICT innovation fund, which will focus on ICT innovation and adaptation, using both: ▪ Matching grants or shared costs ▪ Full grants	▪ NC is represented on the general innovation fund committee. ▪ Creation of ICT innovation fund to pilot such schemes (e-sector innovation fund). ▪ NC to recommend procedures for the ICT innovation fund and its various schemes. ▪ Governance of the ICT innovation fund is established and its management contracted out.	▪ NC ▪ MOICT ▪ MOHESR ▪ HCST ▪ int@j ▪ Donor Community ▪ ICT private sector
3. Promoting incentives and new channels to complement the ICT Innovation Fund, to finance relevant R&D activities including: ▪ VC Fund ▪ Fundraising activities ▪ Income tax credit/exemptions for ICT companies that invest in R&D.	▪ Rules enacted for income tax credit for ICT companies investing in R&D. ▪ VC Fund created with focus on financing innovative ICT ventures.	▪ Tax Department ▪ JIB
4. Training investment officers in financial institutions to appraise innovative ICT enterprises and private investments in ICT products.	▪ Review current financing practices and make recommendations for content for skill upgrading. ▪ Training provided on cost sharing basis through an innovation fund (e-HR).	▪ NC
5. Make information about funding options available to interested parties.	▪ Construct and launch NC website on funding mechanisms for ICT ventures.	▪ NC

4.4 Strengthening Partnerships between Academia and Industry

University curricula and R&D activities in academia are often slow to change in response to dynamic industries and fast changing technologies. Special measures are therefore planned to strengthen the links between universities and the ICT industry. Such partnerships would achieve several objectives: relevant and up to date curricula for ICT, including R&D; practical R&D that is relevant to local needs and easier to commercialize, augmented financial resources for R&D in the universities.

This strategy recommends two broad measures: i) using innovation funds for promoting academic-industry partnerships (using either the e-sector or e-HR innovation funds, depending on whether the focus is on R&D for a specific ICT product or for R&D HR development); and ii) promoting a partnership culture across academia, ICT industry, and possibly NGOs and foundations.

Case Study: Chile's largest fund, FONDEF, managed by the Ministry of Education is mandated to encourage business innovation and the fostering of competitiveness in joint ventures with universities and technological institutes. In Finland, Tekes and the Academy of Finland recently launched a new funding programme to attract top foreign researchers to Finland. The Finland Distinguished Professor Programme (FiDiPro) makes it possible for universities and research institutes to invite foreign researchers to work in Finland.

Strategy Theme IV: Strengthening Partnerships for innovation, particularly between academia and industry		
Specific Objective: Enhance innovation in the ICT sector through partnering and bridging the gap between academia and private sector		
Expected accomplishments	**Indicators of achievement**	**Responsibility**
1. Development of a culture of cooperation to encourage researchers and research institutes in the public and private sectors to work together.	▪ Establish an Innovation Fund scheme to provide incentives for partnerships in R&D in ICT (e-sector or e-HR fund).	▪ NC ▪ HCST ▪ int@j ▪ ICT Private Sector
2. Encouraging academia, research institutions and private sector involvement in ICT innovation activities, venture capital funds and the commercialization of innovation through technology licensing and incubation.	▪ At least two workshops on the subjects are convened.	▪ NC

4.5 Promoting R&D by Private sector, including FDI

The private sector must be the main driver for R&D, particularly in sectors where substantial gains are to be made from incremental innovation and local adaptation. Incentives should be strengthened for both producers of ICT as well as major users or consumers who often need to invest in R&D for adaptation and effective assimilation of the new technology. Having the private sector in the lead would augment national resources available for R&D as well as ensure that R&D activities remain relevant to local needs and/or global markets. The recruitment of foreign companies to place some of their R&D activities in Jordan, at least for regional adaptation, should also help access cutting-edge R&D practices and make Jordan an attractive center for a host of other ICT activities. It may also upgrade the capacity of local enterprises to move up the value chain and insert themselves more effectively into global supply chains.

Case Study: A hallmark of the Irish policy framework has been to balance FDI attraction with domestic industry R&D and development. Thus, through instruments to co-finance strategic R&D, FDI was organized in such a way as to facilitate cluster formation in which Irish companies could build competencies and markets around the core of inward investment.

The strategy will rely on the e-Sector innovation fund as a key instrument to facilitate private sector participation in R&D. Most ICT enterprises in Jordan are small and thus unlikely to invest adequately in R&D on their own. Several other reasons also justify the use of this innovation fund for seed money or cost sharing private enterprises that are common to R&D and imperfections of the market. Incentives to enterprises will be augmented further through income tax credit or exemptions for companies who invest in R&D. Information on R&D opportunities, on locally developed ICT products and other measures to address information market imperfections will be carried out.

An innovation culture should be nurtured through various awareness building measures. The media can play an important role. Several countries have used innovation or study tours to innovation centers and dynamic ICT clusters as a potent tool to promote innovation culture and build commitment to creating the enabling environment for an innovation-driven economy. This is common practice among U.S. companies, but also used by countries such as Chile, Ireland, Israel, India, Czech Republic, and many others. As an example of such efforts, the U.S. and Czech Government jointly established the US-Czech Republic Cooperation to Advance High Technology, whose mandate has been to share US experience in commercialization of high technology products, in order to contribute to Czech initiatives for improved innovation and to identify new opportunities for international cooperation in high technology growth. Such tours must however be planned effectively and both the visitors and receiving companies and research centers must be briefed and prepared adequately to realize the potential benefits of such tours.

Strategy Theme V: Promoting Private sector investment in R&D, including FDI		
Specific Objective: Strengthening incentives for private sector to invest in R&D for ICT and market Jordan to FDI as a location for R&D in ICT.		
Expected accomplishments	**Indicators of achievement**	**Responsibility**
2. Increased knowledge about requirements for FDI and other forms of investments needed in R&D activities in Jordan, and disseminating it to concerned parties.	▪ Information is made available on the website and through nationally sponsored conferences, at least once annually.	▪ NC
3. Design an innovation fund scheme and recruitment campaign to facilitate R&D partnerships between local and international companies in ICT.	▪ Scheme is designed, piloted and evaluated (e-sector fund). ▪ Recruitment campaign and scheme to bring leading ICT companies to locate some of their R&D in Jordan.	▪ NC ▪ int@j ▪ MOICT ▪ JIB
3. Promote the commercialization of Jordan ICT locally developed products.	▪ Website posting and updating of products and services developed locally.	▪ NC ▪ int@j ▪ JIB
4. Development of incentives for enterprises to engage in or outsource R&D.	▪ R&D programs are considered as investment project under JIB laws. ▪ Income tax credit/ exemptions for ICT companies that invest in R&D. ▪ NC to recommend procedures for the various schemes.	▪ NC ▪ MOICT ▪ JIB
5. Promoting innovation culture	▪ An annual innovation tour is organized to innovation centers such as Bangalore, India and the Silicon Valley/Technology Corridor in the Northeast U.S. The objective is to engage policy makers in NC, HCST, MOHESR, MOICT, and NACTIB, Int@j, and academic and media leaders in building partnerships (e.g. network creation) and shared understanding of the innovation ecology for developing excellence in ICT in leading clusters in 2 countries, one developed, and one developing. ▪ Public awareness campaigns are launched through media programs with heavy involvement from business leaders, academics and Int@j.	▪ NC ▪ int@j

4.6 Promoting Incubators and Grassroots Innovation

Most of the dynamism of the ICT sector comes from new entrants and small enterprises. However, small enterprises do not have the necessary scale for supplying many of the support services they need on their own, such as R&D, marketing, legal services, and modern infrastructure. Empirical evidence also shows that small and medium enterprises located in clusters have a competitive advantage because of their higher collective efficiency through external economies and joint actions. External economies and joint actions offer powerful opportunities for upgrading in software clusters and incubators in particular. Incubators and clusters make shared services and infrastructural support possible. They also facilitate cooperation between industry and university. An innovation fund for incubators and clusters (e-incubators) is therefore recommended.

Case Study: Many leading countries in ICT R&D strategy and development have used a cluster or incubator approach. Chile and Bangalore are just two such cases – Bangalore electronic cities offer a "single-point contact" for all regulatory functions; Chile's technological parks also capitalize on the synergies structures.

The strategy will also rely on creating two other funds, an e-government (e-gov) fund and an e-society innovation fund. These funds will be correspondingly dedicated to R&D to address barriers to ICT diffusion among government agencies and among grassroots organizations and the poor. These two groups of ICT users face substantial barriers to ICT adoption. Government agencies are major potential users of ICT to improve public services and social welfare, however they are often little equipped to procure appropriate products and sustainable solutions to realize their missions. Moreover, government can achieve significant economies of scale if adaptations to products to their common business are financed and shared through a common fund such as the proposed e-gov innovation fund. In terms of the poor and rural populations, commercially available ICT products and services are often too complex and costly to be accessible and affordable for the majority of these populations.

Strategy Theme VI : Promoting Incubators, Shared Support Services and Grassroots Innovation		
Specific objective: Inducing the development of incubators and shared support services and supporting adaptation of ICT products and services to meet the needs of local government and grassroots organizations.		
Expected Accomplishments	**Indicators of achievement**	**Responsibility**
1. Improve the management of innovation within enterprises and NGOs through the development of guidelines according to international standards on how to manage innovation and R&D centers. ▪ Develop effective mechanisms to nurture new ventures. ▪ Access to information and material.	▪ Guidelines for the management of ICT innovation and R&D in ICT are published.	▪ NC ▪ HCST
2. Encouraging the establishment of technology clusters/incubators that facilitate sharing of resources for limited and pilot production of ICT products.	▪ Cost sharing studies with private sector to establish feasibility of ICT incubators, and clusters. ▪ Co-financing pilots for incubators under an e-incubator innovation fund scheme.	▪ NC ▪ HCST ▪ int@j
3. Provide for the development of shared and specialized services for innovative ICT enterprises and start-ups.	▪ Possible cost sharing scheme with Int@j, IT user associations or others to promote the creation of such services in the private sector or within clusters and incubators (using e-incubator fund).	▪ NC ▪ int@j
4. Improve awareness of universities and private sector of grassroots needs (of NGOs, civil society organizations, and rural communities) and of barriers to ICT diffusion and the digital divide.	▪ Workshops and conferences to bring together potential suppliers and grassroots organizations (using the e-society fund).	▪ NC ▪ Civic Societies ▪ NITC

5. Increase collaboration among grass roots organizations universities / enterprises through joint R&D on local content, low cost products and high grassroots priorities.	▪ Establish an e-society innovation fund to focus on financing ICT applications and products for the poor and innovations to promote ICT literacy and access.	▪ NC ▪ NITC
6. Increase dialogue and incentives for collaboration among public CIOs, government leaders and industry to adapt ICT products and services to local government agencies and their common services and processes. The objectives are to improve public ICT acquisition, standards and interoperability, to promote interoperability within industry, and to encourage ICT adaptation for local public services and rural areas.	▪ Establish an e-government innovation fund for encouraging the ICT industry to develop common packages for common government business processes, for researching ICT procurement practices, and for promoting open standards and interoperability.	▪ NC ▪ MOICT ▪ NITC

4.7 Improving Information Infrastructure for Knowledge Sharing

This is the final component of the strategy and the most straightforward. This program aims to improve access to information on R&D facilities, the national library network, local R&D human resources, and international and local R&D databases. In addition to policy measures to promote more competition for broadband services (Theme I), it is recommended that special reduction be sought from Telecom/Internet providers for broadband subscription fees for R&D institutions. These are measures for the short term. Improving knowledge sharing can take many other measures over the medium term; it is therefore recommended to study the overall knowledge management system for the R&D of Jordan and ways to improve it over time and on a holistic basis.

Strategy Theme VII: R&D ICT Infrastructure and Access to Information		
Specific Objective: Ensure the availability of a robust and effective infrastructure and access to information for R&D in the ICT sector.		
Expected accomplishments	**Indicators of achievement**	**Responsibility**
1. Building a repository of existing infrastructure and laboratories, and setting criteria for better utilization of these facilities.	▪ Repository creation, data collection and availability on-line.	▪ NC ▪ NITC
2. Ensuring effective and affordable infrastructure for R&D in the ICT sector.	▪ Reduction in broadband subscription fees for R&D institutions by 50%.	▪ MOICT ▪ TRC
3. Facilitating access to information, particularly university libraries and other research centers.	▪ Framework for national library networking and access is developed. ▪ Universities and research centers are implementing plan.	▪ MOICT ▪ JUNET

5 Implementation Mechanisms

5.1 Proposed Partnership Model

The partnership model for the implementation of R&D strategy in ICT is shown in Figure (6.1) (see Annex 2 for more details). It involves three major stakeholders:

- **Government**, with MOICT as the focal point and champion for government entities concerned with R&D in ICT;
- **Higher Education**, represented by universities and research institutions dealing with ICT related education and research; and
- **Industry**, mainly the ICT industry with development issues in ICT and its related topics and applications for the development of ICT products and services, and solving problems that their solutions have major ICT components.

These three stakeholders will establish an incubation scheme suitable for the type of research to be carried out through this partnership.

The partnership model depicts the relationships and links of the three major players in the proposed strategy. The model also shows the relationship of the program with respect to possible external players that could provide financial and/or technical assistance to the R&D in ICT program and projects. In cases where an NGO or foundation is involved as a potential user of the R&D, it may become a fourth player.

Prior to the implementation of the model, the three stakeholders are expected to embark on a number of actions that improve readiness for the initial stage:

The Government, through MOICT, must take the following actions:

- Establish a national R&D for ICT committee with representatives from:
  - Ministry of Higher Education and Scientific Research and key universities in Jordan;
  - Higher Council for Science and Technology;
  - Royal Scientific Society (RSS);
  - National Information and Technology Center (NITC)
  - The ICT private sector industry in Jordan;
  - Jordan Investment Bank (JIB); and
  - High caliber professionals and advisors.
- Set up a dynamic website for the R&D in ICT program for sharing information with prospective partners and the professional community as a whole. The website should be the single and comprehensive entry point for disseminating information and receiving proposals. It should gradually develop into an active portal hosting databases, holding discussions and

sharing results and best practices on line and through workshops and seminars.

- Select one or more universities for the initial phase, according to a predefined set of pre-qualification criteria.
- Survey the industry to solicit views on research and development topics suitable for the initial phase.
- Commission a feasibility study for the establishment of small scale manufacturing facilities and services for supporting R&D and prototyping production to be incorporated within the incubation scheme within the initial phase.
- Solicit support and commitment from international and regional entities that may offer financial and/or technical support for the initiative.
- Review existing laws and legislations with the intention of suggesting reform and introducing new legislations in support of R&D in ICT.
- Implement directives that are listed in the strategy.
- Provide seed fund for the incubation scheme.
- Commission studies and surveys for raising society awareness on the issue of R&D in ICT.

The selected university for the initial phase must commit itself to the following actions:

- Allocate seed fund for the incubation program.
- In close cooperation with the national committee, seek support from selected ICT firms to join the pilot program.
- Select a subset of undergraduate students for the purpose of undergoing an intensive program in preparation for the R&D tasks ahead.
- Establish a committee to oversee the proposed program in close coordination with MOICT and the selected ICT firms.
- Establish the incubation scheme suitable for the program and in close coordination with the ICT firms.
- Implement directives that are listed in the strategy.

The selected industry firm(s) should take the following actions:

- Allocate seed fund for funding the proposed incubation scheme.
- Select topics of interest to the industry in close coordination with the university.
- Agree on required facilities for the incubation scheme.
- Draw out a five year plan for incubation program.

The model could be easily replicated with other universities and different subsets of ICT firms to address similar or different research issues that are of interest to Jordan.

Examples of some selected opportunities in ICT hardware are presented in Annex 3. These will need to be validated with the private sector and additional opportunities, particularly in terms of software development and ICT diffusion will need to be identified as part of the implementation of this Strategy.

5.2 Implementation Mechanisms

The proposed partnership model can be best promoted and implemented by cost sharing and stimulating incremental bottom up initiatives from those private associations and enterprises and universities that respond to jointly agreed priority programs arising from the key elements of the R&D strategy. An Innovation Fund will be created for co-financing or providing initial grants for initiatives that respond to set priority programs. Rather than specifying opportunities upfront or top down, or by selecting a university or designating a Center of Excellence, this fund would seek proposals from all potential partners and encourage open competition for initiatives that best respond to priority programs.

Rationale for the funding mechanism

The innovation funding mechanism will be created to meet the challenge of funding small bottom-up and high-priority initiatives of the private sector, universities and NGOs even while ensuring that such initiatives will benefit the sector and the economy at large. Its design should emphasize:

- Competitive funding to ensure that scarce grants are given to the best proposals.
- Ownership and active participation of the private sector, and in particular, the software and ICT industry and relevant training and educational institutions
- Demand-driven funding to match the priorities and absorptive capacity of the beneficiaries
- Flexibility and timely response—rather than funding according to detailed and rigid plans—to accommodate the pace of change in this sector
- Innovation and shared learning through funding pilots and initiatives with large demonstration effects, and through well developed monitoring and evaluation and various means of dissemination of lessons learned
- Pump-priming initiatives with strong externalities and demonstration effects, with the intention to scale up through other sources of private and donor financing—given the large potential demand, potential interest of multinational companies and bilateral aid agencies, and the modest initial funding that could be made available through public funds.
- Outsourcing to outside management agent (rather than government administration or the NC) to avoid the intensive administrative burden of review of and disbursement for many innovation initiatives.
- Public-private partnership and transparency through the creation of an independent Innovation Fund Board, independent review of grants, and other safeguard mechanisms.

Overall, the Innovation Fund, its governance, promising areas of intervention, and modalities for funding will draw on international best practices. Many variations exist for such R&D funding and promotion activities. Each funding mechanism must be ultimately designed to match local conditions and stakeholder priorities—preferably

through engaging focus groups in joint design of the Fund. However, the initial outline proposed here draws on practices from countries that are in a leading position in the ICT sector, export in software and ICT products, and/or the use of ICT for national competitiveness. Most are also of comparable size to Jordan. These countries include: Singapore, Ireland, Israel, Finland, and Chile. India also presents a pool of models for funding ICT innovation, but given its size and diverse conditions among its states, its ICT use for the domestic economy remains uneven and at the pilot scale.

Case Study: Countries have followed varying models when dividing responsibilities for innovation policies and their implementation, depending on specific country circumstances. Ireland, for instance provides example of a 'dominant player model' when it comes to the institutional division of labour. In this instance, one organization is responsible for a large part of the entire chain of policies or their implementation. Forfas was established to primarily coordinate innovation policies and their implementation by other agencies without itself being the implementing agency nor making any funding decisions. In 1997, Ireland established an advisory council, the Irish Council for Science Technology & Innovation (ICSTI) to incorporate views of industry and academia into the development of innovation policies. On the other hand, in Singapore the set-up is different, with a 'division of labor' model, whereby there are separate systems (Ministry of Science & Education and Ministry of Trade & Industry) existing next to each other that each support innovation from different perspectives. A third, more fragmented structure has strongly separated pillars, and is not found in any of the best practice cases studies with applicability for Jordan.

Priority programs and modalities for governance

The following are the proposed priority programs—they are in line with the strategic themes and should be validated by key stakeholders:

1. Promoting ICT products and services innovation (e-ICT sector)
2. Partnering for innovations in developing the ICT workforce (e-HR)
3. Promoting incubators and shared services (e-incubators)
4. Promoting innovation for e-government (e-gov innovation)
5. Promoting innovation to bridge digital divide (e-society)

An umbrella ICT Innovation Fund may be established to cover these five programs. Each program will cover a range of the initiatives (indicators) under the strategic themes, some already specified above. Initiatives will be specified in response to proposals from various stakeholders that respond to the priority programs. Other programs, such as a venture capital fund mandated to finance innovative ICT ventures, may be added or dropped in light of experience.

Alternatively, a separate innovation fund may be created for each program, with its own governing and management mechanisms. There are pros and cons to these two alternatives. Economies of scale and administration argue for a unified umbrella innovation fund. Under the same fund, criteria for eligibility and modes of funding or cost sharing may differ for each program. Stakeholders will be engaged in defining the primary goals of each priority program, possible key initiatives that may be responsive to program goals, criteria for eligibility and modalities for financing, drawing on international best practices and Jordanian experience.

The Innovation Fund(s) will be governed by a board and will be contracted out to a managing agency that will be selected through international competitive bidding. The aim is to ensure competition, transparency and the institutionalization of innovation activities. Outcome indicators will be defined for each program and monitoring and evaluation of the fund(s) will be critical to ensure learning, accountability, and knowledge sharing from such innovations. The initial resources allocated to the innovation fund(s) are unlikely to meet all proposals and needs on a national scale. The fund(s) will therefore focus on critical innovations and initial funding on a pilot scale. Successful pilots and innovations will be scaled up through other means of funding or mainstreamed into educational reforms and other national programs.

Phasing and Costing the Innovation Fund(s).

Economies of scale and possible synergies may be captured by initiating at the same time the five innovation funds (or 5 priority programs under one umbrella program). They may be designed in parallel, with intensive involvement of a core group of stakeholders. It is likely to take about 6 months to design each of these funds. A pilot phase of 2 years is recommended before any major scaling up, as such funds are best adapted through experimentation and early evaluation. Costs for the pilot phase for each fund/program is attached.

1. Promoting ICT products and services innovation (e-ICT sector): initial public share US$ 3 million.

2. Partnering for innovations in developing the ICT workforce (e-HR): $ 5 m.

3. Promoting incubators and shared services (e-incubators): $ 5 m.

4. Promoting innovation for e-government (e-gov innovation): $ 3 m.

5. Promoting innovation to bridge digital divide (e-society): $ 3 m.

In addition to public funds, it should be possible to co-finance these funds through multinationals, large local ICT companies and donors. Foundations may be interested in contributing to the e-Society fund. Modalities for cost-sharing with recipients or beneficiary users of the fund will vary, ranging from 20% to 80%, but cost sharing is recommended in almost all cases to ensure commitment and mobilize additional resources for innovation from outside the budget. Some of existing mechanisms for funding form taxes or general R&D or training funds may be used for the proposed funds. The rationale for this is that ICT is an R&D-intensive industry, requires much adaptation to local needs. It is also less mature discipline and does not always enjoy the attention it deserves from more established and theoretical disciplines.

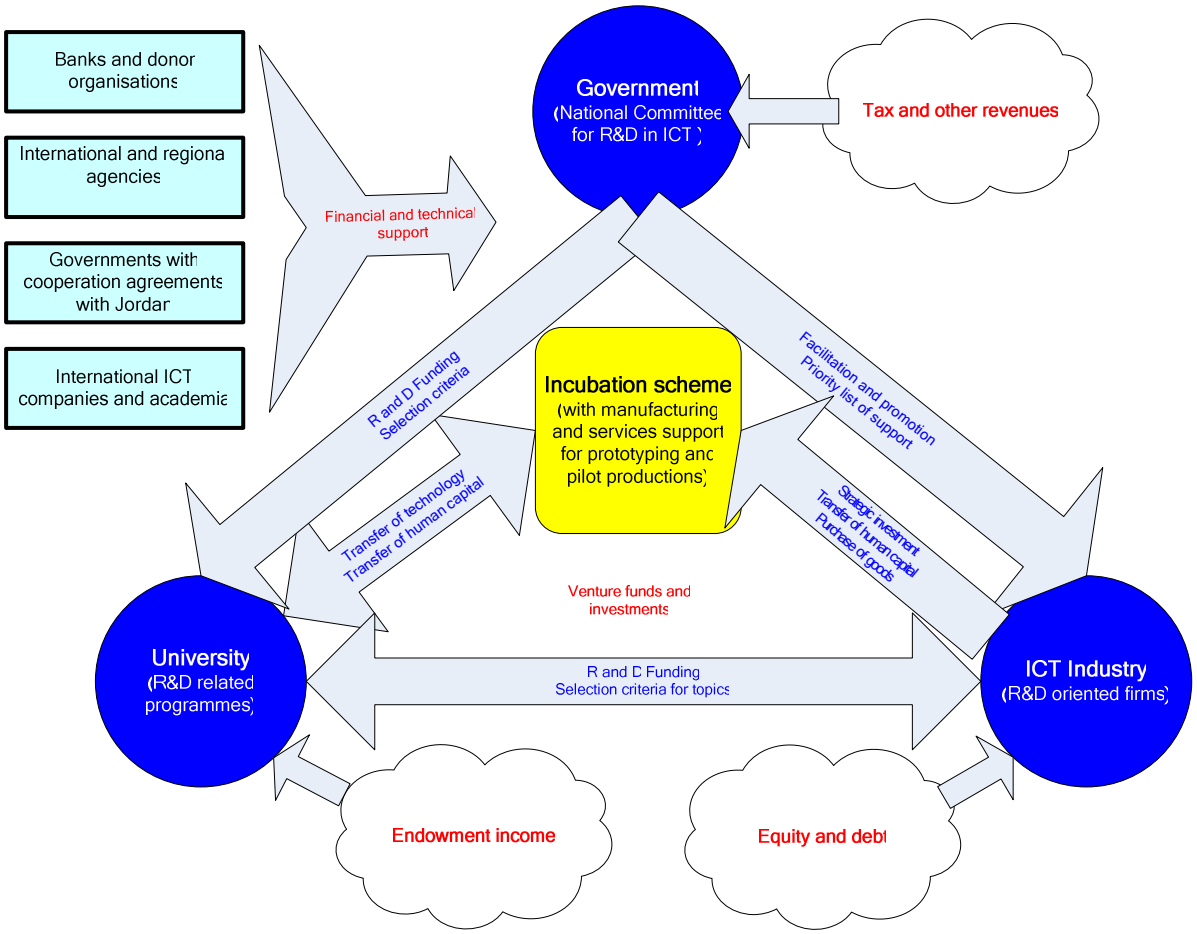


Figure (5.1) R&D in ICT Partnership Full Model

6 Conclusions and Recommendations

Jordan must develop a new momentum to realize the competitive dynamism it requires to take its place in the vanguard of the global knowledge economy and society.

The success of the R&D effort is never assured. The success of the R&D for the ICT sector requires private public partnership, commitment on behalf of the government to provide the appropriate legal framework and a conducive environment for R&D for the ICT sector in the country. Critical success factors, which will determine the overall framework for implementation of this strategy include:

Critical Success Factor	Requires
Commitment by three stakeholder groups (Government, Academia and Private Sector) to implement strategy	Dedication of resources, including both personnel and financial resources, to embrace the partnership model to implement the strategy and its components and to champion/advocate for action.
Promote incremental R&D, not just disruptive R&D	Orientation of funding towards incremental R&D
Market-driven approach	Private sector takes the lead in identifying R&D opportunities that can be commercialized. Government is an enabler and facilitator and academia is a partner to support market-driven innovations.
Selective intervention	Complementary to the market-driven approach, the Government should only intervene where the private sector and academia cannot but the potential benefits/ spillovers are high enough to justify intervention

Joint Technology Initiatives, based on broadly-based, long-term public-private partnerships, can become **flagship projects** for a more dynamic and competitive ICT based industry and economy. A range of identification criteria for R&D initiatives was suggested. These will be refined by the concerned governance mechanisms.

On this basis, the initiative now lies with the relevant industries, the universities and the Government. It is for the leaders of the industries concerned to build a case to demonstrate that the proposed model that have been developed meet the criteria for a technology initiative and that its implementation will lead to concrete deliverables that will impact positively on Jordan's industrial competitiveness, so contributing to growth and sustainability. In this regard, a definite commitment is required with regard to the exact definition of projects, their financing and the putting in place of the necessary structures for their effective implementation.

The three major stakeholders are invited to endorse these developments. They are asked to reflect on the extent to which they can work together in developing further

the concept presented with a view to setting up public-private partnerships in R&D in ICT to boost the industrial capabilities in Jordan.

One possible way to implement these partnerships on an ongoing basis is the proposed specialized innovation funds. The design of these funds, their governance, criteria for eligibility and modalities for cost sharing are expected to be elaborated by the major stakeholders during the implementation phase.

Strategic plans are only valuable to the extent that they are implemented. The following provides an overview of the next steps required to move this strategy to full implementation and the achievement of the strategies goals and objectives:

1. **Convene workshop of key stakeholders to reach consensus on the above-stated strategy**—while the plan was developed in consultation with a number of stakeholders, without buy-in by all stakeholders, the strategy cannot be achieved.
2. **Development of detailed action plans in coordination with stakeholders—** the Action Plans should be fully elaborated to enable implementation and monitoring, including prioritization of strategy elements, discrete action items for each line-item, time-bound targets and goals with implementation milestones and progress indicators, identification of resources, assignment of responsibility, key performance indicators that are aligned with the overall objectives
3. **Establishment of monitoring and evaluation mechanism**—at the end of the day, the strategy should be an evolving document; monitoring and evaluation at regular intervals this will ensure that the strategy implementation remains on-track and will enable stakeholders to assess the validity of strategy assumptions and to adjust implementation, as appropriate to align with new developments.
4. **Identify and approach external resources**—one key element of the action plan will be to identify the resource requirements, which will enable the MOICT to approach international and bilateral donor agencies, international foundations and other potential external funding sources.