

Mapping research systems in developing countries

Country report: The Science and Technology system of Jordan



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HASHEMITE KINGDOM OF JORDAN

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1. Introduction to research in Jordan

Jordan is a relatively small country with limited natural resources and semi-arid climate. Its strategic position connecting Asia, Africa and Europe has played a major role in shaping its history and development status.

From a political perspective, The Hashemite Kingdom of Jordan is a constitutional monarchy which gained independence in 1946. It is located at the centre of a complex and dynamic political, social and economic sub- system between Iraq, Saudi Arabia, Syria, Palestine and Israel. Regional tensions have continuously impinged upon the country decision-making processes. Jordan is classified as a lower – middle income country whose economy is constrained by limited arable land and scarce water mineral and energy resources.



The 2006 budget does not exceed 3.45 billion JDs (43.7% of GDP) with a deficit of 480 million JDs. The deficit is a result of the escalating oil bill, growing debt service payment, diminishing foreign aid and an anticipated lower GDP growth. Table 1 shows a selection of development indicators for

¹ This report has been based on the following intermediate reports:

1. Science & Technology and Innovation Profile of Jordan, authored by Dr. Khaled Elshuraydeh and Eng. Isam Mustafa/Project Manager, with the assistance of Dr. Mohammad Al Majali, Eng. Majeda Al Assaf, Eng. Falak Sarraf, Mr. Omar Hamarneh, all from the Higher Council for Science and Technology;
2. Scientific Production, report authored by Françoise Laville and Jean Thèves (Observatoire des Sciences et des Technologies); and the report of Pier Luigi Rossi and Roland Waast (Institut de Recherche pour le Développement)
3. Research in the Exact Sciences in Jordan, intermediate report by Nedal M. ALouran
4. Research in Social Sciences in Jordan, Abdel Hakim al Husban (Yarmouk University).

Jordan from the UNDP Human Development Report 2004 which would give the reader an idea of the development process in the country.

Table 1: Selected Development Indicators for Jordan from the UNDP HDR 2004 and 2005

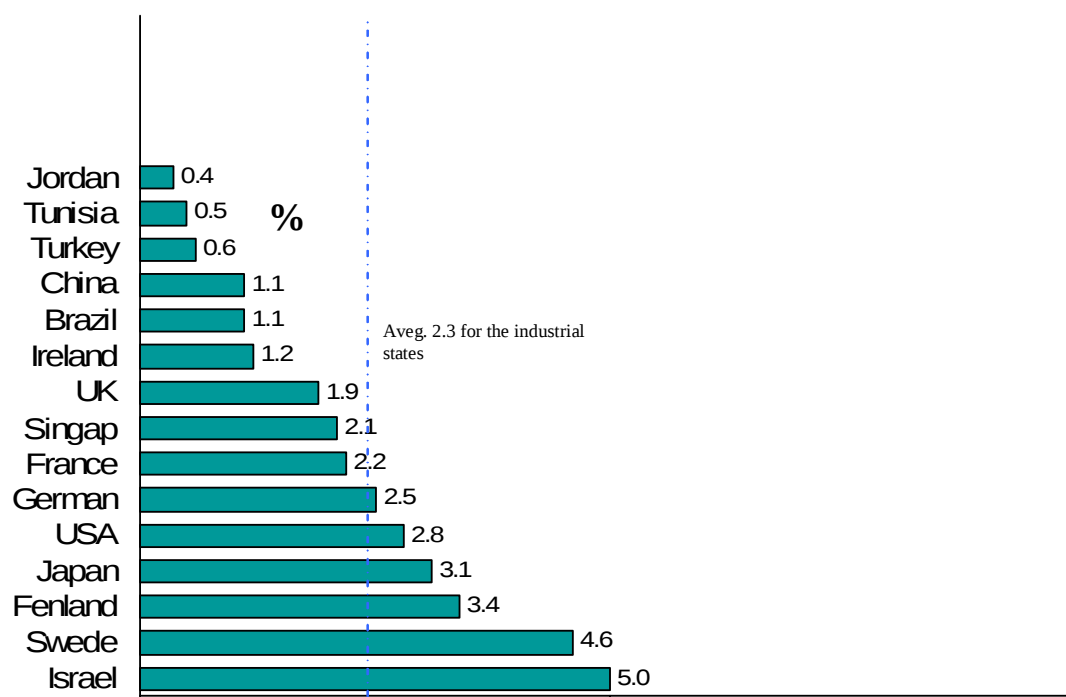
No	Item	Indicator 2004	Indicator 2005
1.	Human Development Index	0.750	0.753
2.	Population (million)	5.3	5.4
3.	Annual population growth rate (%)	2.1	2.1
4.	Population with sustained access to improved sanitation (%)	99	93
5.	Per capita GDP (US\$)	4,220	4,320
6.	HDI Ranking	90	90
7.	Life expectancy (years)	70.9	71.2
8.	Infant mortality rate (per 1,000 births)	27.0	23.4z
9.	Health expenditure per capita (US\$/annum)	412	418
10.	Gender related development index	0.734	0.740
11.	Military expenditure (% of GDP)	8.4	8.9
12.	Public Expenditure on education (% of GDP)	4.6 -	-
13.	Public Expenditure on health (% of GDP)	4.5	4.3
14.	Adult literacy rate (%)	90.9	89.9
15.	Internet users (per 1000)	57.7	81
16.	Cellular subscriber (per 1000)	229	242
17.	Population with less than 2.0 US \$/ day (%)	7.4	7.4
18.	ODA received as % of GDP	5.7	12.5

Source: UNDP Human Development Report 2005

Due to the particularity of the Jordanian State formation process in which the external factors whether regional or international played a crucial role, foreign aid was always indispensable for the continuity of the state and the Hashemite regime. After its creation in 1921 until the forties of the 20th century the whole public budget was financed by the British mandate. Until now, the foreign aids still play an important role in the Jordanian economy. Concerning the general indicators on

scientific research, Jordan is in the lower average category but slightly above the average of Arab countries (0, 2%), with a disbursement on scientific research of 0, 34% of the GDP in 2003.

Figure 1: Disbursement on scientific research in Jordan compared with other countries as % of GDP (for the period 1996-2002), source: Human Development Report, UNDP, 2003



Source: UNDP HDR 2003

Table 2: Science and Technology Indicators

S & T Indicator	1986 Study	1996 Study	2003 Study
No. of institutions working in S&T activities	196	524	835
No. of employees working in S&T activities	4389	18364	42151
No. of employees (scientists and engineers) working in R&D activity based on (FTE) ²	418	1593	1464
Expenditure on S&T activities (million JDs)	72.4	*107.2	**496.7
Expenditure on R&D activities (million JDs)	5.6	17.5	22.9
Expenditure on education and training (million JDs)	39.7	67.0	105.9
Expenditure on S&T services (million JDs)	27.1	22.7	367.8
Expenditure on S&T activities	3.77	*2.36	** 7.3
Expenditure on R&D (To GNP (%))	0.29	0.38	0.34
Expenditure on education and training (%)	2.07	1.48	1.60
Expenditure on S&T services (%)	1.41	0.50	5.40
Scientists & engineers working in R&D based on (FTE) for every 1000 inhabitants	1.6	3.6	2.7

Source: Elshuraydeh K. & Mustafa I. (HCST: 2007)

The GERD is presented in table 3.

Table 3: GERD

GERD as % of GDP	GERD by source of funds %					
	Business Enterprise	Government	Higher Education	Private Non-profit	Abroad	Not distributed
0.34%						100%

Source: UNESCO Institute for Statistics, 2002, *For more details about Funding and Expenses, see below, § 4*

² The FTE was calculated based on responses of engineers and scientists on the following question: how much of your time (%) is devoted to teaching, R&D, management etc.

Research is present in three main sectors: universities, the NGOs network and private centres, and research centres directly linked to the Higher Council for Sciences. But most scientific research is carried out by the universities. The contribution of the private sector is not visible in the field of scientific research, neither directly carrying it out nor providing financial support. Few initiatives have been taken to furnish some units and offices or to renovate some buildings. Jordan has private and public universities; however the new private universities, which are market-oriented and of a lower level, hardly carry out any research activities. As far as NGOs and private research centres are concerned, they can only be partly considered as independent as a particularity of Jordan is the prevalence of "Royal NGOs". Private centres are being registered increasingly above all in social sciences but only part of them has real activities. That is due to the increase in consultancy concerning the Jordanian society for international organization and donors.

Since the 1950's, Jordan has made efforts to develop its indigenous science and technology capabilities, using its young, skilled labour force. Past development plans have aimed at integrating and upgrading the country's scientific capacity, and increasing the efficiency of the services and commodity-producing sectors. Jordan's ability to undertake scientific research was enhanced with the creation of private and public scientific institutions, of which 193 are involved in science and technology. Of these institutions, 82 have laboratory facilities totalling 379 laboratory units. The following is a more detailed description of these institutions and centres.

2. The institutional framework

Over the past fifty years, Jordan has witnessed the establishment of a number of universities: Jordan University in 1962 in Amman, Yarmouk University in 1976 in Irbid, Mu'tah university in 1981 in al-Karak, Jordan University for Science and Technology in 1986 in Irbid, Al al-Bayt University in 1994 in Almafraa, The Hashemite University in 1995 in al-Zarqa and al-Balqa' Applied University in 1997. The latter was meant to restructure the sector of colleges. In 1990, the first private university, Amman Private University, was established in Amman. Currently, the number of private universities continues to soar. The number has reached 12 universities in 1996/1997. Seven more universities were later granted permits by the government.

In its early years, higher education presented an opportunity for successive governments to take advantage of some regional developments such as oil boom, development projects in neighbouring Gulf Countries, and waves of Arabization in Morocco and Algeria. Due to the oil boom in the 1970s, Jordan University, besides some Iraqi, Syrian, Egyptian and Lebanese universities, was able to provide the developing Gulf markets with qualified Jordanian graduates.

The need of the Gulf countries for qualified personnel plays a crucial role in determining the variables of supply and demand in the Jordanian education market. When the Gulf countries were lacking universities to prepare qualified cadres in administration, agriculture, industry, journalism and services, they turned to Arab markets including the Jordanian market. The Gulf countries sought constantly to attract Jordanian graduates, especially those with MAs and PhDs. By doing so, these countries were able to advance their system of higher education.

With its relatively limited natural resources, Jordan relies heavily on the human element for its economic and social progress. Due to the quality of the services provided in the country, Jordan is achieving internal success and is also able to export human expertise and skilled manpower to other countries in the region. Planners for higher education in Jordan adopted the philosophy that Jordan

could become an important provider of qualified human staff (teachers, doctors, engineers, nurses, bankers, journalists, technicians) to the Gulf countries which lacked the necessary educational infrastructure. Therefore, Jordanian universities played a crucial role in attracting hard currency into Jordan. Moreover, Jordan provided some Arab countries, especially Morocco and Algeria, with qualified graduates in the fields of Arabic language and Islamic Sharia after the adoption of Arabization policies in these countries during the 1970s and 1980s of the last century.

The Gulf markets and universities exercise a great pressure on higher education and scientific research in Jordan. A large number of better qualified cadre with PhDs and who have received their education in the best Western universities and have acquired practical experiences within Jordanian academic institutions prefer to work in the Gulf countries due to the difference in the salary between Jordan and the Gulf countries. Work conditions in the Gulf countries in terms of work hours, availability of facilities, and work social conditions are also more attractive. Therefore, we can talk about a drain in the Jordanian qualified and trained cadre which leaves the Jordanian educational system and moves to the Gulf countries.

Over the 1980s and 1990s, Jordan has also witnessed the establishment of a number of nongovernmental organizations. Though the main interest of such organizations was studying issues such as poverty, child labour, literacy and woman's health problems, they sought to play a complementary role to the one played by the Jordanian authorities. The 1990s, the period when the martial laws were lifted, witnessed a remarkable improvement in the Jordanian-American and Jordanian-Western relations. In light of this, the number of nongovernmental organizations in Jordan increased in a noticeable manner. Research agenda also changed. Topics such as human rights, women rights, child rights, freedom of speech, democracy, freedom of journalism, market economy, and privatization were placed high on the agenda.

Most of these nongovernmental organizations are usually directed or supervised directly by ex or current officials or members of the royal family or indirectly through joint projects between these organizations and the Jordanian state agencies. The establishment of any society or organization requires certain strict procedures controlled by the Ministry of Interior and its agencies including the security department.

In addition to non-governmental organizations, there is a rapid increase in the number of private study centres in social sciences which usually register themselves as commercial companies. These centres provide research-related- services to the local and foreign markets. Several factors have largely contributed to establishing these private centres: First, the lifting of the martial laws in the 1990s; second, the increase in the need of the private sector for more researches and studies; and third, the huge influx of Western and foreign capital into Jordan. This capital is considered by the political system in Jordan as supportive rather than threatening their decision-making.

In the early sixties Jordan started its search for more efficient utilization of S&T in its development plans, which led to the establishment of the Scientific Research Council in 1961. The objectives of the Council included planning, promoting, and financing research, identifying national research priorities, promotion of scientific research culture, and enhancing S&T cooperation with other countries. In 1977 the Council was replaced by the Directorate of Science and Technology at the Ministry of Planning (called at that time National Planning Council) which was entrusted with

preparing the S&T policy, plans, and programmes, in addition to linking scientific activities to developmental objectives.

Jordan's political will in strengthening S&T infrastructure and linking its activities with national objectives of development was reflected and resembled in the holding of "Jordan's Science and Technology Policy Conference" in 1978. The Conference was held under the patronage of HM King Hussein and the chairmanship of HRH Prince El Hassan Bin Talal. This event was a turning point in reviewing the major issues facing the country in organizing and orienting its scientific and technological efforts towards the needs of development.

The Conference recommended that Jordan should endeavour to set up a national organizational structure responsible for planning, coordination, financing and promotion of scientific and technological activities at the national level, either through reconstituting an existing structure or creating a new one.

Based on this recommendation and the need stemmed from the increased scientific activity in Jordan, it was decided to institutionalize science and technology activities under a national umbrella that would set science and technology policy, strategies, plans and programs. A national committee was established, around 20 years ago, and entrusted with a task to develop a framework for a national organization that would cater for S&T activities in Jordan. To this end the Higher Council for Science and Technology was established in 1987 to build a national science and technology base to contribute to the achievement of national developmental objectives.

2.1 The Higher Council for Science and Technology (HCST)

The Higher Council is presided over by HRH Prince El Hassan Bin Talal, who has been instrumental to the progress of science and technology in Jordan from the very beginning. 3. Under the Chairmanship of HRH, the Council is made up of the following: the Minister of Finance, the Minister of Planning and International Cooperation, the Minister of Higher Education and Scientific Research, the Minister of Telecommunications and Information Technology, the Minister of Energy and Mineral Resources, the Minister of Industry and Trade, the Minister of Education, the Minister of Agriculture, the Commander-in-Chief of the Jordanian Armed Forces, the President of the Royal Scientific Society, the President of Amman Chamber of Industry, the President of Amman Chamber of Commerce, the Secretary General of the HCST, and three persons of qualification and experience to be appointed by the president for two-year renewable terms (see Law 30/87).

The HCST is entrusted with several responsibilities that include the following:

- Ratifying the general policy of science and technology in the Kingdom, defining its priorities, and drawing up the related programs and plans as well as following up on their implementation and evaluation.
- Drawing up the strategies suitable for the development of scientific and technological potential in the Kingdom and providing the scientific environment suitable for this purpose.

³

Law Nb. 30, 1987, and its amendments, the Higher Council for Science and Technology.

- Supporting the institutions and units of scientific and technological research and providing the necessary funding for the support of scientific and technological research as well as scientific and technological services and activities in the kingdom.
- Participating in the supply and training of manpower and technical potential for scientific and technological research institutions.
- Representing the Kingdom before Arab, regional and international institutions and bodies concerned with science and technology.
- Undertaking scientific and technological cooperation and concluding agreements related to scientific and technological research in collaboration with local, Arab, regional and international organizations.

The Council may establish affiliated specialized centres of scientific and technological research.

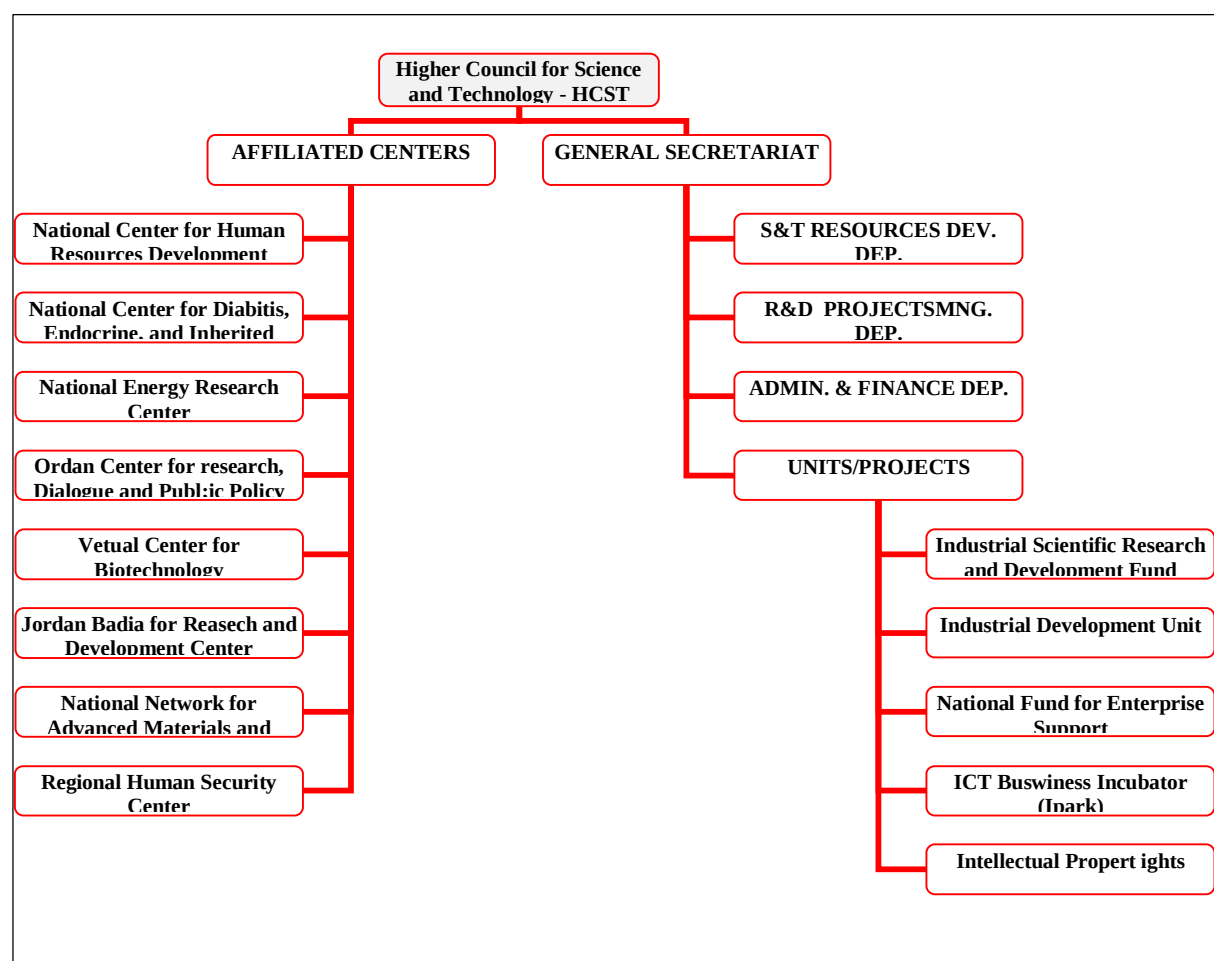
The Jordanian Government provides the Higher Council with an independent budget through which the council supports research and development projects and programs. This includes activities that contribute to strengthening channels of communication and increasing coordination and cooperation between various national institutions, thereby providing the basis for enhancing the role of S&T within comprehensive development.⁴

⁴

HCST Brochure, 2005, the Higher Council for Science and Technology.

The organizational structure of the HCST is illustrated in the following chart.

Figure 1: Organizational structure of the HCST



Source: Elshuraydeh K. & Mustafa I. (HCST: 2007)

The total number of employees at the General Secretariat (GS) is 41, out of which PhD holders represent around 7.3%, master's degree holders 19.5%, BA/BSc holders 17.1%, Diploma holders 9.8%, and below diploma 46.3%.

The total budget of the GS for the year 2006 is around 1.5 million JD*, out of which salaries represent around 35.1%, R&D 27.3%, other projects 23.9%, and others 13.7%. The government through HCST provides for 94% of the GS financing, and the rest comes from foreign sources.

2.2 Research centres and units affiliated to the HCST

HCST has eight affiliated research centres.⁵ It also has specific units dedicated to issues such as environmental monitoring, managing the business incubators network, managing intellectual property rights, etc.

⁵ The information used in this part was collected using a specially designed questionnaire adapted according to the type of institution considered (Annex 1).

Table 4: Research centres and units affiliated to the HCST

Research centre	Total operations budget ** Thousands JD	Total personnel	Research expenditures (Allocations 2006)***
Higher Council for Science and Technology (HCST) – General Secretariat	1,500	41	--
National Centre for Human Resources Development (NCHRD) *	484	39	132
National Centre for Diabetes Endocrine and Inherited Diseases (NCDID) *			
National Energy Research Centre (NERC) *	436	31	
National Virtual Centre for Biotechnology (NVCB) *		4	
Jordan Centre for Public Policy Research & Dialogue (JCPPRD) *	100	6	
Jordan Badia Research and Development Centre (JBRDC) *	525		91
National Network for Advanced Materials and Nano-Technology (NNAMNT) *	150		
Regional Human Security Centre (RHSC) *			

Source: Elshuraydeh K. & Mustafa I. (HCST: 2007)

2.3 Other research centres

There are few NGOs that also contribute to the overall research activities in the country but with a relative small percentage. Example on that is the Royal Scientific Society (RSS), established in 1970. These research centres are considered as among the most distinguished ones in Jordan.

Table 5: Other research centres

Research centre	Total 2006 operations budget ** Thousands JD	Total personnel	Research expenditures (Allocations 2006)***
Royal Scientific Society	9,700	668	
National Centre for Agricultural Research and Technology Transfer (NCARTT)	3,200	416	1000
Pharmaceuticals Research Unit (PRU)	1,300	53	93

Source: Elshuraydeh K. & Mustafa I. (HCST: 2007)

The Royal Scientific Society has the following research/technical centres/Departments: Information Technology Centre; Electronic Services and Training Centre; Mechanical Design and Technology Centre; Building Research Centre; Environment Research Centre; Quality Assurance Department; Marketing, information and International Relations Department; Technology Transfer Centre; and Enterprise Support & Conformity Assessment Department. PhD holders represent around 8.2% of employees, Master Degree holders 13.3%, High Diploma holders 1.05%, BA/BSc holders 39.1 and lower qualifications represent 25.3%

Salaries represent around 45.8% of the total budget, R&D 24.7%, other projects 11.3%, and others 17.7%. RSS is a private institution. Most of its financing (97.5%) is self financing, the remainder (2.5%) comes from the government.

The National Centre for Agricultural Research and Technology Transfer (NCARTT) was established in 1951. It is affiliated to the Ministry of Agriculture. The objective of the Centre include: Utilization of the agricultural research results for the purpose of increasing agricultural production (both plants, and animals); increasing the efficiency of plants production; sustaining natural agricultural products and utilizing them optimally; servicing agricultural development; and sustaining environmental balance. The Centre has seven branches in seven different areas all over Jordan.

PhD holders represent around 10.6% of the employees, Master Degree holders 17.5%, High Diploma holders 1.2%, BA/BSc holders 24%, Diploma holders 6%, and below diploma represent 40.6%.

Salaries represent around 64.7% of the total budget, R&D 3.5%, laboratory equipment 2.1, and others 9.8%. Most of the financing of NCARTT (95%) comes from the government; the rest comes from foreign sources.

The Pharmaceuticals Research Unit (PRU) was established in 1993, with the objective of conducting Research and studies of drugs for human use. The PRU has the following facilities: analytical facilities; clinical facility; and Product safety research laboratory. The PRU has also conducts collaborative research with various universities.

PhD holders represent around 9.4% of the employees, Master Degree holders 11.3%, BA/BSc holders 66%, Diploma holders 7.5%, and below diploma represent 5.7%

Salaries represent around 15.9% of the total budget, R&D 5.9%, and laboratory equipment 78.1%. Most of the financing of PRU comes from the self financing.

3. Human Resources in S&T Activities

The study of national R&D potential conducted by HCST covered 1583 scientific and technological units⁶ in Jordan that are situated within 681 national institutions including both private and public sectors such as governmental and private universities, scientific centres, governmental ministries and institutions , and private institutions (companies, factories, consultation offices etc).

Scientific and technological activities covered by the above study include the following:

- a. Basic research
- b. Applied research and technological development
- c. Education and training
- d. Scientific and technological services such as information and documentation, laboratory testing, standards and specifications, quality control, maintenance and spare parts, technical and management consultations, national and international accreditations, patenting,...etc.

It should be noted that the Higher Council has adopted a very wide definition of research including education and services, which explains the high number of research activities amount they have found. The same is true for their definition of researchers as “all scientists and engineers that are working in the scientific and technological activities”. That is why there is such a difference between the number of engineers and scientists (15 799) and the Full Time Equivalent (FTE 464).

3.1 Categories of S &T Human Resources.

The study classified human resources working in the above defined scientific and technological activities into four categories: scientists & engineers, technicians, technical staff, and management staff⁷. Data given in Table (1) indicate that 42 thousand persons worked in scientific and technological activities in 2003, out of which 15,800 were scientists & engineers. Technical staff and technicians reached nearly 20,000 persons.

⁶ A scientific and technological unit is defined as the smallest part of an institution that can conduct integrally scientific and technological activities. See: National Scientific and Technological Requirements and Potential Study/ Second Stage-S&T Potential Study issued by the General Secretariat of the Higher Council for Science and Technology (HCST), May 2005.

⁷ In Jordan “technicians” refers to Personnel with High School degree in vocational areas, or Three year diploma in a vocational training institution. “Technical staff” refers to personnel with a Community college or equivalent degree in any field of knowledge.

Table 6: Human Resources Working in Scientific and Technological Activities.(Public & Private Sectors 2003/2004)

Human resources category	Numbers	%
Scientists & Engineers	15799	37.6
Technicians (see note 14)	6352	15.1
Technical staff	12970	30.8
Management staff	6940	16.5
Total	42061	100.0

Source: S&T Potential Study, Higher Council for Science and Technology, 2005.

3.2 *Distribution of Researchers*

As given in Table 2, the total number of researchers who work in both private and public sectors is almost 15,800, out of which 48% are working in public institutions.

Table 7: Categories of Human Resources: Distribution by Major Economic Activity (Public & Private Sectors 2003/2004)

%	Total	Numbers of Human Resources Categories in S&T				Major Economic Activity of Institution
		Management Staff	Technical Staff	Technicians	Scientists & Engineers	
36.6	15405	1665	9263	2540	1937	Manufacturing
4.7	1966	583	532	462	396	Wholesale & Retail Trade
2.2	916	187	39	183	507	Financial Intermediation
7.9	3336	455	475	413	1993	Real Estate ,Renting & Business Activities
7.2	3049	493	406	681	1471	Public Adm., Defence & Compulsory Social Security
28.1	11813	2549	685	958	7621	Education
2.8	1177	178	81	372	546	Health & Social Work

Table 7 Continued

%	Total	Numbers of Human Resources Categories in S&T				Major Economic Activity of Institution
		Management Staff	Technical Staff	Technicians	Scientists & Engineers	
2.6	1111	361	356	121	273	Other Community, Social & Personal Service Activities
7.8	3286	469	1142	622	1055	Other Economic Activities
100.0	42061	6940	12970	6352	15799	Total
	100.0	16.5	30.8	15.1	37.6	%

Source: S & T Potential Study, Higher Council for Science and Technology, 2005

3.3 Researchers According to Economic Activity

The distribution of researchers, according to the major economic activity of the institutions they are working in, is given in Table 3. Most researchers work in education; manufacturing occupies only 12% of the researchers. Consequently, there is a large difference if the personnel are taken into account as they are mostly involved in manufacturing whereas scientists and engineers are mostly involved in education. All services occupy 3,717 researchers (48.5%), while public administration occupies 1,469 researchers (9%).

Table 8: Distribution of Researchers in Public & Private Sectors According to Major Economic Activity

%	Numbers	Major Economic Activity of Institution
12.3	1937	Manufacturing
2.5	398	Wholesale & Retail Trade
3.2	507	Financial Intermediation
12.6	1993	Real Estate ,Renting & Business Activities
9.3	1469	Public Adm., Defence & Compulsory Social Security
48.2	7621	Education
3.5	546	Health & Social Work
1.7	273	Other Community, Social & Personal Service Activities
6.7	1055	Other Economic Activities
100.0	15799	Total

Source: S&T Potential Study, Higher Council for Science and Technology, 2005.

In the public sector, the percentage of researchers working in the education sector is the highest, as it reached (62%), followed by those working in public administration (19%). All service sectors occupy 12% of public sector researchers. (Table 9).

Table 9: Distribution of Researchers in Public Sector According to Major Economic Activity

%	Numbers	Major Economic Activity of Institution
0.7	53	Manufacturing
1.1	87	Wholesale & Retail Trade
0.9	65	Financial Intermediation
6.4	493	Real Estate ,Renting & Business Activities
19.2	1469	Public Adm., Defence & Compulsory Social Security
61.7	4715	Education
0.9	65	Health & Social Work

Table 9 Continued

%	Numbers	Major Economic Activity of Institution
2.8	213	Other Community, Social & Personal Service Activities
6.3	479	Other Economic Activities
100.0	7639	Total

Source: S&T Potential Study, Higher Council for Science and Technology, 2005.

3.4 Researchers According to Field of Study

Table (5) shows the distribution of total researchers, in public and private sectors, according to the field of study. Around one third (33%) of researchers acquired their degrees in the field of engineering sciences, followed by 13% in the field of mathematics and computer sciences, 10% in the field of medicine sciences, 9% in the field of commercial and business administration, 8% in the field of natural sciences, and 7% in the field of humanities and religious sciences.

Table 10: Distribution of Researchers in Public & Private Sectors According to Field of Study

%	Numbers	Field of Study of Researchers
3.6	566	Education Science
7.3	1156	Humanities, Religion Science
5.1	799	Social & Behavioural Science
8.5	1346	Commercial and Business Administration
7.6	1193	Natural Sciences
13.4	2122	Mathematics & Computer
10.0	1589	Medicine Science
32.7	5160	Engineering Science
5.3	836	Agriculture Science
6.5	1032	Others *
100.0	15799	Total
*Others include Law, Fine and Applied Arts, Mass Communication &Doc. ,Pharmacy ,Physical Education, Dentistry, Architecture &Town Planning, Applied Engineering , and Veterinary M.		

Source: Annual Statistical Report on Higher Education in Jordan (2003/2004), Ministry of Higher Education & Scientific Research, 2005.

Table (6) indicates that around one quarter of public sector researchers acquired their degrees in the field of engineering sciences, 13% in the field of mathematics and computer, and around 9% in each of the fields of humanities & religious sciences, medicine sciences, and agriculture sciences.

Table 11: Distribution of Researchers in Public Sector According to Field of Study

%	Numbers	Field of Study of Researchers
5.6	425	Education Science
9.2	704	Humanities, Religion Science
7.3	554	Social & Behavioural Science
6.0	459	Commercial and Business Administration
8.0	612	Natural Sciences
12.8	977	Mathematics & Computer
8.9	678	Medicine Science
25.4	1943	Engineering Science
8.7	667	Agriculture Science
8.1	620	Others *
100.0	7639	Total
*Others include Law, Fine and Applied Arts, Mass Communication &Doc. ,Pharmacy ,Physical Education, Dentistry, Architecture &Town Planning, Applied Engineering , and Veterinary M.		

Source: Annual Statistical Report on Higher Education in Jordan (2003/2004), Ministry of Higher Education & Scientific Research, 2005.

3.5 Academic Staff and Enrolled Students in Universities.

The Annual Statistical Report on Higher Education in Jordan (2003/2004) issued by Ministry of Higher Education and Scientific Research⁸ covered twenty governmental and private Jordanian universities. The following paragraphs will highlight some statistics about the academic staff and enrolled students in the Jordanian universities, and their distribution according to universities, sex, academic rank, and field of acquired degrees.

3.5.1. Academic Population According to Universities and Sex

All academic ranks of academic staff are covered in Table (7) including full professor, associate professor, instructor, lecturer, and teaching & research assistant. Enrolled students of all degrees are covered in table (7) including B.A/ B.Sc., higher diploma, M.A/M.Sc., and PhD.

⁸ The Annual Statistical Report on Higher Education in Jordan for the year 2003/2004. Report issued by Statistics Section – Directorate of Studies and Planning/ Ministry of Higher Education and Scientific Research, 2005.

Table 12: Distribution of Academic Staff and Enrolled Students in the Jordanian Universities (Female & Total) for the Academic Year 2003-2004

University	Academic Staff			Enrolled Students		
	Female	Total	%	Female	Total	%
Jordan University	173	1008	17.7	18837	32317	18.2
Yarmouk University	87	721	12.7	11084	19896	11.2
Science & Technology University	106	626	11.0	6880	15330	8.6
Mu'tah University	65	580	10.2	10391	17237	9.7
Al-al Bayt University	19	187	3.3	7524	13670	7.7
The Hashemite University	82	357	6.3	8249	14393	8.1
Al- Balqa Applied University	25	258	4.5	7003	13195	7.4
Al-Hussaien Bin Talal University	8	78	1.4	2326	3561	2.0
Amman Private University	29	189	3.3	1455	5131	2.9
Philladelphia University	63	319	5.6	1448	7307	4.1
Al-Isra University	34	195	3.4	1586	5314	3.0
Applied Science University	40	273	4.8	1757	6173	3.5
Jerash Private University	16	160	2.8	1741	4242	2.4
Al-Zaytoonah University	51	217	3.8	1866	7012	4.0
Irbid National University	15	99	1.7	1353	3918	2.2
Zarka Private University	17	150	2.6	2040	4222	2.4
University of Petra	72	191	3.3	1395	3172	1.8
Princess Sumaya University	2	50	0.9	242	889	0.5
Jordanian Academy of Music	3	17	0.3	15	31	0.1
Educational Science Faculty	5	21	0.4	357	501	0.3
Total	912	5696	100.0	87549	177511	100.0
%	16%	100%		49.3	100%	

Source: Annual Statistical Report on Higher Education in Jordan (2003/2004), Ministry of Higher Education & Scientific Research, 2005.

Total number of academic staff including all academic ranks in public and private Jordanian universities is 5,696, out of which 16% are females.

Jordan University has the largest academic staff (18% of total), followed by Yarmouk University (13%), Science and Technology University (11%), and Mu'tah University (10%). Academic staff in other universities ranges between 6% and 0.3% of national academic staff.⁹ . Total number of all enrolled students including all degrees is 177,511 students, out of which around 49% are females.

Jordan University represents the largest percentage of enrolled students (18%) followed by Yarmouk University (11%) and Mu'tah University (10%). Four universities represent between 8% and 7% of the student population. (Jordan Science and Technology University, Al Al-Bayet University, the Hashemite University, and Al Balqa Applied University). All other universities have much smaller student populations.

B. Academic Population According to Field of Study

Table (8) shows the distribution of academic staff of all academic ranks according to the field of their acquired studies (according to department), and enrolled students of all degrees according to the field of study. Moreover, the table gives also the ratio of students to academic staff in each field.

Table 13: Distribution of Academic Staff & Enrolled Students in Universities by Field of Study

Students / Academic Staff	Students	Academic Staff	Field of Study	
84:1	26891	321	Nr.	Education Science
	15.1	5.6	%	
29:1	28928	1008	Nr.	Humanities, Religion
	16.3	17.7	%	
39:1	6432	165	Nr.	Law
	3.6	2.9	%	
24:1	6971	285	Nr.	Social & Behavioural Science
	3.9	5.0	%	
48:1	30183	626	Nr.	Commercial and Business Administration
	17.0	11.0	%	
16:1	8826	566	Nr.	Natural Sciences
	5.0	9.9	%	

⁹ The Statistics cited above contain more indicators regarding percentage of female academic staff in each university out of all universities, and out of all staff within that university.

Table 13 Continued

Students / Academic Staff	Students	Academic Staff	Field of Study	
31:1	22228 12.5	715 12.6	Nr. %	Mathematics & Computer
12:1	3256 1.8	274 4.8	Nr. %	Medicine
28:1	5050 2.8	183 3.2	Nr. %	Pharmacy
29:1	7352 4.0	257 4.5	Nr. %	Para- Medical Science
28:1	19828 11.2	690 12.1	Nr. %	Engineering
18:1	3367 1.9	192 3.4	Nr. %	Agriculture
21:1	8745 4.9	414 7.3	Nr. %	Others*
31:1	177511 100.0	5696 100.0	Nr. %	Total
*Others include Fine and Applied Arts, Mass Communication &Doc., Physical Education, Dentistry „Architecture & Town Planning, Applied Engineering ,and Veterinary M.				

Source: Annual Statistical Report on Higher Education in Jordan (2003/2004), Ministry of Higher Education & Scientific Research, 2005.

Academic staff is mainly located in the humanities and religious studies (18%), followed by the fields of mathematics & computer sciences (13%), engineering (12%), and commercial and business administration (11%).

Students mainly study in the field of commercial and business administration (17%), humanities and religion (16%), education sciences (15%) mathematics & computer (13%), and engineering (11%).

Ratio of students to academic staff is 84 to one in the field of education sciences, followed by a ratio of 48 to one in the field of commercial and business administration, law (39:1). Humanities & religion (29:1), para-medical sciences (29:1), engineering and pharmacy (both 28:1) have similar ratio of students to academic staff.

C. *Academic Staff by Ranks of Staff and Fields of Study*

The distribution of the different academic ranks of academic staff in the Jordanian universities according to field of study is shown in Table 9.

Table 14: Distribution of Academic Staff in the Jordanian Universities for the Year 2004

Field of Study		Full Prof.	Associate Prof	Assistant Prof.	Instructor	Lecturer	Teaching & Research assistant	Total
Education Science	Nr.	60	68	130	36	25	2	321
	%	18,7%	21,2%	40,5%	11,2%	7,8%	0,6%	5,6%
Humanities, Religion	Nr.	175	167	440	120	68	38	1008
	%	17,4%	16,6%	43,7%	11,9%	6,7%	3,8%	17,7%
Social & Behavioural Science	Nr.	59	74	87	32	25	8	285
	%	20,7%	26,0%	30,5%	11,2%	8,8%	2,8%	5,0%
Commercial and Business Administration	Nr.	52	140	264	109	41	20	626
	%	8,3%	22,4%	42,2%	17,4%	6,5%	3,2%	11,0%
Natural Sciences	Nr.	146	110	156	29	37	88	566
	%	17.4	10.3	7.0	4.1	7.8	22.3	9,9%
Mathematics & Computer	Nr.	35	95	284	163	49	89	715
	%	4,9%	13,3%	39,7%	22,8%	6,9%	12,4%	12,6%
Medicine	Nr.	64	55	125	2	19	9	274
	%	23,4%	20,1%	45,6%	0,7%	6,9%	3,3%	4,8%
Pharmacy	Nr.	26	32	68	23	12	22	183
	%	14,2%	17,5%	37,2%	12,6%	6,6%	12,0%	3,2%
Para-Medical Science	Nr.	12	13	75	46	82	29	257
	%	4,7%	5,1%	29,2%	17,9%	31,9%	11,3%	4,5%
Engineering	Nr.	94	154	290	57	54	41	690
	%	13,6%	22,3%	42,0%	8,3%	7,8%	5,9%	12,1%

Table 14 Continued

Field of Study		Full Prof.	Associate Prof	Assistant Prof.	Instructor	Lecturer	Teaching & Research assistant	Total
Agriculture	Nr.	56	51	61	7	6	11	192
	%	29,2%	26,6%	31,8%	3,6%	3,1%	5,7%	3,4%
Others*	Nr.	60	108	237	79	57	38	579
	%	10,4%	18,7%	40,9%	13,6%	9,8%	6,6%	10,2%
Total	Nr.	839	1067	2217	703	475	395	5696
	%	14,7%	18,7%	38,9%	12,3%	8,3%	6,9%	100.0
*Others include Law, Fine and Applied Arts, Mass Communication & Doc., Physical Education, Dentistry, Architecture & Town Planning, Applied Engineering, and Veterinary M. Percentages represent the percentage of the academic rank inside each discipline.								

Source: Annual Statistical Report on Higher Education in Jordan (2003/2004), Ministry of Higher Education & Scientific Research, 2005.

Assistant professors constitute the main body of the academic staff in Jordanian universities (39%), followed by associate professors (19%), and full professors (15%).

The fields of Agricultural sciences, Medicine and Social & Behavioural sciences have the highest percentage of full professors (29%, 23% and 20% respectively). The lowest percentage of full professors is in the fields of para-medics, Math & Computer sciences, and Business Administration (4,7%, 4,9% and 8,3%).

All ranks below associate professor can represent a substantially high percentage of the academic staff. This is the case of Para-medics (around 90% of the academic staff in the field), Computer Sciences (around 80%). This percentage, which can be taken as an indicator of the share of the youngest population among the academic staff, is in the middle levels in business administration, pharmacy, engineering, literature & religion, education sciences. It is the lowest in Agricultural sciences (44% of the academic staff is below associate professor), natural sciences (55%), medicine (57%) and social and behavioural sciences (53%).

Not surprisingly, the number of all sorts of employees practising or supporting research (in every sense of the word and including not only the education sector but research centres and all sorts of firms) is much higher:

R&D Personnel		Researchers	
FTE	Headcount	FTE	Headcount
	42153		15891

Source: UNESCO Institute for Statistics 2003

4. Financial resources devoted to research

The expenditure of the units on scientific and technological activities in Jordan is shown in Table 12. Total expenditures were around 500 million J.D, of which approximately 23 million J.D is allocated to research and development (4.6% of total expenditure on S&T).

Table 15: Expenditure of S&T Units in Jordan According to Type of S&T Activities (2003-2004)

Scientific & Technological Activities	Expenditure (Thousand J.D)	%
Basic Research (1)	883	0.2
Applied Research and Technological Development (2)	21995	4.4
Research and Development (1+2)	22878	4.6
Education and Training	105903	21.3
S&T Services	367829	74.1
Total	496660	100.0

Source: S & T Potential Study, Higher Council for Science and Technology, 2005.

4.1 Expenditure on Basic and Applied Research

Expenditure on R&D activities is around 23 million J.D, of which a mere 4% is spent on basic research, while most (96%) is allocated to applied research and technological development. It is the public administration & defence sector that is responsible for most expenses, largely ahead with almost 7, 3 thousands J.D. (32% of R&D expenses), followed by the manufacturing sector with 5,4 millions J.D (24%) and business services with 3.9 millions J.D. (17.3%)¹⁰. Education spends 3.3 millions J.D. and other social services account for more than 2.9 millions J.D. (about 12.8% of R&D expenditures).

¹⁰

Business sectors sums real estate, renting & business activities and financial activities.

Basic research is mainly executed by higher education institutions, mainly universities (92% of basic research). All other sectors (mainly business activities and manufacture) spend around (8%). Remarkably, public administration and other sectors do not declare any basic research.

On the other hand, 7.2 million J.D. is spent by institutions in public administration on applied research and technological development (33% of that type of expenses) The manufacturing sector represents 25% of applied research and technological development (while representing only 1% of basic research expenses), followed the business services activities (around 12% of applied research and technological development), and education (11%).

Table 16: Distribution of R&D Expenditure in Jordan According Major Economic Activity (2003-2004)

Total		Applied Research %	Basic Research %	Major Economic Activity of Institution
%	Value (Thousand JDs)			
23.7	5417	24.6	1.0	Manufacturing
5.6	1288	5.9	-	Financial Intermediation
11.6	2659	11.8	6.9	Real Estate ,Renting &Business Activities
31.8	7268	33.0	-	Public Adm, Defence &Compulsory Social Security
14.5	3325	11.4	92.1	Education
2.3	518	2.4	-	Health & Social Work
2.8	634	2.9	-	Other community, Social & Personal Service Activities
7.7	1769	8.0	-	Other Economic Activities
100.0	22878	21995	883	Total
	100.0	96.1	3.9	%

Source: S & T Potential Study, Higher Council for Science and Technology, 2005

4.2 R&D Expenditure of Private & Public Sectors

Expenditure on R & D (both basic and applied) according to major economic activity of private and public institutions is shown in Table 12.

Table 17: Distribution of Expenditure on R&D Activities in Jordan by Different Sectors According to Major Economic Activity (2003-2004) (Thousand JDs)

Total		Others		Private		Public		Major Economic Activity of Institution
%	Value	%	Value	%	Value	%	Value	
23.7	5417	19.9	261	62.0	5149	0.1	7	Manufacturing
5.6	1288	8.0	105	11.0	911	2.0	272	Financial Intermediation
11.6	2659	9.9	130	6.2	520	15.1	2009	Real Estate ,Renting &Business Activities
31.8	7268	-	-	-	-	54.8	7268	Public Adm, Defence &Compulsory Social Security
14.5	3325	2.4	31	12.5	1043	17.0	2251	Education
2.3	518	-	-	3.6	298	1.7	220	Health &Social Work
2.8	634	-	-	2.4	196	3.3	438	Other community, Social & Personal Service Activities
7.7	1769	59.8	783	2.3	191	6.0	795	Other Economic Activities
100.0	22878	100.0	1310	100.0	8308	100.0	13260	Total
	100.0		5.7		36.3		58.0	%

Source: S & T Potential Study, Higher Council for Science and Technology, 2005

The public sector has the highest percentage of expenditure (58%) as compared to around 36% by the private sector. Public administration, defence & compulsory social security are mainly responsible for expenses in the public sector (55%), followed by education (17%), and business services activities (around 17%). Within the private sector, manufacturing activities are responsible for most expenditures on R&D (62%), followed by private education (around 13%), and business services (17.2%). Institutions, other than public or private, have the highest expenditures on R&D in manufacturing activities (around 20%), followed by business service activities (approximately 18%).

4.3 R&D Budget (2006) of Universities

During the first quarter of 2006, HCST distributed a short questionnaire prepared for the purpose of this study, to universities, scientific centres, and some other relevant national institutions. The questionnaire covered 2006 R&D budget as a main section under which items such as salaries & wages, R&D projects, other projects (mainly construction projects), and laboratory equipment are included. In this chapter, although the budget allocated for R&D projects will be our main concern, other items (salaries, equipment, and facilities) are also shown. Table (15) reports these figures on budgets. Direct R&D budget (including R&D projects and laboratory equipment) of all universities totalled around forty million J.D., out of which 55% is allocated for R&D projects, and 45% for lab equipment.

Jordan University still spends the highest budget on R&D direct spending (more than 5 million J.D.) followed by JUST (nearly 2.8 millions J.D.) and the Hashemite University (2.6 millions J.D.). Six universities have declared spending in R&D between 1 to 2 million J.D.¹¹ and other universities ranged below half million J.D.

Table 18: Research and Development Budget Indicators of Universities for the Year (2006) (Thousand J.D)

University	Direct R&D Budget Indicators				Other R&D Budget Indicators	
	R&D projects	Lab. Equip.	Total	%	Salaries	Other Projects
Jordan University	5295	3838	9133	23.2	59158	9021
Yarmouk University	300	1733	2033	5.2	22782	-
Science & technology University	2780	3165	5945	15.1	29410	8165
Mu'tah University	1332	294	1626	4.1	27564	1855
Al-al Bayt University	2000	1000	3000	7.6	10000	
The Hashemite University	2640	2566	5206	13.2	10830	9854
Al Balqa Applied University	1262	1339	2601	6.6	23407	7563
Al-Hussein Bin Talal University	1921	-	1921	4.9	5105	6100
Amman Arab University for Graduated Studies	1000	50	1050	2.7	2195	-
Applied Science University	343	183	526	1.3	7244	-
Al-Isra University	153	254	407	1.0	6077	215
Jerash Private University	250	493	743	1.9	2941	175
Al-Zaytoonah University	574	72	646	1.6	8126	
Irbid National University	168	200	368	0.9	2481	1872

¹¹ Al-al Bayt University; Al-Hussein Bin Talal University; Mutah University; Tafila Technical University; Al Balqa Applied University; Amman Arab University for Graduated Studies.

Table 18 Continued

University	Direct R&D Budget Indicators				Other R&D Budget Indicators	
	R&D projects	Lab. Equip.	Total	%	Salaries	Other Projects
Zarka Private University	81	150	231	0.6	3398	-
University of Petra	260	176	436	1.1	4850	965
Princess Sumaya University	150	142	292	0.7	1696	654
Tafila Technical University	1295	1990	3285	8.3	2995	2020
Total	21804	17645	39449	100.0	230259	48459
%	55.3	44.7	100.0			

Source: Questionnaire conducted by HCST, 2006.

Total allocated salaries (year 2006) of all universities reached an amount of nearly 230 million J.D., where Jordan University constituted nearly one forth, followed by Jordan Science and Technology University, and Mu'tah University, and together almost formed the one fourth of the total salaries in Universities reporting here.

Other budget items covered mainly new construction projects such as colleges, laboratories, scientific and consultation centres, libraries ...etc. with a budget summing up to 49 million J.D. Detail in the table shows intense construction and supporting expenses activity in some universities with high budgets on this item.

4.4 R&D Budget (2006) of Scientific Research Centres

Research and development budget for the year 2006 of scientific centres in Jordan is shown in Table 14, gathered through a specific questionnaire that covered 2006 R&D budgets, including salaries & wages, R&D projects, other projects, and laboratory equipment as in table 13 above. Table 14 includes all centres either affiliated to HCST or not.

Table 19: Research and Development Budget Indicators of Scientific Centres (2006)
(Thousand J.D)

Other R&D Budget Indicators		Direct R&D Budget Indicators				Scientific Centre
Other Projects	Salaries	%	Total	Lab. equip.	R&D Projects	
1106	4437	59.9	2391	-	2391	Royal Scientific Society
-	370	2.9	115	6	109	National Centre for Human Resources Development
-	2071	4.5	180	68	112	National Centre for Agricultural Research and Technology Transfer
-	220	1.3	50	-	50	Jordan Badia Research and Development Centre
25	33	1.5	60	-	60	National Biotechnology Centre
-	324	1.9	77	43	34	National Energy Research Centre
-	45	1.0	40	-	40	Jordan Centre for Public Policy Research & Dialogue
-	204	27.0	1076	1000	76	Pharmaceutical Research Unit
1131	7704	100.0	3989	1117	2872	Total
			100.0	28.0	72.0	%

Source: Questionnaire conducted by HCST, 2006.

Direct R&D budget (including R&D projects and lab. equipment) of all scientific centres is around four million J.D, out of which (72%) is allocated to fund R&D projects , and (28%) for lab. equipment.

The Royal Scientific Society is by far the largest centre (60% of total direct R&D budget), followed by the Pharmaceutical Research Unit with a percentage of 27%.

Total allocated budget for salaries is around seven million J.D, out of which around (58%) is allocated by The Royal Scientific Society, and (27%) by the National Centre for Agricultural Research and Technology Transfer.

Only the RSS and the National Biotechnology Centre that was newly created report construction projects for more than one million J.D.

5. International cooperation in research

Jordan has signed international cooperation agreements either under the Ministry of Planning and International cooperation, or the Higher Council or the universities directly. The Ministry of Planning was established by law in 1984 as a substitute body for the national Council for Planning. Its mandate includes increasing the Gross Domestic Product growth rate; reducing the rate of poverty and unemployment; attaining development equilibrium among various districts and governorates; and developing efficiency and effectiveness in public sector performance.

Table 20 lists the international S&T agreements/MoUs/Programmes/projects that Jordan is engaged in through the Ministry of Planning and International Cooperation.

Table 20: International S&T Cooperation via the Ministry of Planning and International Cooperation (MoPIC)

Initiative	Foreign Party	Jordanian Counterpart	Starting Date	Duration	Areas of Cooperation	Budget
Trans-European Mobility Scheme for University Students (TEMPUS)	EU	Ministry of Higher Education (EMPUS National Office)	2003	5 Years	Higher Education	6 Million Euro
MoU on S&T Cooperation	Pakistan	HCST	2001	5 Years	S&T Fields across the board	NA
Agreement on Cultural and Technical Cooperation	Italy	MoPIC	1999	Open	Enhancing Education and S&T	NA
Agreement on S&T Cooperation	Croatia	MoPIC	2004	5 Years	S&T Fields across the board	NA
Agreement on S&T Cooperation	Congo	MoPIC	2002	5 Years	S&T Fields across the board	NA
Grant Agreement to establish IT Incubator in Jordan	USA	HCST	2006		IT and SMEs Development	256,000 \$US

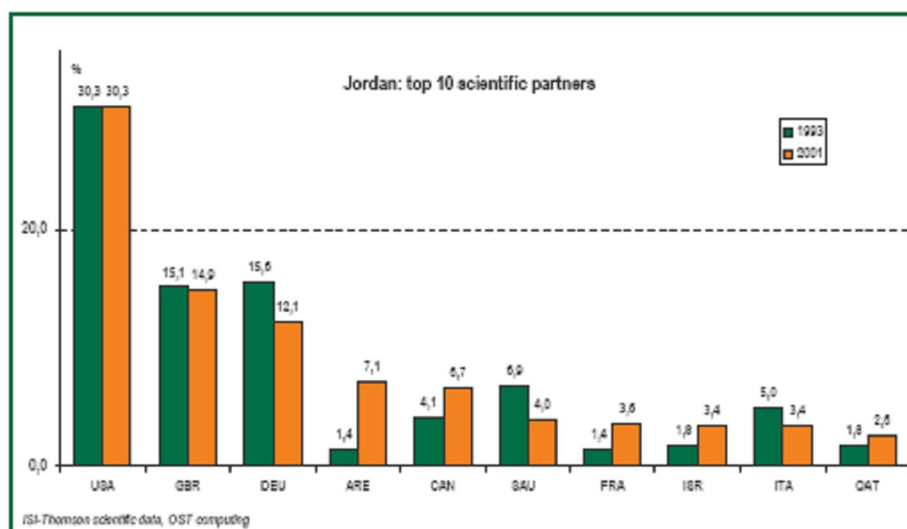
Source: Elshuraydeh K. & Mustafa I. (HCST: 2007)

The Higher Council for Science and Technology places great emphasis on the significance of S&T cooperation due to the beneficial impact that it has on the exchange of information and transfer of knowledge and technology. To this end the Higher Council is signatory to many cooperation agreements with Arab and international bodies. Many of these culminate in joint projects that assist

in the development of S&T capacities (see annex for a detailed list of the cooperation agreements of the Higher Council).

The cooperation programmes described in annex should be compared with the results on scientific partnership as shown by the bibliometric analyses. Even if numerous cooperation programmes are listed with the EU and very few with the USA, most of the joint-publications of Jordanian researchers are written with American researchers.

Figure 2: Evolution of scientific partnership for Jordan between 1993 and 2001



Source: Laville & Theves, OST 2007

The results show relatively little cooperation with Arab countries- a situation that the researchers underline even more as they have not recorded any regional cooperation (research that is of common concern for the neighbouring countries, especially with countries sharing some ecosystems). Researchers believe that it is due this to the political framework in the region and believe that the public institutions should determine and work out the policy for transboundary collaboration in this field.

6. Legislative framework

Science and technology has advanced to unprecedented limits in various areas like biotechnology, information and communication technology, and makes substantial contributions to economic growth. However, the impact of S&T on society has not been uniformly beneficial and the technological divide is being increasingly felt especially in the developing countries. Jordan is one of the developing countries that realized the pivotal role of science and technology in the advancement of the economy. Since its independence Jordan catered for employing science and technology to serve its economy and to improve the standards of livings of its people. To that end, consecutive governments have taken many initiatives and established special vehicles to fulfil that goal.

Jordan has been always been keen on exploring ways and means to link its scientific and technological efforts to the overall socio-economic development plans. Intensive efforts have been

made in developing the domestic Science and Technology (S&T) capabilities. Socio-economic development plans have aimed at integrating and upgrading the national scientific and technological capacity, along with improving the competitiveness of the services and commodity producing sectors.

Jordan's political will in strengthening S&T infrastructures and linking its activities with the national objectives of development was reflected in the laws, by-laws, regulations, and decision by the council of ministers pertaining S&T. Such legislations paved the way towards the establishment of a number of institutions entrusted with missions and goals in the different fields of S&T.

The National Charter, which was adopted in 1991, outlines general guidelines for constructive dialogue between the executive and legislative organs, as well as between decision-makers and political and intellectual elites concerning questions of authority, rights and responsibility. The National Charter, along with the Jordanian Constitution, provides a compass for the national debate on fundamental issues. The third part of the charter was titled: Science and Technology under which the following requisites for an effective contribution by science and technology were highlighted¹²:

A clear political decision and national will must exist to acquire, transfer, develop and utilise technology to meet the country's needs on the basis of careful planning which relies on indigenous institutions and on an advanced system of education. The scientific method must govern the people's way of thinking. It must be utilised for solving problems and enhancing the ability of Jordanian society to transform raw data into a system of knowledge which can be applied in various fields. National data banks must be established for this purpose. Special emphasis must be placed on the teaching of science and mathematics, with due attention to their application, at all levels and in all types of educational institutions. Society as a whole must acquire the culture of science and technology in order to be able to interact in an effective and rational manner with advanced technological processes.

A climate of academic freedom must be provided, together with the resources for advanced scientific research. Also, research must be geared towards meeting the developmental needs of Jordan in all areas. Arabic must be the medium of research and development activities as well as a vehicle for innovation and publication. Jordan's natural resources must be developed, whilst guarding against the negative effects of technology, preserving the ecological balance and protecting the living environment from pollution.

However, no specific strategy for research is available at the local universities institutions. The Higher Council for Science and Technology is attempting at establishing such a strategy, but at the individual level, the selection of research subject and objective usually starts by the identification of the problem followed by preparing a detailed proposal where the objectives, methodology, requested resources are defined. Depending on the scale of the project and the requested budget, the proposal is either submitted to the institution itself (usually to the Dean of Scientific Research) or to other funding agencies (i.e. UN agencies, US aid agencies, EU...).

¹² <http://www.kinghussein.gov.jo>

7. Scientific production

II.1. SCIENTIFIC PRODUCTION PER DISCIPLINE

Table 8: World share (fractional counting) of scientific publications of Jordan for 8 disciplines (1993, 1997, 2001 and evolution) ; comparison with Thailand, Chile and South Africa for 2001

Discipline	World shares (%) of scientific publications (fractional counts)					South Africa	Chile	Thailand
	Jordan							
	1993	1997	2001	Evolution 2001/1993 (%)	Evolution 2001/1997 (%)			
Fundamental biology	0.12	0.17	0.24	+ 97	+ 44	2.33	1.62	0.98
Medical research	0.23	0.35	0.42	+ 79	+ 19	3.83	1.63	1.43
Applied biology-ecology	0.34	0.44	0.65	+ 92	+ 48	10.41	3.30	1.94
Chemistry	0.36	0.37	0.45	+ 26	+ 22	2.39	1.84	0.99
Physics	0.28	0.34	0.29	+ 2	- 14	1.71	1.13	0.33
Astro and Geo- sciences	0.25	0.49	0.81	+ 219	+ 66	7.34	3.90	1.12
Engineering	0.60	0.79	1.20	+ 100	+ 53	2.96	1.16	1.32
Mathematics	0.47	0.45	0.44	- 6	- 1	3.77	2.33	0.35
Total	0.29	0.39	0.50	+ 72	29	3.80	1.82	1.12
Number of publications	176	268	355	+ 102	+ 32	2,711	1,296	800
ISI-Thomson scientific data, OST computing						OST - 2005		

Fractional counting: contribution to world science for each author in co-published contributions is fractioned in order to have a count of one for each article (or 100% on the whole group of authors of the contribution). This type of counting, called "fractional counting", where each article weights as a unit, permits to make counts of publications for a country or a discipline, since all totals add-up. It is thus well adapted to macro-analysis. Extended to impact measures (see further), this type of counting is preferable for international visibility comparison.

The following comments have to be taken with care, considering the total number of articles.

The number of scientific publications of Jordan has doubled from 1993 to 2001, and its world share, as well, almost doubled during the same period of time (table 8). The disciplines that have a higher world share are engineering (1.20 ‰) and astro and geo-sciences (0.81‰). The world share of the applied biology-ecology is also higher than the average national world share, with 0.65‰. Those three disciplines are the ones that have known an important positive evolution. The only exception is for mathematics, whose world share decreased during this period of time.

Table 9: World share (integer counts) of scientific publications of Jordan for 8 disciplines (1993, 1997, 2001 and evolution); comparison with Thailand, Chile and South Africa for 2001

Discipline	World shares (%) of scientific publications (integer counts)					South Africa	Chile	Thailand
	Jordan				Evolution 2001/1997 (%)			
	1993	1997	2001	Evolution 2001/1993 (%)				
Fundamental biology	0.15	0.23	0.34	+119	+46	3.54	2.21	1.91
Medical research	0.29	0.40	0.50	+71	+24	4.65	2.00	2.17
Applied biology-ecology	0.40	0.55	0.76	+92	+40	11.39	4.35	3.41
Chemistry	0.48	0.49	0.65	+35	+32	3.04	2.30	1.48
Physics	0.44	0.49	0.48	+9	0	2.59	1.70	0.54
Astro and Geo- sciences	0.41	0.65	1.01	+148	+56	10.22	7.56	1.99
Engineering	0.67	0.92	1.42	+112	+54	3.79	1.61	1.68
Mathematics	0.53	0.49	0.53	+19	+28	4.89	3.41	0.52
Total	0.35	0.47	0.82	+76	+32	4.84	2.58	1.65
Number of publications	215	329	445	+107	+35	3,451	1,841	1,185
ISI-Thomson scientific data, OST computing								

ISI-Thomson scientific data, OST computing

OST - 2005

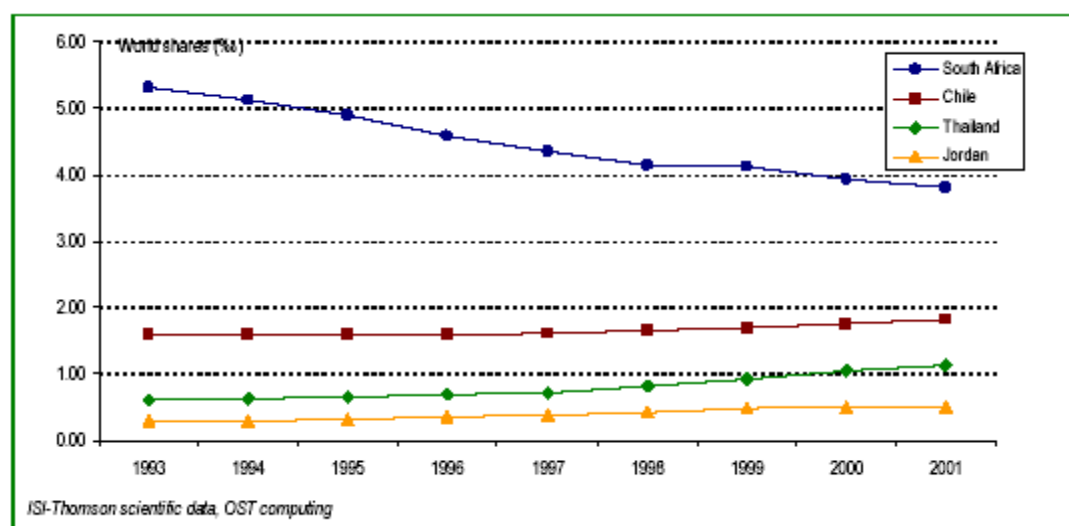
Integer count: participation in world science. Each actor is credited with a unit as long as he is present in a publication. The number of participation does not add-up, because of multiple counts. This kind of counting produces a sum of authors superior to 100% and the data vary with the scale changes. Despite this inconvenience, the integer count is well adapted to micro-analysis and is easier to comment for co-publications.

Source: Laville & Theves, OST 2007

When looking at the scientific publications with the integer count (Table 9), the same tendencies appear, both in terms of ranking and in terms of evolution.

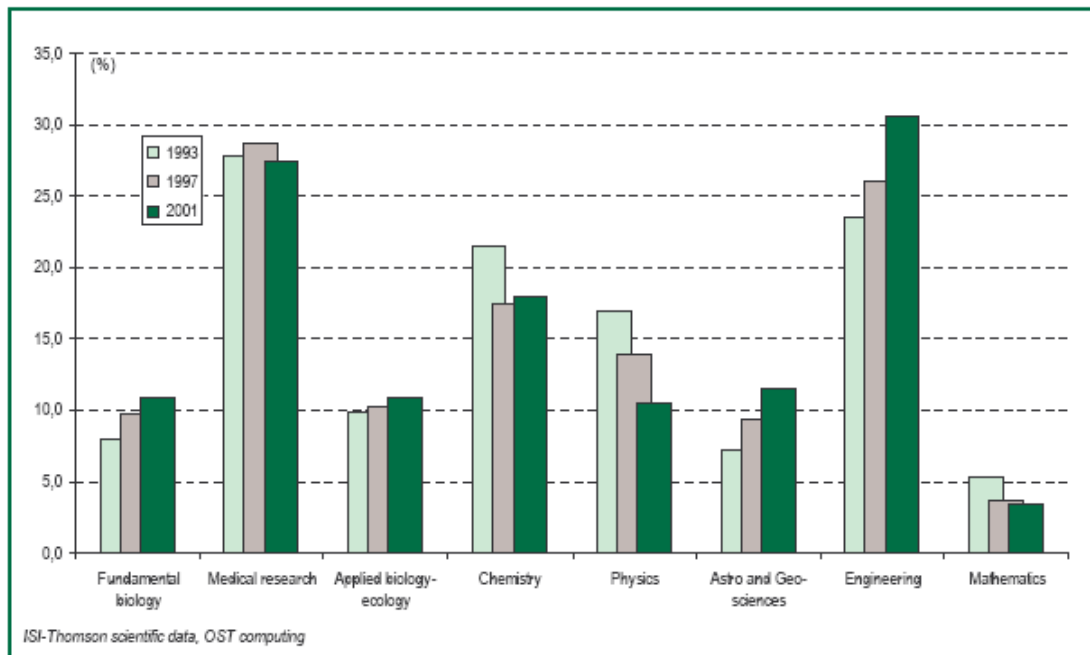
The evolution of the scientific publication of Jordan is steadily improving, during the period studied (Figure 6).

Figure 6: Evolution of world share in scientific publications from 1993 to 2001 of Jordan; comparison with Thailand, Chile and South Africa



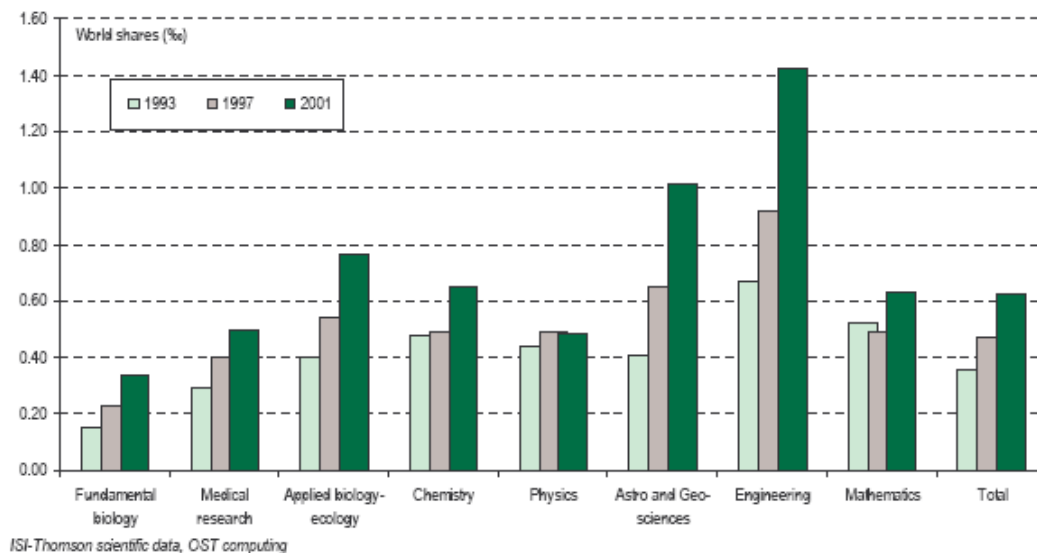
Source: Laville & Theves, OST 2007

Figure 7: Discipline share of scientific publications for Jordan (1993, 1997, 2001)



In terms of national discipline specificity, engineering, medical research and chemistry are the disciplines that give the more publications compared to the total number of Jordanian publications. Physics and mathematics are decreasing during that period, while the number of publications in engineering, already the most important at the national level, is growing (figure 7).

Figure 8: World shares of scientific publications for Jordan (1993, 1997, 2001)



Source: Laville & Theves, OST 2007

As seen previously, the world share of almost all the disciplines is growing strongly. This can be explained by either an involvement of more Jordanian scientists in the international scientific

community (hence, a growing presence in the international journals) and/or a more important scientific activity.

Table 10: Specialisation index for Jordan in 8 disciplines (1993, 1997, 2001); comparison with Thailand, Chile and South Africa for 2001.

Discipline	World specialisation index					South Africa	Chile	Thailand
	Jordan							
	1993	1997	2001	Evolution 2001/1993 (%)	Evolution 2001/1997 (%)			
Fundamental biology	0.43	0.44	0.49	+14	+12	0.61	0.89	0.88
Medical research	0.81	0.92	0.84	+4	-8	1.01	0.90	1.27
Applied biology-ecology	1.17	1.14	1.31	+12	+15	2.74	1.82	1.73
Chemistry	1.23	0.96	0.90	-27	-5	0.63	1.01	0.88
Physics	0.97	0.87	0.58	-40	-33	0.45	0.62	0.30
Astro and Geo- sciences	0.88	1.27	1.63	+85	+29	1.93	2.15	1.00
Engineering	2.08	2.04	2.42	+16	+19	0.78	0.64	1.17
Mathematics	1.63	1.16	0.89	-45	-23	0.99	1.28	0.31
Total	1.00	1.00	1.00	0	0	1.00	1.00	1.00

(ISI-Thomson scientific data, OST computing)

OST - 2001

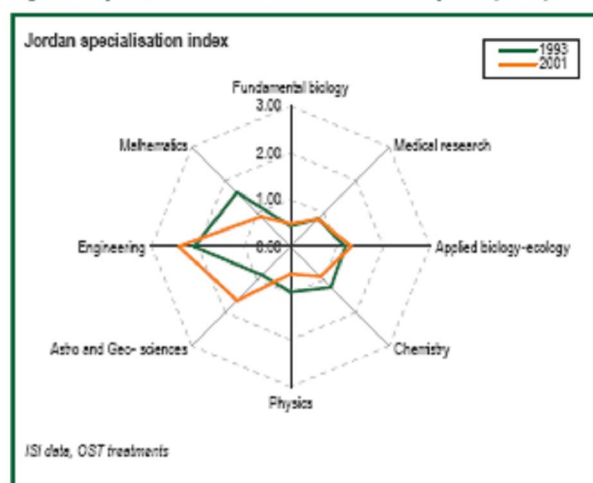
ISI-Thomson scientific data, OST computing

OST - 2005

The *specialisation index* is the ratio of the world share of publication in one discipline to the world share of all disciplines. The index varies below and above one. When this index is above one, it shows a specialisation in the discipline, or no specialisation if it is below one.

Source: Laville & Theves, OST 2007

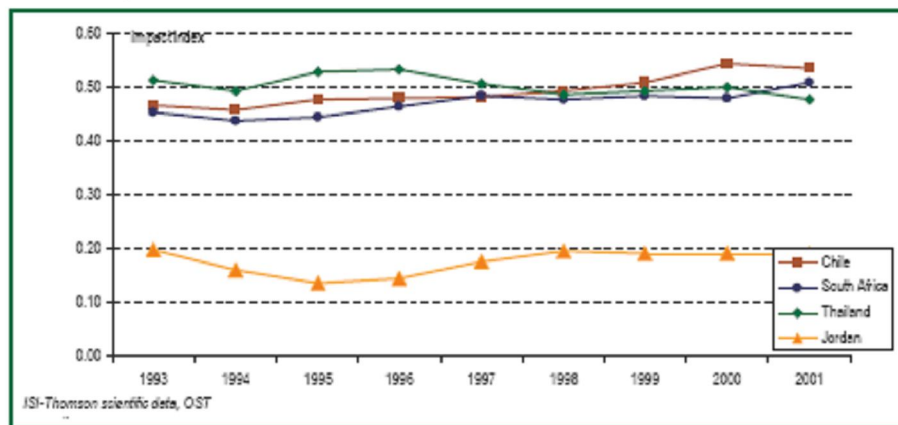
Figure 9: Specialisation index for Jordan in 8 disciplines (1993, 2001)



Source: Laville & Theves, OST 2007

The trends from 1993 to 2001 are a lesser importance of more fundamental disciplines (mathematics, physics and chemistry) for more applied disciplines (figure 9).

Figure 11: Evolution of impact index in scientific publications from 1993 to 2001 of Jordan; comparison with Thailand, Chile and South Africa



Source: Laville & Theves, OST 2007

The impact index of Jordan is stable. Again, when looking at the disciplines, it is the engineering part that has the higher impact index (0.48) while fundamental biology and astro- and geo-sciences have the lowest (respectively 0.16 and 0.17). Physics, even is decreasing (cf. discipline share and world share), has the second impact index of Jordan. From 1993 to 2001, the index is stable in time.

When looking at the world share of publication of Jordan by sub-disciplines, some interesting trends are evident. Even if engineering is, by discipline, the most important, general and internal medicine has a quite high world share (1.11%). As expected from the analysis by disciplines, plant science and agronomy (1.02‰), and as well mechanical engineering and fluid mechanics (1, 89‰) have world shares higher than 1. These three sub-disciplines have been increasing steadily from 1993 to 2001. The second group of important sub-disciplines (world share above 0,90‰) are medical chemistry and pharmacy (0,95‰) as well as chemical engineering and polymer science (0,91‰).

Table 14: Jordan specialisation index by important sub-disciplines (ordered by index value of 2001)

Sub-disciplines	Jordan: world specialisation index				
	1993	1997	2001	Evolution 2001/1993 (%)	Evolution 2001/1997 (%)
Mechanical engineering, fluid mechanics	3.04	3.08	3.81	+ 25	+ 23
General & internal medicine	0.87	1.75	2.23	+ 155	+ 27
Plant science, agronomy	1.70	1.57	2.05	+ 21	+ 31
Medical chemistry, pharmacy	2.52	1.99	1.90	-24	- 4
Chemical engineering, polymer science	1.97	1.70	1.83	- 7	+ 7
Dairy & animal science, animal pathology	0.76	1.85	1.61	+ 112	- 13
Ecology, environment	0.91	1.06	1.55	+ 69	+ 45
Geosciences	1.09	1.59	1.47	+ 35	- 8
Microbiology, virology, infectious diseases	1.25	0.97	1.25	0	+ 30
Epidemiology, public health	1.03	1.24	1.18	+ 14	- 5
Optics, electronics, signal processing	1.55	1.31	1.12	-28	- 14
Computer & information science	0.51	0.54	1.10	+ 116	+ 71
ISI-Thomson scientific data, OST computing				OST - 2005	

The sub-disciplines shown in this table are those with more than 10 publications and a specialisation index superior to 1,10 in 2001.

Table 15: Jordan specialisation index by important sub-disciplines (ordered by index value of 1993)

Sub-disciplines	Jordan: world specialisation index				
	1993	1997	2001	Evolution 2001/1993 (%)	Evolution 2001/1997 (%)
Mechanical engineering, fluid mechanics	3.04	3.08	3.81	+ 25	+ 23
Medical chemistry, pharmacy	2.52	1.99	1.90	- 24	- 4
Chemistry	1.54	0.86	0.99	- 35	+ 14
Applied physics	1.28	1.12	0.64	- 50	- 43
ISI-Thomson scientific data, OST computing				OST - 2005	

The sub-disciplines shown in this table are those with more than 10 publications and a specialisation index superior to 1,10 in 1993.

Source: Laville & Theves, OST 2007

The world specialisation index of Jordanian sub-disciplines reflects the national activity of publications. Most of the sub-disciplines that have a high specialisation index (table 14) are also sub-disciplines that have increased during the time period studied. The two main exceptions are medical chemistry and pharmacy (-24% from 1993 to 2001) and optics, electronics and signal processing (-28%).

Table 16: Jordan specialisation index (ordered by index value of 2001) and impact index

Sub-disciplines	Jordan (2001)	
	World specialisation index	Impact index
Mechanical engineering, fluid mechanics	3.81	0.44
General & internal medicine	2.23	0.12
Plant science, agronomy	2.06	0.31
Medical chemistry, pharmacy	1.90	0.23
Chemical engineering, polymer science	1.83	0.29
Dairy & animal science, animal pathology	1.61	0.25
Ecology, environment	1.55	0.33
Geosciences	1.47	0.15
Microbiology, virology, infectious diseases	1.26	0.12
Epidemiology, public health	1.18	0.41
Optics, electronics, signal processing	1.12	0.32
Computer & information science	1.10	0.48

ISI-Thomson scientific data, OST computing

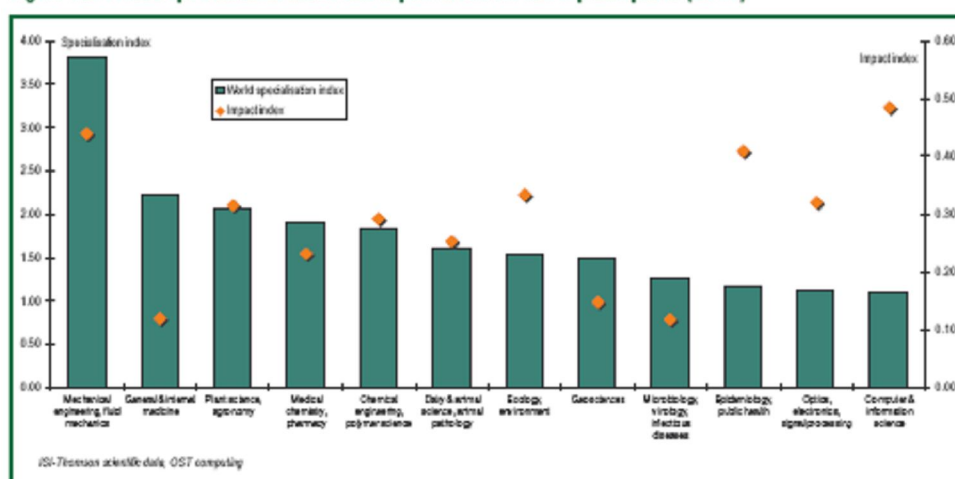
OST - 2005

The sub-disciplines shown in this table are those with more than 10 publications and a specialisation index superior to 1,10.

Source: Laville & Theves, OST 2007

The impact index of the sub-disciplines gives another focus on Jordanian publications. We see that computer and information science, with an index of 0.48, is the sub-discipline with the highest index, followed by mechanical engineering and fluid mechanics (0.44) and epidemiology and public health (0.41), three sub-disciplines that are quite distinct as such but also distinct in patterns of publications, their world share being quite different.

Figure 12: Jordan specialisation index and impact index for the top disciplines (2001)



The sub-disciplines shown in this table are those with more than 10 publications and a specialisation index superior to 1,10.

III.1. CO-PUBLICATIONS OF JORDAN ALL DISCIPLINES

Table 18: Share of international co-publications with Jordan top 10 scientific partners for 1993, 1997 and 2001, all disciplines.

The 10 first scientific partners of Jordan (all disciplines)					
1993		1997		2001	
Rank	Country	Pays	%	Pays	%
1	United-States	United-States	30,3	United-States	30,3
2	Germany	United-Kingdom	15,6	United-Kingdom	14,9
3	United-Kingdom	Germany	13,0	Germany	12,1
4	Egypt	Irak	6,4	United Arab Emirates	7,1
5	Saudi Arabia	Saudi Arabia	5,5	Canada	6,7
6	Italy	Egypt	5,2	Saudi Arabia	4,0
7	Canada	Canada	4,8	France	3,6
8	Kuwait	United Arab Emirates	ns	Israel	3,4
9	Australia	Australia	ns	Italy	3,4
10	Irak	Oman	ns	Qatar	ns
Copublication numbers		73	110	165	

ISI-Thomson scientific data, OST computing

OST - 2005

“ns” : not significant if the number of co-publication is lower than 5

Table 19: Comparison with the top 10 scientific partners of Thailand, Chile and South Africa for 2001

The 10 first scientific partners in 2001 of:					
South Africa		Chile		Thailand	
Rank	Country	Pays	%	Pays	%
1	United-States	United-States	35,8	United-States	33,8
2	United-Kingdom	France	14,7	Japan	22,1
3	Germany	Spain	14,2	United-Kingdom	14,7
4	Australia	Germany	13,6	Australia	8,9
5	France	United-Kingdom	9,2	Myanmar	4,3
6	Canada	Brazil	7,6	China	4,2
7	Netherlands	Argentina	6,9	France	4,2
8	Italy	Italy	5,1	Germany	4,1
9	Switzerland	Canada	4,9	Netherlands	3,6
10	Belgium	Mexico	3,8	Canada	3,5
Copublication numbers		1 316	920	658	

ISI-Thomson scientific data, OST computing

OST - 2005

Source: Laville & Theves, OST 2007

First of all Table 18 shows that the number of scientific co-publications of Jordan more than doubled from 1993 to 2001. The analysis of 10 first partners of Jordan in terms of scientific co-publications gives us quite a clear view on who are the prominent partners. The United States are by far and from 1993 to 2001 the first partner for a third of Jordan co-publications, followed from 1997 on by United Kingdom, which account for about 15% of the total. If Jordan is involved within Arab countries (Saudi Arabia, United Arab Emirates, etc.), it is decreasing. It is also noticeable that the no countries of the Mareq appear. The last comment is about the very discrete presence of European country. Except for UK and Germany, only France and Italy are among the 10 top partners and not very intensively. Canada is becoming a more important scientific partner and Israel appears as a partner in 2001, for about 3, 4% of the scientific co-publications of Jordan.

Engineering is the discipline which accounts for the most important number of co-publication, which is also the domain of specialisation of Jordan, followed by medical research and chemistry. If taken for each discipline, United States is usually the first scientific partner, except when it is the second

one, for Mathematics (first partner: United Arab Emirates), Medical research (first partner: United Kingdom) and Chemistry (first partner: Germany).

Interviews with researchers confirm the main role played by Germany in the sector of chemistry. Historically most researchers in chemistry have studied in Germany and remained in cooperation with the research laboratories there. They prefer to register their patents in Germany to be recognised worldwide, despite the financial cost. They do not trust the Royal Scientific Society Patents system and find it too local. As far as medication is concerned the interviews reveal that cooperation with the United States has increased.

If the last bibliometric results are compared with those from the Pascal data basis (Luigi Rossi Roland Waast IRD), we can observe almost the same orientation in disciplines. Indeed a specialisation in energy engineering and pharmacy appears. However the “Science des Technologies de l’information et de la communication” (STIC) is more prevalent than before, ranked at the first place. The institutional level of analysis confirms the main role played in research by three public universities: Jordan University, JUST and Yarmouk University.

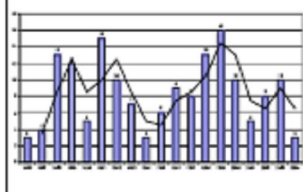
		JUST Univ		YARMOUK Univ		JORDAN Univ		Univ Private Miscel		R&D Ind		Centres Miscel			Total
A21 Hydro	9	13	7	5	4	11								23	43
A42 : Amélioration des plantes	12	21			2	8								13	29
A60 : Indus agro-alim	6	17			15	15								21	35
M32 : Pharmaco-Toxico	44	37	10	6	46	33	4	15	13	18	9	7		107	114
M51 : Maladies infectieuses	20	21	6	9	9	8								43	45
S10 : Math (divers)	10	12			6	9								24	33
S12 : Proba-Stat			5	16	7	13								17	35
S23 : Phys. : Méca, Thermo	33	32			18	14								53	53
S25 : État solide, struct, prop méca-therm	6	13	5	7	5	8								18	29
S26 : État solide, prop électro-magnét	9	24	17	34	18	33								57	91
S28 : Phys. : Théories & Méthodes	6	7			1	12								13	26
S31 : Chimie géné	18	35			7	13								30	54
S41 : STICs	36	45	8	24	13	11	4	6						86	117

		JUST Univ		YARMOUK Univ		JORDAN Univ		Univ Private Miscel		R&D Ind		Centres Miscel			Total
S42 : G. électrique	12	7	3	11										23	26
S43 : G. chimique	20	22			18	22								52	66
S44 : BTP, transports	52	25			4	13								67	52
S45 : G. métaux	10	10												13	22
S48 : Pollution	17	27	20	11	9	10								52	72
S49 : G. Energ	56	46			34	20								115	112
S53 : Géologie		19	13	7	7	5	8								33
tot	485	537	111	166	304	337	20	36	31	28	18	20		1062	36

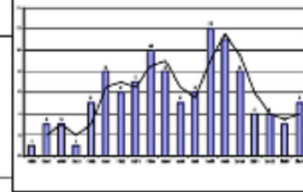
Institutional level

Detailed capabilities

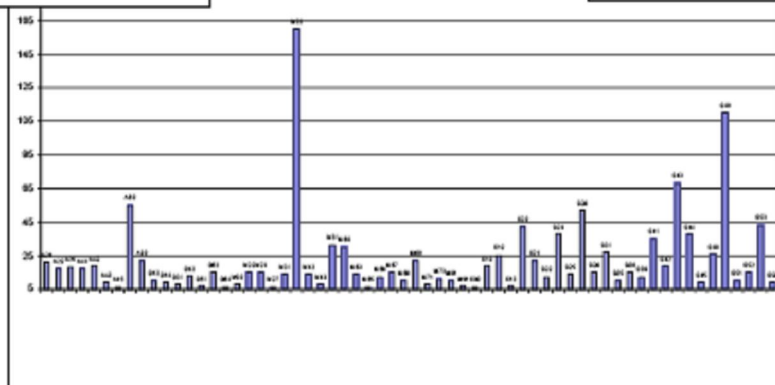
M32 : Pharmacology-Toxicology



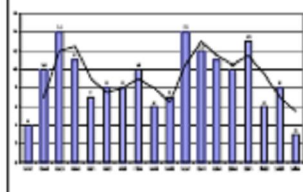
S49 : Energetic engineering



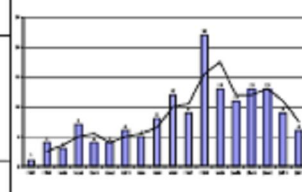
The University of Jordan - Amman
Source : Base Pascal, 1987 - 2004
1214 notices. Traitements : IRD



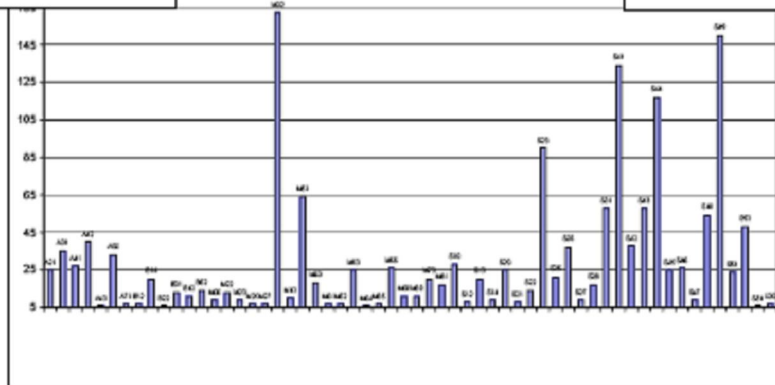
M32 : Pharmacology-Toxicology



S49 : Energetic engineering



Jordan University of Science and Technology - Irbid
Source : Base Pascal, 1987 - 2004
1632 notices. Traitements : IRD



Source: Rossi & Waast, 2007

Bibliometric results should always be interpreted with some caution given that numerous articles published in so-called "local reviews", in Arabic for example, are not registered, even if they are important for the Jordanian scientific community. Jordanian research is published at national, regional and international level. On a national scale, there are several local accredited journals that are issued by the universities and academic institutions in Jordan. Most of the research that is of

significant interest to the community is usually published in such local journals. And some researchers prefer to publish in these journals either to save the time usually needed to submit, review and modify the articles in international journals.

Nevertheless, it is interesting to note that Jordan's specialisation in energy engineering and chemistry/pharmacy corresponds to the state's main orientation as presented by the national agenda. According to the government as Jordan lacks natural resources but has qualified staff, its economy should aim at providing services to the Middle East and the Gulf countries. One of Jordan's main goals is to specialise in medical services and to develop state of the art clinics. Unlike the general trend in research in Jordan, the increase of publications on pharmacy is due to private universities and industrial research and not to the three main public universities. Regarding energy engineering, technologies are being developed to exploit low quality oil wells that are now economically viable. It also shows how Jordan's economy is oriented towards Gulf countries. Jordan exports engineers, researchers and professors there, where salaries are much higher.

8. The dynamic of research

After the institutional presentation of research in Jordan and the analysis of the bibliometric data, the focus will now be on the social aspect of research. The status of the profession of researcher has an impact in the way research is done. Concentrating on the researchers' vision of their activity, let us examine how they themselves identify issues and problems. A zoom on a few disciplines in hard sciences and social sciences allows us to obtain a more precise and detailed panorama of the activity.

8.1 *The profession of researcher*

According to the regulations of higher education in Jordan, a faculty member in a university is defined first as an instructor whose main job is to teach and whose work hours are teaching hours. Despite the above mentioned fact, regulations of universities stress the importance of scientific research. Job promotions in universities are entirely dependent upon research activity and record. In this respect, a clear gap could be noticed. While university laws define the faculty as an instructor and define her/his responsibilities in terms of teaching, s/he is not rewarded for quality of teaching and teaching history. Instead, these laws require some research accomplishments for the sake of promotion within the university academic ladder.

Table showing the number of credit hours that each staff member should teach per week:

Lecturer	15 credit hours
Full Lecturer	12 credit hours
Assistant Professor	12 credit hours
Associate Professor	12 credit hours
Full Professor	9 credit hours

Source: Al-Husban Abdelhakim (2007),

University instructors represent the backbone of the research activity. Given that there are no specialized independent institutes dedicated for scientific research or a special position with the Jordanian system of education and researching called a 'researcher,' scientific research has always

been a secondary activity in comparison with teaching. In Jordan, unlike the Western societies which have specialized research centres, universities constitute the main body that carry out scientific research, especially in the field of humanities.

Put it another way, one of the main shortcomings of scientific research in Jordan is that a university faculty is hired to teach but gets rewarded or punished based only on research activities as stated by regulations of higher education in Jordanian universities.

While some universities reward the one who carries out research by granting her/him a higher academic rank which entitles the person to receive a higher salary and a reduced teaching load and to occupy an administrative position inside the university, some universities punish those who do not carry out research activities by not granting her/him tenure. For instance, university laws state that a faculty professor with a PhD who does not get promoted from the rank of assistant professor into the rank of associate professor in ten years of service would be fired from the university. Yarmouk university regulations reward faculty member who conducts scientific research while punishing her/him for not doing so.

The academic ladder for the PhD academic staff in Jordan consist of three ranks. After obtaining the PhD from a recognized university, the PhD holder is nominated as an assistant professor. He has to spend five years in teaching and after publishing 5 articles in refereed journal whether Jordan or international he has the right to ask the deans council for the first promotion. After sending all these published articles to some evaluators mainly outside Jordan and if they are positively evaluated then the assistant professor can move to a higher rank which is associate professor. The associate professor has to spend 5 years in this rank and publish 7 articles in refereed journals before asking the deans council to nominate him as a full professor which is the highest academic rank in Jordan. Academic promotion leads to a considerable rise of salary. There is then no real incentives for researchers who have got the professorship, many of them switch to less momentum after this rank, so the professorship becomes the ultimate purpose and not the research itself.

Income of people involved in research work (most of the research in the country is carried out mainly at the universities) is relatively good, compared with those with other careers in both public and private sectors. However all public universities have (more or less) similar scale for salaries which mainly depends of the professional rank of the research staff (assistant professor/researcher, associate/professor). Research staff who works on large-scale projects and get involved in some admin work usually get paid for such extra efforts.

Table showing the rate of salaries in the public universities in Jordan

Lecturer	J.D. 600-700
Full Lecturer	J.D. 800-900
Assistant Professor	J.D. 900-1000
Associate Professor	J.D. 1100-1300
Full Professor	J.D. 1400-1600

Source: Al-Husban Abdelhakim (2007),

The average salary of some professions and public careers

<u>Career</u>	<u>Salary</u>
General Doctor working in the Ministry of Health	400 J.D
School Teacher in a public school	240 J.D
Army officer	400 J.D

Source: Al-Husban Abdelhakim (2007),

Salaries in private universities are higher than in public universities, so a migration of researchers from public universities and institutions into private ones, for financial issues, can be noticed. This has consequences on research because at the opposite of the salaries, public universities usually have better budget for scientific research than private ones. However, the researchers acknowledged that the public universities have noticed this issue and have reacted and modified the salary scale accordingly in order to retain their expertise.

Social factors play a big role in impeding scientific research or limiting its efficiency in Jordan. This role is manifested in the details of daily life that the researcher has to live with on one hand and in the position that scientific research and science occupy within the social structure on the other. It is also manifested in the nature of power network in the Jordanian society which in turn determines the position of the researcher and the power relations s/he is engaged with inside the society.

The position of the social researcher within the social power network and her/his ability to exercise power within this network is another result that unfolds from the above situation. In a society that believes in a metaphysical explanation rather than a positivist one for phenomena, social and economic power network is usually occupied by those who support and reinforce the metaphysical or fatal perspectives, i.e. religious people. Religious people enjoy a big share of the power pie and the ability to exercise this power while the researcher, especially in social sciences, becomes marginalized. The social power that the social researcher occupies is not based on the technical knowledge of social issues but through the possession of a certificate with a bureaucratic stamp and through occupying a position inside the university system which itself becomes controlled by bureaucracy.

Social traditions which stress the importance of receiving friends and relatives during times specified for research and the multiple irregular familial commitments prevent the researcher from concentrating on the research in hand and from spending continuous time to process the ethnographic data. In a society which stresses personal and kinship relations, most visits and practices of socialization are organized inside the university offices. Moreover, family and neighbours of the researcher regularly visit her/him in the office on campus to ask for some favours and services such as transferring a student from one major to another, obtaining a financial assistance for a student, or asking for an assistance in a course grade.

The social view that sees the university faculty as capable of exercising certain forms of social and political power encourages many people to seek different types of assistance from her/him to secure some services or settle problems with the state bureaucratic agencies. This includes helping a relative to find a job in the university or elsewhere and receive services from the administration.

The social definition of science, which limits science to the possession of a certificate, considers obtaining a PhD degree as the end of the process of reading and researching and impedes conducting a research. The degree is what gives the person a social status in the society and even in the university rather than the record of scientific research.

8.2 *Exact sciences*

Major and common development in the research field of the group interviewed was the wide use of modern technology and the web for communicating with international research centres, giving some classes online, reading and submitting articles etc., in addition to the increase of the joint researches with international research institutions. AS Ph.D. programs in scientific fields are recent in Jordanian universities, researchers do not see any significant role for PhD students/researches up to date. They attribute this mainly to the university system which imposes strict time limits on students to finish their work.

A major and common point was raised by all the interviewees regarding the old equipment at laboratories. This issue has impacted the quality of data they get in their experiments. They agree upon the fact that without external assistance the local institutions will not be capable to replace such equipments from their own budgets since they are very expensive.

The impact of the research work done by the group interviewed could be divided according to the type and the conditions of the research itself, for instance, research projects and activities funded by European countries and organizations have enhanced and strengthen Euro-Mediterranean Cooperation. On the technical part, some research that were conducted by the group interviewed have contributed to the economic development in Jordan (e.g. discovering new gypsum deposits in certain areas in Jordan by Prof. Salameh and Localized Geophysical surveys to detect large Voids; future Sinkholes in The Dead Sea area which had negative impact on the tourism and infrastructure).

Lack of financing is the most important restriction in universities and institutions in Jordan. Although financial support is a serious problem, some researchers cited other problems such as the shortage of professional technicians and research assistants trained on advanced and specialized scientific equipment.

Many of the researches are expensive and they do not directly produce goods and benefits for people, therefore people and the community often do not show appreciation of the issues which might frustrate the research groups. This lack of public awareness of the importance of scientific research and the absence of scientific groups who will provide the necessary cooperation and technical assistance to the researcher were also noticed during the survey.

University professors claim they do not have enough time to do their research, and the system itself does not allow the appointment of research staff. Professors in the universities should teach and do research at the same time, but because of the heavy teaching load, they cannot find enough time for research.

There is an additional problem regarding lack of cooperation among institutions in the same field to reach common objectives and solve problems.

There is a prevalent lack of knowledge in both private and governmental sectors about the importance of certain aspects (e.g. biotechnology adoption) and what is necessary to facilitate and expedite work in this field.

It is important to mention that according to the researchers the appropriate scientific atmosphere is often absent for research activities.

8.3 *Social sciences*

It could be easily noticed that there is more emphasis on research in the fields of natural and applied sciences than in the fields of humanities. At the same time, humanities occupy a low status in the priorities of universities and the government. This indifference to research in humanities can be attributed to two main factors. First, the state and its institutions have historically stressed the importance of natural, medical and engineering sciences and ignored, until recently, social and human sciences. To prove such a claim, one needs only to look at statistics of sending students on scholarships abroad by the government on one hand and the government expenses on research in natural sciences compared to low budgets for research in social and human sciences on the other hand.

The Higher council for Sciences and Technology has lately broadened the scope of its interest to include humanities and social sciences. However, such interest and role are limited to funding researches and projects only. The Council does not hire a qualified staff of social researchers to conduct researches for it.

Second, social imaginary and mentality in Jordan treat mathematics, physics, chemistry and medicine as difficult sciences that require a high level of intelligence, while social and human sciences are treated as easy ones. Therefore, a Jordanian social hierarchy in classifying sciences and fields of knowledge exists in which medicine, engineering are ranked first, and natural sciences such as physics, chemistry and biology come second, followed by economic and administrative sciences, while human sciences, especially social sciences such as anthropology, sociology, and archaeology occupy the lowest rank.

State's control over the spheres of jobs and employment in Jordan makes such social imaginary become clearer and more intensive. Until now, regardless of privatization and market economy policies, the state employs about 60% of the labour force in Jordan. The ministries of education and health receive the highest share of employment. However, the ministry of education still does not list graduates majoring in anthropology and archaeology among the candidates for its jobs. The school curriculum does not include material on archaeology, anthropology and philosophy as it heavily stresses pure and natural sciences.

8.4 *Anthropology*

Anthropological research is considered as one of the ancient scientific branches that have produced scientific and fieldwork research about the Jordanian society. The first academic department of anthropology in Jordan was established in Yarmouk University in 1984 with the primary purpose of conducting scientific research at the hands of a number of Western researchers from England, United States, Germany and Turkey who designed the course plan, taught courses, and supervised MA dissertations. The language of instruction was mainly English.

The department of anthropology at Yarmouk University is the only academic department concerned with fieldwork studies about Jordanian society. The department was founded for the purpose of conducting scientific research about the Jordanian society. It was originally limited to the graduate level with the graduation requirement of writing a dissertation on one of the anthropological phenomena in the Jordanian society. The department continues to be concerned with scientific research in addition to teaching until the year 2002 when a bachelor program was established. Therefore, teaching rather than scientific research became the primary concern of the department.

In addition to anthropological research conducted by instructors and students of the department of anthropology since the year 1984, a large part of the anthropological studies in Jordan has been conducted by some Western researchers from the United States, France, England and Scandinavian countries. Studies conducted by Western researchers are by far more than those conducted by Jordanian researchers.

Some of the anthropological studies on the Jordanian society are conducted by Jordanian researchers who study abroad in Western universities as a requirement for obtaining their higher degrees. They usually choose a topic of study related to the Jordanian society. This situation explains why Edward Said has called the researcher an 'informant' when he argues that the role of the Arab anthropologist who studies in a Western university and chooses a research topic related to her/his own society is one that helps the Western society itself.

Topics of the anthropological research have changed over time and varied according to the societies and institutes which the researchers belong to. Early studies concentrated on the topic of social and cultural change in light of modernization theories. During the eighties and the nineties of the last century some studies focused on the relationship between the state and the tribe in Jordan. Another topic that was of a major concern for anthropologists was the status and living conditions of the Palestinian refugees in Jordan. Some studies focused also on the peasant economy while others focused on women and family in terms of roles and statuses. Lately, research interest has switched to focus on topics such as identity, gender, oral history, Palestinian immigrants, women's rights, child labour, political development, city formation in Jordan its relationship with citizenship, and studies of poverty and discourse.

Another aspect of change has included analytical frameworks and approaches employed in these studies especially those conducted by Western researchers in Jordan. Studies conducted in the 1960s, 1970s, and 1980s of the twentieth century employed the Marxist and functionalist approaches whereas recent anthropological studies tend to adopt theories of postmodernism, especially the theoretical frameworks developed by Michel Foucault and Pierre Bourdieu.

8.5 *Archaeology*

Jordan is a very rich country concerning archaeological sites. Many studies showed that Jordan contains more than 100,000 archaeological sites covering a long history of human occupation, extending from the Palaeolithic to the Ottoman period. Many of these sites are threatened by the modern urban development of the country. Some of them have already been removed either partially or completely. Jordan needs an intensive and well organized plan to study and protect these archaeological sites.

There are many institutes that conduct scientific research in the field of archaeology in Jordan. These institutes are either governmental, semi governmental, foreign research centres based in Amman, or teams of seasonal Western or Japanese researchers who come to Jordan either through joint programs with public Jordanian universities or with the Jordanian Department of Antiquities. Department of Antiquities was established in the beginning of the 1950s to organize all activities related to the archaeological practice in Jordan such as supervising archaeological excavations, issuing legislations for archaeological excavations, and protecting and managing archaeological sites and findings. Jordanian universities and Western research centres based in Amman play a crucial role in conducting excavations and managing archaeological discoveries in Jordan.

The first departments of archaeology were created during the end of the seventies and during the eighties of the 20th century. There are four governmental universities that teach archaeology and conduct regular archaeological excavations in different parts of Jordan. These universities are: Jordan University in Amman, Yarmouk University in Irbid, the Hashemite University in al-Zarqa, and Mu'tah University in al-Karak. In addition to conducting excavations, these universities graduate students majoring in archaeology on both graduate and undergraduate levels. Some universities are currently in the process of recruiting a qualified cadre to start a Ph.D. program in archaeology.

Unlike the teaching staff in the department of sociology, the teaching staffs in the different departments of archaeology in Jordan are graduated from western countries like the United States, Germany and France. The western interest in the archaeology of Jordan encourages the creation of many western research centres in Jordan in the field of archaeology like the German Protestant Institute, the French IFAPO and the American Acor. Furthermore part of the western interest in the archaeology of Jordan was to provide young educated Jordanian with scholarships and grants to study archaeology in the western countries. Germany and France were the most active countries in according grants and scholarships for the Jordanians to obtain the PhD degree in the field of archaeology.

Local Jordanian archaeologists are not that many in general. They work mostly in governmental institutions distributed either at one of the governmental Universities or at the Department of Antiquity. The one who is getting a position at the University consider himself the luckiest because of the salary and the quality of the job comparing to the one who is working at the Department of Antiquity. At the same time the Department of Antiquity has the complete responsibility to protect

and preserve the majority of the archaeological sites in the entire country. Further it is the only institution that has the power to give the field work permission to the different archaeological expeditions who are willing to work in Jordan.

This is also the case of the archaeologists at the Universities who have to apply to get permission from the Department. This point is very important and sensitive since the chances for getting permission is not equal for all archaeologists. The criteria of obtaining the permission is not always clear. Generally speaking there are some important points which must be taken into consideration by each archaeologist before applying to get the permission. First the personal relation with the people in charge at the department is very important. The second difficulty the archaeologists face in Jordan is the financial fund. The Jordanian can only work in an expedition and the biggest difficulty that Jordanian archaeologist is facing when they plan to do field archaeology is raising fund for their projects. It is almost impossible to obtain financial support from the private sector in Jordan. The only source of support can be obtained either through the University itself where the archaeologist is working or from the Department of Antiquity this for the one who is working at the Department.

For this main reason and many other purposes there are some local archaeologists who prefer to do joint projects with foreigner researchers. Westerner archaeologists have better chances of raising, sometime, big fund for their projects overseas. This enables of course the archaeologists to use the multidisciplinary research system in their projects (which mean a much better research quality).

Other purpose of having local archaeologists do archaeology jointly with westerners is that westerners can represent for Jordanians the source of the updated information related to the project such as using the different needed laps to analyze the floral and faunal remains or doing some methods of the chronometric dating. Other important reason also is that westerners provide the project with expensive high technology instruments such as remote sensing technology. There is also an important reason which is that working with westerner team help getting the project more internationally popular and accepted. Westerners look to a project done by westerners more respectfully than just local. Finally the expenses of the publication which is the most important point will be mostly covered by the westerners.

These are the benefits of the local archaeologists when they do their projects jointly with the westerners but what are the benefits that foreigners gain from such joint work? First a financial reason: westerners have to pay 20% of their total budget of the project to the Department of Antiquity but if they do it jointly with any Jordanian institutions they will not have to pay for it. Second logistically: local team provides usually the expedition house, transportation, tools, storage places for tools and artefacts, workers and access to some of the decision makers and governmental institutions.

Exchanging the benefits of each team and the importance of their contribution in the project reflect the nature of the relationship between the co-directors and the staff of both teams. It is clear that the contribution of the westerner team will be fundamental while the local one is secondary. From this point of view the relation between both teams, the westerner and local, is unequal. Although the relation between the two teams seems equal on paper in the reality the westerner team is the one who is in charge of most issues of the project. In some cases this affects the relation between both teams negatively especially if the local team rejects this fact.

Archaeologists face different kinds of difficulties when they do their research at the University. Research in archaeology in general is different than other sciences since archaeology depend mostly on the field work. This work needs a lot of time for example some of the excavations take 3 months for each field work season. Sometimes University doesn't give this time to the researches because of the teaching or administrative duty. Other problem is that the students who are willing to attend such excavation have to take a semester off otherwise they can't participate in the project. After finishing the field work, archaeologists need even more free time to study and analysis the results of the excavations.

Archaeological research in Jordan does not cover all archaeological periods equally. The early historical periods (Bronze and Iron Ages) and the classical era (Hellenistic, Roman, and Byzantine periods) are the most covered periods by the archaeological research while the Stone Ages received less interest and the Islamic Ages are the less studied periods among the archaeologists. The reasons behind these differences of the interest among the archaeologists can be referred to both ideological and financial reasons. The early historical periods include all the events of the Bible. Since Jordan is part of the Holy land scholars easily find financial support for their projects in Jordan. In the case of the classical periods the archaeological sites usually contain an attractive monumental building (Theatres, Temples, Churches, Palaces etc.) which helps to find source of funding. At the same time classical civilizations have historical roots with the West.

The interrelationship between archaeology and tourism, especially Western tourism, has placed much emphasis on the Greek-Roman heritage rather than the prehistoric ages or the Islamic periods that followed the classical Greek, Roman and Byzantine periods. Historically, tourism in Jordan has been associated with waves of tourists coming from European and American countries to visit certain archaeological sites in Jordan that have special cultural and religious values. This explains why there was emphasis on the classical era, especially the Roman period. A large share of the funding goes to these classical archaeological sites because investment in them will eventually lead to a better output in the sector of tourism.

In general, the Ottoman era has been neglected to the extent that knowledge and scientific research on the Roman and Greek era exceeds by far those on the Ottoman era even though the latter is closer in terms of time, religion and culture to the Jordanian society. The conflict between the Jordanian Hashemite regime, which allied with the British forces during WW1, and the Ottoman Sultan, who sought to maintain the land of the Ottoman Empire under his control, contributed to make the scientific research on the Ottoman heritage and legacy undesirable in Jordan.

"Another problem facing the scientific research in archaeology in Jordan is something that has to do with the dominance of description over analysis in the archaeological researches" states Dr. Lamia El Khoury from the department of Archaeology in Yarmouk University. In other words, most of the researches conducted by Jordanian archaeologists limit themselves to describing the archaeological site in which the excavation is done and the found pieces and materials. Most studies do not go beyond this descriptive level which produces only preliminary descriptive material. Thus, the lack of analysis defeats the ultimate goal of reconstructing the historical and cultural scene of the people who left us the site.

"The method adopted by the Jordanian archaeologists compared to that adopted by their Western or Japanese counterparts has been constantly critiqued. By applying the so called 'multidisciplinary

approach,' Westerners usually work in teams which include specialists in archaeology, botany, zoology, geology, medical science, anthropology and geography" as stating Dr.Zeidan Kafafi from the Department of Archaeology in Yarmouk University. This enables the team members to employ analytical frameworks provided by all these sciences rather than the frameworks provided by the archaeologist alone.

During the last few years many attempts have been made to develop teaching and research in the field of archaeology in Jordan by establishing a Ph.D. program in the field of Archaeology. Two universities (Yarmouk and Jordan universities) are competing to launch this program. The creation of such a program needs the approval of the High Education Council which imposes strict conditions in terms of the number of teaching staff, their academic ranks, and the availability of technical equipments to accord its approval for launching such a program.

Till today the attempts of the two universities did not succeed. The approval of the High Education council has not yet been obtained. It seems that the strong competition between the two universities to launch this program is slowing down the process of creating such a program. Meanwhile since few years Yarmouk University is making continuous efforts to launch a sandwich Ph.D. program in collaboration with the University of Versailles in France and of Leiden in Holland.

8.6 *Sociology*

Teaching sociology and conducting scientific research in this field are limited to three governmental universities out of 30 governmental and private universities in Jordan. None of the private universities in Jordan teach sociology. The three public universities which have academic departments of sociology are Jordan University in Amman since the end of the seventies of the 20th century, Yarmouk University in Irbid and Mu'tah University in al-Karak since the eighties of the 20th century.

Sociology is more known and recognized by the Jordanian administration than anthropology. This fact can be explained by some historical reasons such as the fact that many Jordanian PhD students have graduated from the neighbouring Arab countries like Syria, Egypt and Iraq which had established Sociology departments in the 1950s and 1960s.

During the last years many field projects have been conducted by Jordanian and foreign organisms like the General Department of Statistics, the Noor Al Hussein Foundation, the UNICEF and others. Most of the researchers involved in these projects are qualified in sociology rather than in anthropology. One of the reasons for this situation can be reduced to the quantitative approach who is dominating the social analysis of the Jordanian society. Qualitative methodological tools like interviews, focus groups, biography, ethnographic activity and participant observation seem to be poorly known and recognized by the Jordanian academic corpus and administration.

Research interests for faculty members in Jordanian universities have changed over the last two decades. The early interest focused more on topics such as social statuses in the Arab world in general and in Jordan in particular and on studying tribal societies and Jordanian family and patriarchy. However, sociologists' research interests have changed in the last 10 years or so to focus on topics such as: the role of nongovernmental organizations and charity organizations, and issues of

development and women's political and economic participation in the society. Some researchers focus on issues related to refugees, women's rights and political development.

It should be noted that most sociological researches are compatible with the agendas set by the successive Jordanian governments. Sociologists' choice of research topics in general is based on classical issues in Western sociology or Urban sociology. This in itself reflects a pattern of social issues that industrial societies or societies with big urban centre such as Cairo and New Delhi face. The choice of the research topics that are not clearly related to the Jordanian society can be attributed to the fact that most Jordanian sociologists, who have studied Western sociology that deals originally with Western industrial societies, have not only borrowed concepts, theoretical and analytical perspectives from this Western science but have also borrowed the problems that the Western sociology has historically examined and dealt with.

Most researchers still use the structural-functional model which goes back to the beginning of the twentieth century. Thus, they do not have enough knowledge and familiarity with the more recent theories that have emerged in Europe since the fifties of the twentieth century such as structuralism, deconstructionism, constructionism, and postmodernism. Such theoretical weakness can be explained by the fact that most researchers have completed their higher education in Arab countries such as Egypt, Iraq and Syria which do not place much emphasis on foreign languages. Therefore, literature references that students depend on are mainly in Arabic, translated principally from English or French. It should be noted here that translation in the Arab World is still weak and takes a long time. This implies that a Jordanian sociologist who does not speak English or French has to wait for a long time to read a recent book published in French or English.

8.7 Law

Like the other 3 disciplines, scientific research in Law is always conducted by the staff members in the universities. But contrary to the other 3 disciplines that are only taught in public universities, Law is taught in both public and some private universities. This is due to the fact that those who graduated with a diploma in Law can find job both in the public and private sectors. Law is one of the social sciences disciplines that are widely demanded contrary to the weak demand of archaeologists, anthropologists and sociologists.

The first faculty of Law was created in Jordan University during the late seventies of 20th century. Before that period Jordanians used to leave to Syria, Iraq and Egypt to study law. As such thousands of Jordanians has been formed in law in these countries. Law is currently taught in more than 7 Jordanian universities. Four of these universities are public while the others are private. The 4 public universities are: Jordan University in Amman, Yarmouk University in Irbid, Mu'tah University in Kerak in southern Jordan and Al El Beit University in the eastern part of Jordan. The other universities are private like the University of Jerash, Philadelphia and Irbid National University.

In addition to faculties of law in the different Jordanian universities there are many faculties of Islamic Shari'a. There are many differences between the two disciplines as they are taught in the Jordan universities. Faculties of Shari'a are mainly interested in teaching the different Islamic sciences concerning Koran and the Hadith (sayings of prophet Mohammad). They are concentrating on philology and the lexical study to interpret the contents of Koran and Mohammad's sayings. The term Ulum al quran Quranic sciences is mainly used to describe this discipline. The faculties of

Shari'a are also interested in teaching the Islamic laws as they are understood it in the Koran and the sayings of Mohammad.

Given the fact that since few decades the Jordanian government decided to apply the Islamic law on the family affair (inheritance, marriage and divorce) one of the task of Shari'a faculties is to teach the different articles on family as they are mentioned in the Koran.

On the other hand faculties of law are concentrating on teaching the western juridical frameworks mainly the French and the British juridical codes. Given the fact that all laws and regulations in Jordan except the family laws are derived from the French and British juridical systems, the main task of the faculties of law in Jordan is to teach the western juridical system concerning the public and the private law except the family law which is derived from the Islamic Shari'a since few decades.

Like the other three social sciences, scientific research in Law is mainly achieved through university staffs in Jordanian universities. There are no specialized research centres that are completely dedicated to research. Research in Law can be always considered as a secondary activity since teaching is the main activity that universities staffs are assuming.

9. Problems and Impediments

9.1 Funding

There are two main sources of funding for researchers, national and international. The first one is through an allocation of the university, which is usually low. Researchers however often criticize more the complexity of the procedure to obtain this low budget than the amount itself. From the academics' perspective, bureaucratic procedures in Jordan are often unclear and very rigid. Moreover, they are personalized rather than institutionalized. The proposed research needs to go through certain administrative procedures including the approval of the academic department committee, the faculty committee to be followed by the approval of the dean of the scientific research and the scientific research committee in the university. While conducting the research, the researcher has to contact the deanship of scientific research to cover any expenses such as costs of transportation and other miscellaneous items. These procedures do not proceed in accordance with fixed institutionalized rules that can be applied in a smooth and fast manner. Instead, they are usually personalized. If the researcher has good connections with a high ranked official in the university, the procedures unfold in a smooth, fast and guaranteed way. Apart from the question of the administrative procedures, there are also direct interventions of the state apparatus into the careers of the researchers.

Concerning the agenda of research, most researchers declare that they choose themselves their subjects of research, especially in exact sciences. However in social sciences there is a close relationship between the research subjects chosen by Jordanian researchers during a certain period and the political agenda set for that period. Besides avoiding studying certain issues that could displease the political regime, a large number of researchers study topics that are compatible with the issues stressed in the royal discourse whose priorities have changed over time. Yet, when the regime took several initiatives during the last 5 years to prioritize the Jordanian interests and to stress the Jordanian identity over any pan-Islamic or pan-Arab identities through raising slogans such

as “Jordan First” and “All of us for Jordan,” tens of committees, workshops and conferences were formed and organized under the same name, in addition to several publications.

9.2 *Research agenda*

Since September 11th in the United States and after the American campaign against what has been called “Extremist Islam,” the Jordanian regime took the responsibility of exporting a friendly version of Islam to the West through the initiative of “Amman Message.” Many researchers, journalists and university teachers have published several articles and have organized many conferences and workshops to market the ideas and principles included in “Amman Message”.

The main source of funding for Jordanian researchers is the international one and bidding by donors, NGO's and international institutions. They consequently adopt the vocabulary and the priorities of these organizations so that they get a chance to be financed. Most of the research currently conducted in Jordan is determined by agendas set by foreign research centres and Western governmental and nongovernmental organizations. Some of the research conducted in Jordan include: women's rights, political Islam, political violence, child labour, identity problems in the Arab World, democracy, political participation, and freedom of the press.

In addition to avoiding certain political subjects, studying religious issues from the perspective of humanities and social sciences represent major obstacles for scientific research. Some researchers have expressed their reluctance to examine certain issues related to Islamic history or other religious issues using the analytical framework of the social sciences and humanities. They mainly fear of being accused of religious provocation or being threatened by some religious groups.

9.3 *Publication and Research Evaluation Impediments*

Scientific research and researchers in Jordan also face impediments related to the publication and the evaluation of scientific research and the difficulty in finding valuable, recent references in the areas of specialty. Researchers seem to agree that journals and periodicals, which have to be referred, take a very long time to publish a research. System of promotion in the Jordanian universities states that a faculty needs to publish five researches in referred journals and to spend five years of teaching before s/he can get promoted from the rank of assistant professor to the rank of associate professor. At the same time, the person needs to publish seven researches in referred journals to be promoted to the rank of professorship.

On average, publishing research can take about two years from the date of submitting, even longer in some cases. The journal administration justifies such delay by arguing that referees take a long time to read and evaluate the research. The large quantity of researches and the limited number of journals with few yearly issues make the process of research publication a very complicated one. The long time gap between writing and publishing the research may cause the research lose its sense of newness and originality.

Most researchers are not satisfied with the way their researches, especially those that are sent to referred, scientific journals in the Jordanian universities, are evaluated. Some claim that their research were evaluated negatively because evaluators were able to recognize in one way or another the name of the researcher. The number of researchers who work in the same field is

usually low and thus researchers are familiar with the topics their colleagues are interested in. Thus, though the journal sends the research to the evaluator without any reference to the name of the researcher, evaluators can recognize the researcher. This makes the evaluation process concentrate not on the written material in the research but rather on the history and personality of the researcher.

Reforming the educational institutions including the scientific research organizations is confronted to a real challenge. Some of the obstacles are bureaucratic and may boil down to the excessive role of state apparatus. The ownership of universities in Jordan is mixed. Some universities are public and they are partly financed by the public treasury while other universities are totally privately financed. The owners of the private universities often occupy high position in the Jordanian state apparatus. Therefore they wield influence on proposed policies for reforming the academic institution. Other obstacles are structural since they are related to the structure of the academic institutions and the scientific research institutions themselves.

10. Conclusion

Throughout the three main parts of the report: the institutional presentation, the bibliometric analysis and the focus on the disciplines themselves and the vision of the researchers, a somewhat contradictory picture of the state of research in Jordan has emerged. Jordan has set up high status institutions whose role is to pilot and sometimes finance research in Jordan. All the governmental documents and agenda insist on the importance and value of applied research and innovation for the country. Jordan is still very marginal when compared to the international level in general. Apart from its research capacity, its demographic size does not allow it to really compete anyway. However at the bibliometric level, a general growth can be observed, especially in its disciplines of specialization: computer and information science, pharmacy/ chemistry, and energy engineering.

The researchers themselves nevertheless will not confirm the central place given to research. According to them, in the public universities, they are in a contradictory position as they are evaluated on their publications but unable to really spend time on their research because of their time consuming teaching duties. They also find the administrative procedures very unwieldy and opaque -they slow down the initiatives and according to the researchers the system works with private connections and retributions, if not a tribal network, rendering the system unfair. Secondly the budget dedicated to research by the universities is low, especially for social sciences, and almost inexistent in most of the private universities. The higher salaries in private universities and in Gulf countries is a high incitation for the professors to quit the public universities even if they are more prestigious, have a more substantial budget for research, and if their salaries are generally good compared to the average salaries in the country.

There is a general trend to highly valorised applied research and links with the enterprises. It is not only an incitation given at the state level but also part of the researchers' discourse. They wish to see their research having immediate applications, and concerning social sciences in close connection with the social agenda. But one of the paradoxical consequences of the low budget for research is a concentration on pure research. It is considered as less expensive, even if no financial remuneration of the research is to be expected, because the first investments are lower than for applied research. The lack of means also has consequences on their capacity to keep informed on the latest international developments of research in their disciplines, to obtain the last publications,

which then have an impact on their own capacity to publish articles which will be of interest outside Jordan.

Concerning the agenda for research, a connection can be observed between the state priorities and the subjects of research. At the same time researchers consider that they freely choose their research subjects, especially in exact sciences. Some of them have even been asking for more state coordination and cooperation with other countries. The situation is a bit different in social sciences which are more politically sensitive. This connection may be indirect through financial support for certain themes. Researchers themselves, especially in social sciences may be incited to choose thematics that have been put forward by the government to have better chance of being funded and acknowledged.

The influence of international organizations in Jordan is high. It is part of Jordan policy to search for international development funding, which is also one of the role of the royal NGOs. Jordanian institutions try to develop the statistical tools required by such institutions and to respond to their criteria. This also has consequences on research and the research agenda, not only indirectly because the priorities of the government will often be linked to those of these organizations, but also directly because researchers apply to get fund by these donors and therefore elaborate research projects whose thematics, objectives and vocabulary correspond to their expectations. In social sciences, a lot of small research centres have developed, whose objective is to act as consultant for these organizations. This has consequences on the agenda and the tools used in research, but it is also a trend where Jordanian researchers have become more or less "informant" on their country, producing numerous, often unpublished reports, destined to the organizations. As a consequences of these factors, they are not then in the position to be considered as real analyst, who could exchange views internationally with their colleagues in their discipline.

\The Jordanian state is administratively very present, but financially marginal in research. The marked influence of international organizations, which bring budget and agenda, has direct consequences. The international influence does not orientate research in Jordan towards a better cooperation with foreign research centres or a better integration on the international scene. On the contrary, it has a tendency to transform researchers into informants, well paid but without impact on subjects, theoretical tools and analytical grids. A similar trend has also been observed in other countries from the South.

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