

ABSTRACT.

Scientific and Technological Information in the Arab world needs huge new means for education and training ; in a word a policy.

Indeed ; the situation cannot remain as it is. There must be a change.

Science and Technology information in the Arab World.

The current state of scientific and technological activities in the Arab world suggests that : a) the problems facing Arab countries as regard scientific and technological activities are similar to those facing most Less Developed Countries, and b) that awareness of the impact scientific and technological information upon the socio-economic development and progress is negligible (1).

Regarding the historical background, policy, plans, and development programmes in most Arab countries one would expect a relatively high scientific and technological activity. But the results of the present study show an opposite situation to the increase of interest in science and technology in the Arab world. Therefore, one could be led to the following conclusion : The low productivity of Arab scientists, like most developing countries scientists, could be attributed to the fact that the criteria used to measure the scientific and technological literature output do not apply to these countries (2).

The literature on science and technology in developing countries reflects divergent views. However, the one common message that emerges from this literature is that the main reasons that hinder the scientific and technological activity in developing countries and the Arab countries alike are as follows (3) :

- 1.- Implementation failures and cumbersome bureaucracy. Plans are enthusiastically drawn up, but at the crucial stage of implementation the enthusiasm disappeared and plans are simply dropped.
- 2.- Faulty career patterns, government run laboratories which catapult senior and imaginative scientists into the director's seat leave an entrepreneur young researcher at their mercy.
- 3.- Education weakness, because of the lack of academic freedom and availability of reliable data and information as well as research findings.

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- 4.- Industrial research inadequacies, as industrial activity is hardly absent, therefore there is a low priority in R & D. For example, on the whole less than 1 percent of the GNP is devoted to research and development in the Arab world.
- 5.- Inadequacies in the basic/applied research connection, Arab countries, still lie on the fringes of the recent development in science and technological field. They seem not understanding the fundamental importance of the interaction between science and economic development. It is argued that scientific research nowadays is part of the process of economic development just as important as capital and manpower as factors involved in the process.
- 6.- The Brain drain, as science could not be consumed at home or bring adequate financial rewards, the only satisfying career for Arab scientists is in the West. As a matter of fact, nearly half of the Arab holders of the PhD, which are estimated at more than 27,000 and their number is increasing by more than 10 per cent every year, have left the Arab countries.
- 7.- And finally lack of internal support because of the prevailing academic subculture. Gordon (1979) (4) estimated that of 143 papers submitted from less developed countries to scientific periodicals for publication between 1968-1974, 57 (40 %) were rejected for their inadequacy; while 63 (44 %) were trivial and 104 (73 %) arrived at inaccurate or false conclusions.

This was mainly due to the lack of information and very poor current awareness and information dissemination services, rather than the lack of expertise of scientists and technicians of these countries.

In addition to these interrelated qualitative as well as quantitative factors, all of them very important, it deserves mention, even though it is abundantly obvious that Arab countries like most Less Developed Countries have been for centuries marginalized. The scientific revolution that led to a formidable increase in the number of scientists and an exponential growth of information production, is significant for the more advanced countries.

Next, the absence of industrial infrastructure that set the ground to scientific and technological innovations. As regards Arab countries, they still to some extent not well aware of the forementioned important interaction.

In the light of all these evidence, it is not surprising that Arab countries' science and technological output reveals a rather low production as against the socio-economic indicators (population and gross national product) among others.

Science publication output.

So far as data are concerned, the first problem was to obtain a suitable series of reliable data related to the Arab world science publication output for the period 1981 and 1984.

Therefore, sets of data were adapted from the previous work of T. Braun, W. Glanzel, A. Schubert (5) relative to publication output and relative citation impact of 107 countries for 1978-1980.

The data sources as described by the authors were obtained from the Science Citation Index (SCI), annual cumulations magnetic tapes as well as the database of the Institute for Science Information (ISI, Philadelphia, Pa, USA).

Original papers, review papers notes, and letters published in the SCI source journals in 1978-1980 were considered source items, and citation to them in the two years following their publication were counted.

It is worth noting at this stage that while Braun's data related to 107 countries, this paper data are merely concerned with 14 Arab countries out of 21 that compose the present Arab world (table 1).

The methodological problem was the choice between simple linear regression or log linear regression analysis in addition to the choice of the socio-economic indicators. Since science output should be gauged in relation to the major productivity components. In essence a country's science publication output can be increased by the following components : the size of the population and the level of economic development.

Since the level of development is always measured by the gross national product (GNP), (6) we adopted a similar approach adding to that some qualitative indicators such as : the adults literacy, rate of the number of scientists per 100,000 population and research and development expenditure as a percentage of the GNP.

The sources for the above-mentioned socio-economic development indicators data were The World Development Report 1982 (Adult literacy rates), The World Bank Atlas 1983 (Population and GNP at market price for 1980) and The UNESCO Statistical Yearbook 1987 (Scientists per thousand population ratio).

Arab countries selected

Table 1

Algéria	AL	Morocco	MO
Egypt	EG	Saudi Arabia	SA
Iraq	IR	Somalia	SO
Jordan	JO	Sudan	SU
Kuwait	KU	Syria	SY
Lebanon	LE	Tunisia	TU
Libya	LI	United Arab Emirat	UAE

The data related the 14 Arab countries were processed as follows :

Table 2 provides a comprehensive distribution both by country and by scientific fields of Arab countries' science publication output for 1978-1980.

Figure 1 provides a comparative picture of the distribution in the Arab world science publication output in life science, chemistry and other science fields.

Table 3 shows in a summary forms of the correlation coefficients and slopes of the literature output and the logarithm of the selected socio-economic indicators.

Figure 2 to 6 illustrate the regression results including the regression lines between the logarithm of the literature output and the logarithm of the socio-economic parameter.

Quantitative Analysis.

The above-mentioned Table 2 and Figure 1 lead to the following observations with respect to the distribution by country and by science fields.

- Egypt is indeed ahead of the rest of the Arab countries.
- Life sciences share in the publication output is very important.

Regarding Egypt share in the Arab world science publication output, Table 2 shows that Egypt's ratio of science publication output in life sciences, chemistry and other sciences fields is higher than the ratio of any other Arab country. The ratio exceeds 50 percent of the total science publication output, 48 percent in life sciences, 71.4 for chemistry, and 48.6 in the remaining science fields.

Science output distribution among Arab Countries

Table 2

Country	L.Sce	Ch	Other	Total	%
1 Egypt	1203	1024	697	2924	54.4
2 Iraq	267	120	130	517	9.6
3 S. Arabia	171	84	213	468	8.7
4 Sudan	204	15	41	260	4.8
5 Lebanon	148	25	48	221	4.1
6 Kuwait	91	55	72	218	4.0
7 Tunisia	105	37	44	186	3.5
8 Algeria	71	34	46	151	2.8
9 Morocco	93	16	42	151	2.8
10 Libya	52	11	62	125	2.3
11 Jordan	64	14	29	107	2.0
12 U.A.E	11	-	7	18	0.3
13 Somalia	14	-	1	15	0.3
14 Syria	11	-	3	14	0.3

Total	2505	1435	1435	5375
Percentage	46.6	26.7	26.7	100.0

- Total = All science field combined
- L.Sce = Life sciences
- Ch = Chemistry
- Others = Other Science fields

This could be attributed to various factors. Among these, is the creation since the end of World War II of a high level of awareness and a number of institutional policy-making establishments such as the National Research Centre in 1955, the Science Council and the Atomic Energy Establishment in 1956, and the Council for Scientific Research and Technology in 1971 in addition to the existence of a relatively broad base for scientific and technological potential in terms of both highly trained manpower and research facilities in various fields of pure applied science (7).

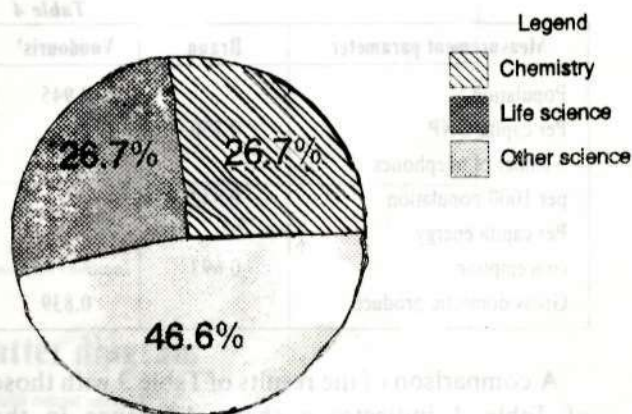
So far as science fields are concerned, Figure 1 shows that life sciences publication output ratio is nearly half of the rest of science fields (46.6%). The reason for this may be found in the structure of

national scientific activities that is primarily concerned with fundamental research. The conversion from the classical university prototype to technological universities has yet not being extended.

Science publication output

Figure 1

Distribution by science fields	Chemistry
Other science Fields (26.7%)	(26.7%)



Life Science (46.6%)

Correlation analysis.

The correlation results indicate that the relationship between Arab countries' science publication output and the selected socio-economic parameters is very weak.

The correlation coefficient values are relatively very low as against those obtained by Voudouris' (8) and Braun's (9) studies (see Table 4).

The only exception is the result for the proportion of scientists engaged in R & D per 100,000 population which provide a significant correlation coefficient in terms of statistical criteria.

The slopes of the regression lines have also a very low value or a negative one. This suggests that the changes in the socio-economic parameters do not affect in terms of statistical criteria or have a

negative effect upon the volume of scientific and technological literature emanating from the Arab countries.

Regression analysis result.

Table 3

Measurement parameters	r	m
Population	0.52	0.69
G.N.P	0.38	0.46
G.N.P per capita	0.09	0.09
Adults literacy rates	0.37	- 1.55
Scientists in R & D per 100,000 pop	0.69	0.64
R & D expend. as % of GNP	0.38	0.43

Braun Voudouris' results.

Table 4

Measurement parameter	Braun	Voudouris'
Population		0.945
Per capita GNP	0.750	
Number of telephones per 1000 population	0.842	
Per capita energy consumption	0.693	
Gross domestic product.		0.839

A comparison of the results of Table 3 with those of Table 4 indicates a sharp difference in the correlation coefficients values. The question arises : are the developed countries that get a relatively strong correlation because of their level of development or the reliability of the indicators and the method used.

Concluding remarks.

Our findings in the previous sections indicate that, in the broader perspective as represented by Table 3, Arab countries science publication output appear unrelated to the socio-economic factors as measured by the population size, GNP, Adult literacy rates, the number of scientists engaged in R & D and expenditure as percentage of GNP. The absence of a strong correlation between the logarithm of science publication output and the logarithm of the socio-economic indicators may be due to; first, the socio-economic indicators are fraught with shortcomings which impose some important limitation. Second, measuring science and technological activity by the count of publica-

tions is not replicated to the Less developed countries, because scientists in these countries have much to do than publishing and even when they do so they are prevented from being published for unaccuracy, faulty conclusion, etc. (10).

In our view, the clue lies in examining the difference between the Arab world and other less developed nations where scientific activity has been developed such as India, Pakistan, Israel, and so on. To answer the question why these countries have a relatively high rate of science publication output than the entire Arab world provides some insights about the problems hindering the development of science and technology in the Arab countries which have been examined above.

Fig.1 Scatter diagram

Science publication output versus Populatio

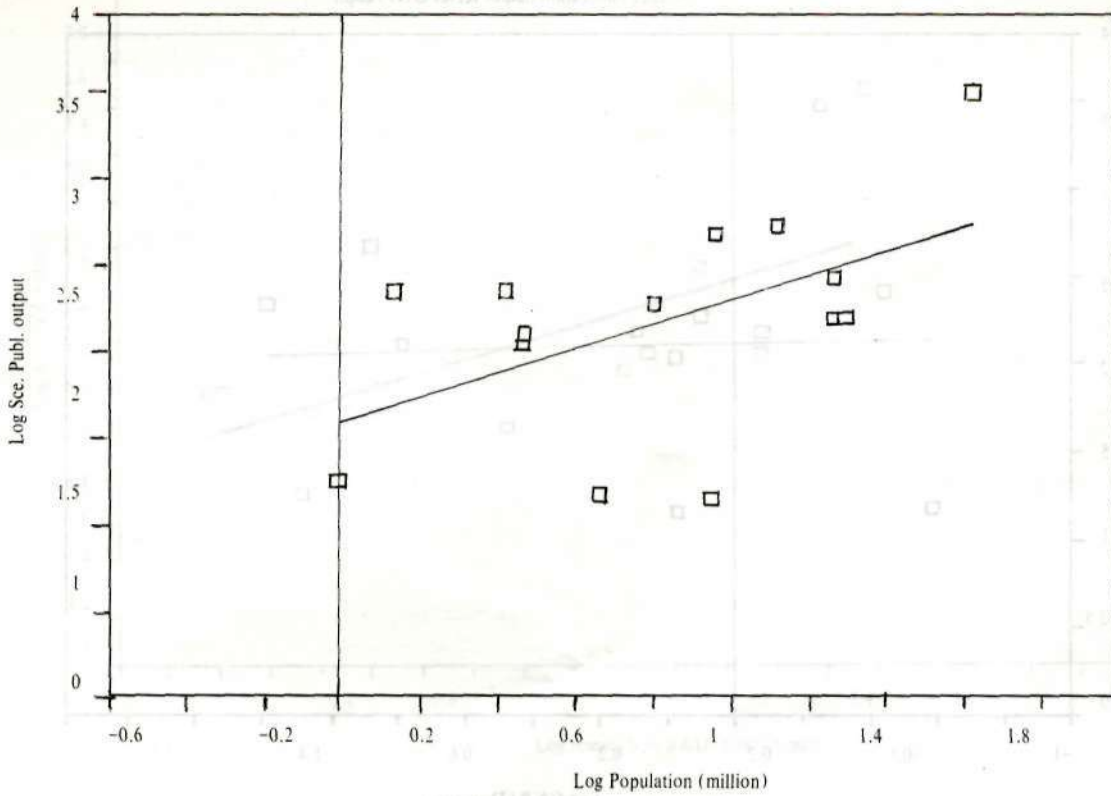


Fig.2 Scatter diagram

Science publication output versus GNP

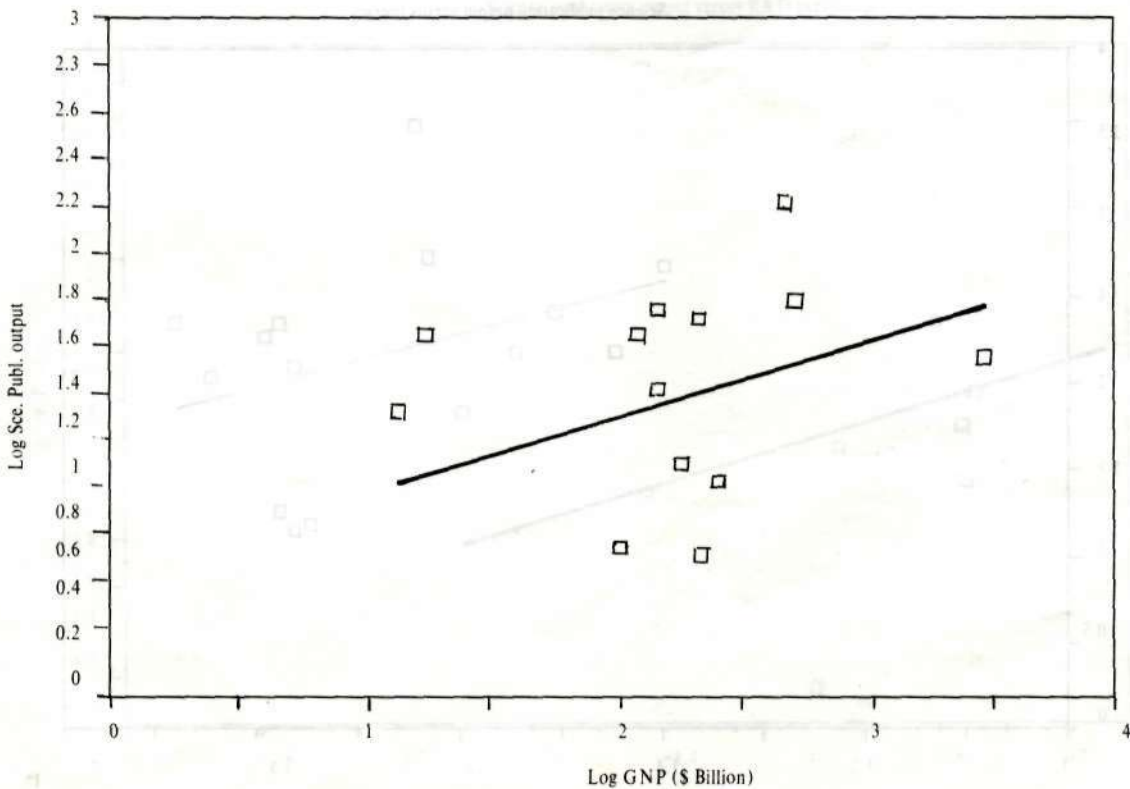


Fig.3 Scatter diagram

Science publication output versus GNP/copit

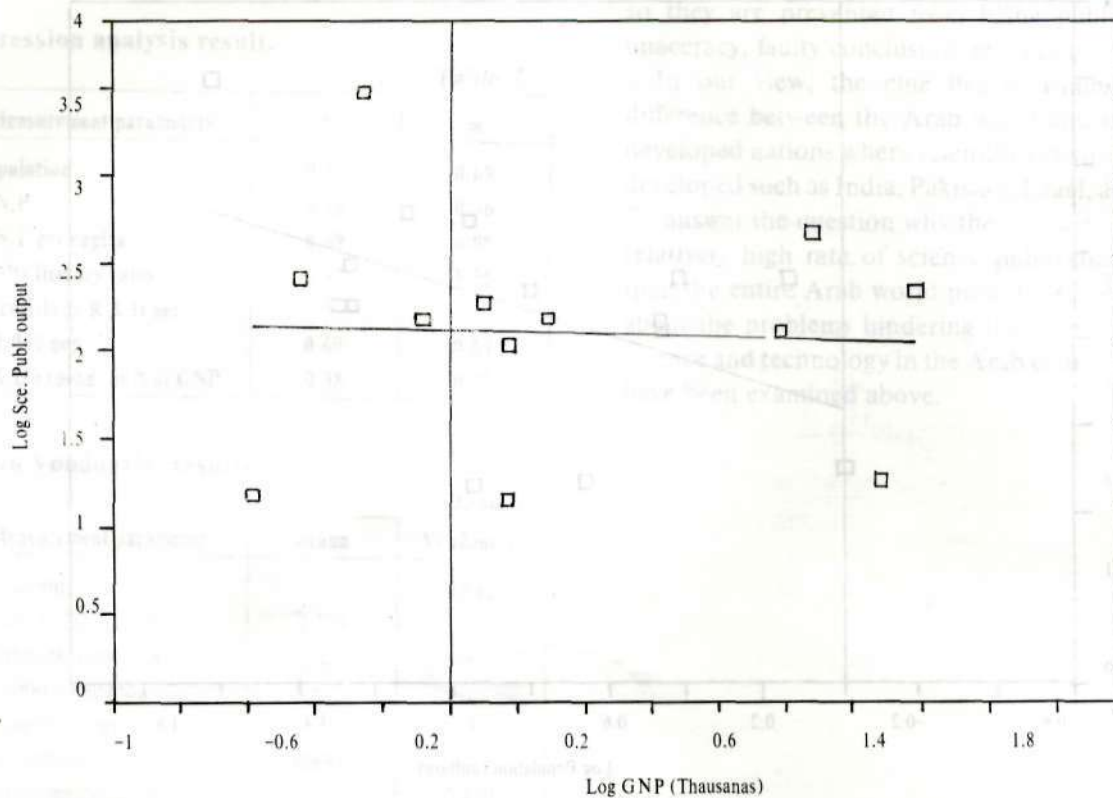


Fig.4 Scatter diagram of

Science publication output versus literacy

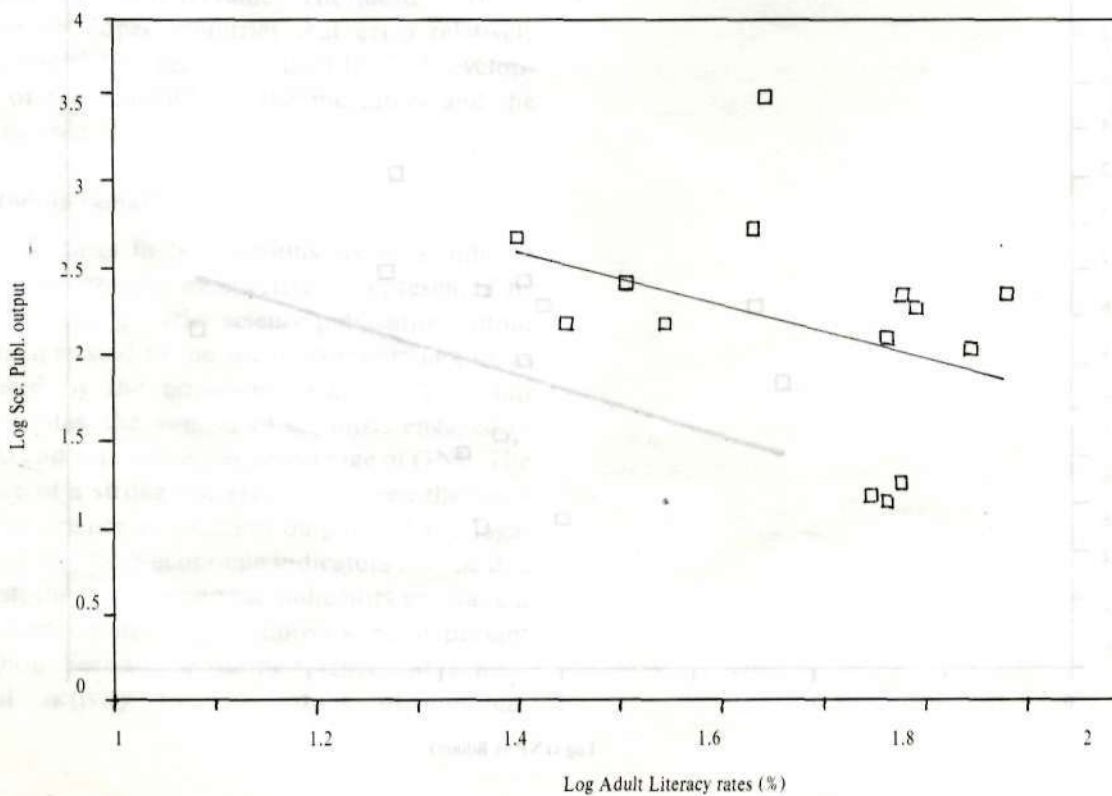


Fig.5 Scatter diagram of

Science publication output versus R&D Scientists

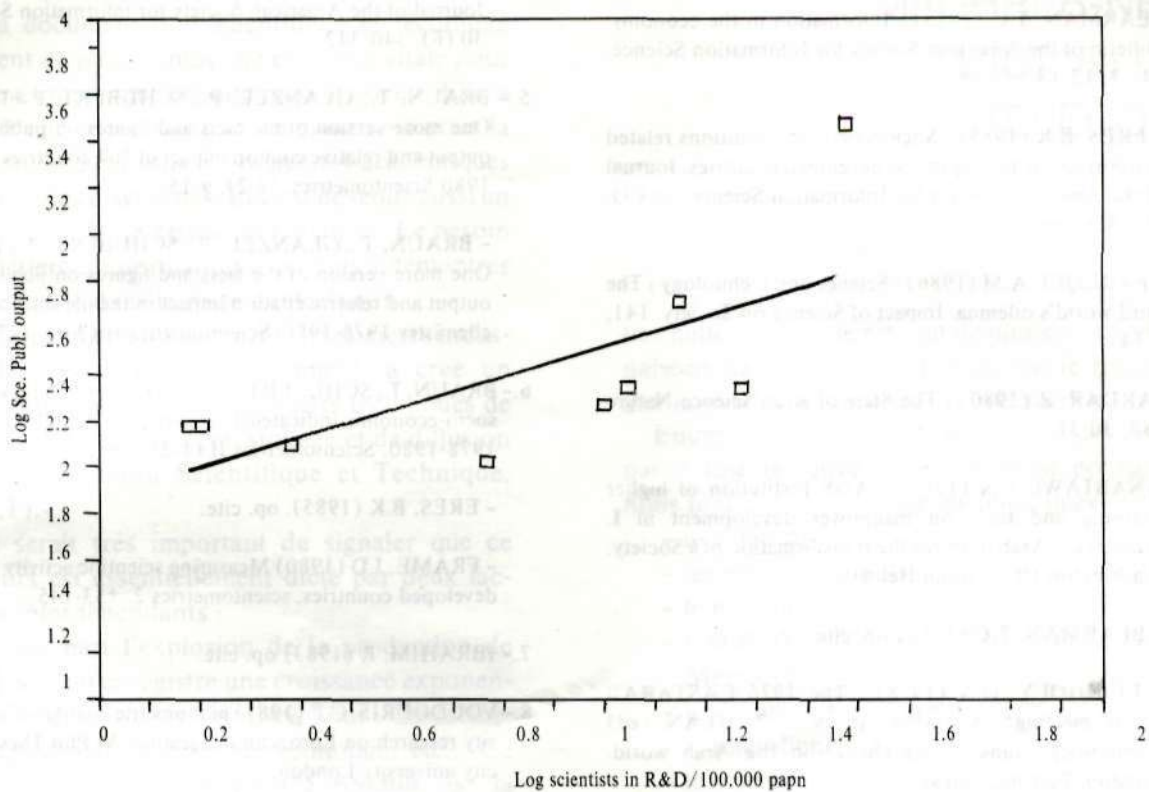
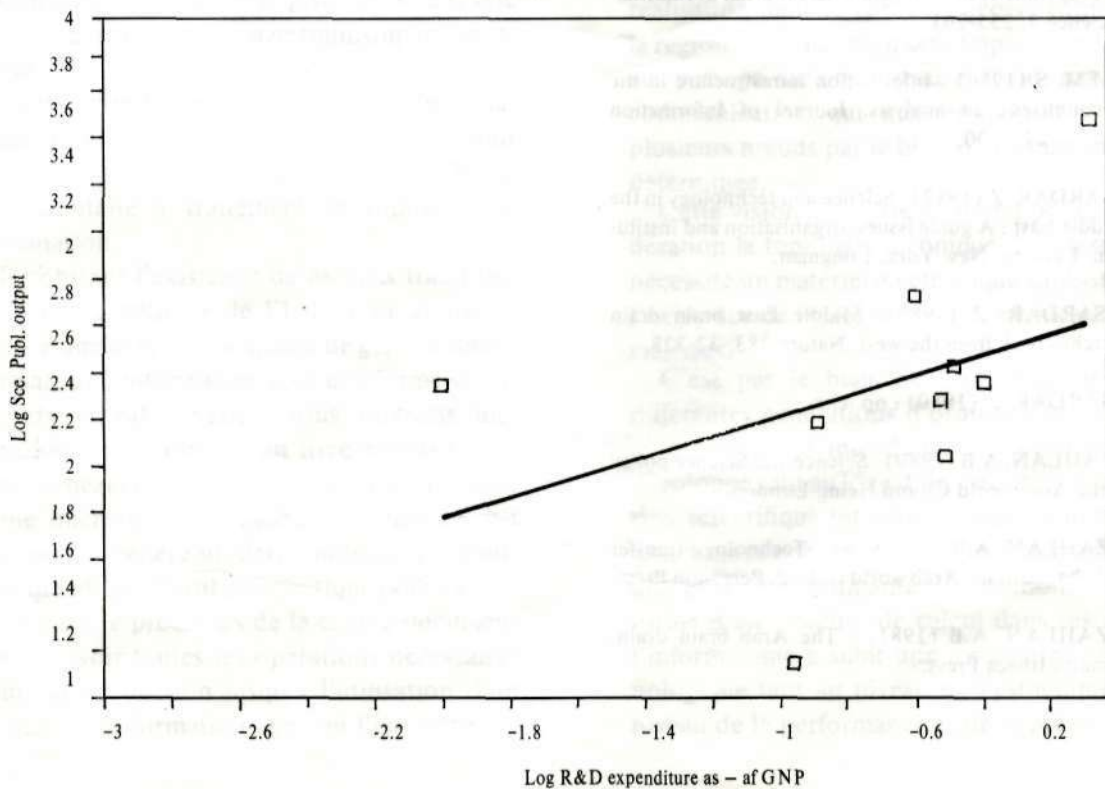


Fig.6 Scatter diagram of

Science publication output versus R&D expenditur



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