THE APPLICATION OF A SYSTEMS ANALYSIS APPROACH TO EDUCATIONAL PLANNING IN IRAN

Mohammad Rahmāni

Introduction

Throughout the history of economics labour has always been considered an important factor in the production process. However, we can no longer consider labour as mere physical power to be used in the production of goods. Only through education can labour be converted into its most useful forms for the process of producing goods and services.

Education is considered an essential factor in the development of societies. The analysis done by Fredrick H.Harbison and Charles Mayers indicates a positive correlation between education and economic growth.[1] Education develops the cultural and social aspects of the society, which are

---

I wish to express my appreciation to the Committee on International Exchange of Persons, Conference Board of Associated Research Council for the grant awarded to me. I would also like to thank the Department of Agricultural Economics of the New York State College of Agriculture at Cornell University for providing me with space and facility.

I would like to thank a number of individuals for the assistance and comments they provided including, Professor Robert J. Kalter, Professor Vladimir L. Stoikov, Professor Herbert H. Hinman, Professor Robert S. Smith, and Mr.Richard L. Shortlidge. My sincere thanks are also due to Mrs. Helene Wilmarth for typing the manuscript and the original draft of this paper.

also important factors for economic growth. It has been indicated that development in technology, in economic performance, and in general welfare of a society is dependent on the supply of high quality manpower.[2]

Although education by improving the knowledge and ability of the human factor plays an important part in development of a society, it does not prove any direct correlation between the level of educational attainment and economic growth.[3] Since "education alone does not create jobs,"[4] how can a country benefit from expanding and developing higher education when there is little demand for college graduates and few jobs relative to their fields of study? The application of a curriculum which does not meet the country's real needs would be too costly. The overproduction of lawyers of low calibre in India and the Philippines is an example of an over-investment in university education.[5] The above mentioned views explain the need for an efficiency analysis whichmight define the optimum growth of different levels and fields of education.

Carrying out projects for the development and growth of the developing countries requires human capital in general. There is a need for technicians and highly educated manpower. Teachers, schools and facilities are needed in order to increase the literate percentage. In low-income countries the industrial sector has not been improved to provide jobs for a great number of technicians, skilled workers, foremen and managers at the middle level with a sufficient income. In most of these countries higher education is considered as the only source of improving one's income and status - the main reason for a high demand for higher education. An increase in investment and expenditure on education is required in order to get more educated manpower. UNESCO statistics[6] indicate an increase in the percentage of national income allocated as public expenditure for educational purposes in most countries in the world. Since the expenditure on education has been recognized as an investment in human capital,[7] with respect to budget constraint, a systematic analysis of investment in education may be of some help in allocating limited resources most efficiently within the educational system of a low-income country.

The literature regarding educational planning suggests

different approaches. The alternative approaches to educational planning are: the manpower requirement approach, a modified manpower requirement approach, the rate of return approach, and the linear programming model.[8] Since the objective of this study is an analysis of the profitability of investment in education, the rate of return approach is implemented for calculation of social and private rate of return to investment in five fields of higher education in Iran. Despite the fact that the advantages of the rate of return approach are limited,[9] it seems that it is the most applicable approach for analyzing the profitability of investment in education.

Since, to my knowledge, this is the first time that such an analysis has been done for Iranian education, there has been a full complement of difficulties and drawbacks in the way of the analysis. The main problem has been the estimation of earning and age-earning profiles, as there are no precise data regarding the earning according to the levels and fields of education. A beginning-earning was derived from a government salary-schedule for non-official employees[10] with respect to a sample survey done in 1964 in Iran. It has been assumed that this earning will reflect the appropriate productivity of college and high school graduates to the individuals and the society. Justification for this assumption is as follows:

From the private point of view the rate of return analysis is valued regardless of whether the earning reflects the actual productivity or it is conventional earning from the degree one has earned. The main purpose of a person investing in education is to increase his future income.

In a pure competitive economy, wages are supposed to be determined by the marginal productivity of workers. Otherwise it has to be accepted that other factors have interferred with the market supply and demand. Now in an economy where the government is the main employer of a particular level of educated manpower, the probability exists that because of non-economic reasons, the salaries are not set exactly according to the productivity of employees. This may also affect the private labour market in setting salaries or wages not exactly equal to the productivity of labour. Therefore it is feared that the estimated earning may not reflect the

productivity of a particular level of education to the society. Avoiding this problem as much as possible, in the estimation of earning for calculating the rate of return to investment in higher education in Iran, the salary-schedule for non-official employees, which is more sensitive to the changes in a labour market, was chosen as the basic earnings data. The most relevant figure for beginning-earning was derived from the result of a sample survey on earning in Iran, which is supposed to reflect the productivity of labour. Since the derived figures are close to those obtained in the survey, it is assumed that they are the best reflection of the productivity of highly educated manpower. Still the probability remains that the figures might be over-or-under-estimated. It is hoped that in future work on this topic in Iran one may get proper data on earnings.

The result of the rate of return calculation is then used to test the truth of the following hypotheses:

1. The private rate of return to investment in higher education in most fields in Iran is high enough to attract people to higher education.

2. Since higher education in Iran is to a great extent public, and the government subsidizes higher education, the private rate of return is higher than the social rate of return.

3. The rate of return to investment in technical fields such as engineering, agriculture, and science is higher than in theoretical fields such as literature and social sciences.

It is not irrelevant at this stage to mention Anderson's view that "education in most of the developing countries is an exclusively public service and in an exclusively public educational system political criteria out-weigh economic ones."[11]

Background and present condition of education in Iran[12]

In order to highlight the background of the following

efficiency analysis, it would be useful to briefly describe the general condition of education in Iran before going into any detailed analysis.

The first and second Development Plans of Irān paid attention only to certain limited aspects of education, and therefore before the Third Development Plan, in 1963, educational programmes were not sufficiently comprehensive. The Third Development Plan gave special attention to education in general and to illiteracy and technical training at the secondary and higher level in particular.

The Third Development Plan gave the priority to primary education so that educational facilities could be provided for 60 per cent of the children in the 7-12 year age bracket It was supposed to provide educational facilities for 681,000 new children, so that by the end of the Third Plan period, 1968, the total number of pupils at the primary level would have increased to 2,225,000. However the formation of a Literacy Corps within this period induced an increase above the estimated number, up to 2,900,000 pupils. At the secondary education level it was envisaged that the number of pupils would be 400,000 by the end of the period. But, in spite of the Plan recommendation regarding reduction in the rate of growth of secondary education, the number of pupils at this level reached about 658,000 by 1968. The numbers in higher education increased by 53 per cent during the Third Plan period, e.g. from 24,500 at the beginning of the Plan to 37,500 by the end of the period.

The educational objective of the Fourth Development Plan, 1968-1972, is the rapid development of education at different levels and in different fields, co-ordinated with growth in other sectors and corresponding to the needs of the country's economics, social, and cultural development.

Table 1 shows the expansion at different levels of education for the periods of Iran's Third and Fourth Plans. During the Fourth Plan, the expansion in primary education will provide educational opportunities for about 93 per cent of the school age children in urban areas and about 55 per cent in rural areas.

Higher education: The institutions of higher education

Table 1. Irān: Increase in the number of students in the Third and Fourth Plan periods (1000's of students)

	Number at the end of Second Plan 1963	Number at the end of Third Plan 1968	Absolute increase	Percentage increase of Third Plan over Second Plan	Number at the end of Fourth Plan 1972	Absolute increase	Percentage increase of Fourth Plan over Third Plan
Kindergarten	13	16	3	23.1	20	4	25
Primary	1,719	2,900	1,181	68.7	3,738	838	29
Secondary	336	658	322	95.9	*1,328	670	101
Vocational	9	17	8	88.9	50	33	194
Higher education	24.6	37.5	12.9	52.4	60	22.5	60
	1956	1967	Absolute increase	Percentage increase	1972	Absolute increase	Percentage increase
Number of literates	1,673	4,673	3,010	179	9,075	4,392	93

*This figure comprises 872,000 in guidance courses
376,000 in theoretical secondary courses
80,000 in combined theoretical and vocational secondary courses
1,328,000

Source: Imperial Government of Irān, Plan Organization, *Fourth Development Plan,* Tehrān, Irān. P.266.

in Irān consist of public and private universities and colleges. Table 2 shows the total number of students in the institutions of higher education during the academic year 1968-69.

Table 2. Irān: Number of students in Irānian institutions in higher education in academic year 1968-69

Institution	Number of students		
	Male	Female	Total
Public universities	21,971	6,666	28,637
Private universities	7,206	1,557	8,763
Public colleges and institutions of higher education[a]	6,169	1,324	7,493
Private institutions of higher education	3,581	4,016	7,597
Institutions of higher education under supervision of Ministry of Education (mostly above secondary level)[b]	1,163	182	1,345
Institutions of higher education under supervision of other governmental agencies[c]	3,988	1,319	5,307
Total	44,078	15,064	59,142

a. These institutions mostly consist of only one college.
b. These institutions are mostly above secondary levels and are related to the Ministry of Education, which deals with education at primary and secondary levels.
c. These institutions train specially skilled and educated personnel for the governmental agency that the institution is related to, e.g. the College of Police Officers is related to the Ministry of Interior.

Source: Imperial Government of Irān, Ministry of Science and Higher Education, *Universities and Institutions of Higher Education in Irān*, Tehran, Irān, p.114-121.

The statistics for the academic year 1969-70 show an increase of 3,267 students in the number of students in Irān's public and private universities and the public institutions of higher education related to the Ministry of Science and Higher Education.[13] In addition, the number of Irānian students in foreign countries in the academic year 1968-69 was reported to be 20,317.[14]

In comparing the rate of increase in the number of students at the higher education level per 100,000 inhabitants in Irān with India, Pakistan, and Turkey during the period

1950-1965, we see a higher rate of increase for Irān than for the compared countries. Table 3 shows the mentioned rates.

Table 3. Irān: Total number of students per 100,000 inhabitants, and total rate of increase in the number of students per 100,000 inhabitants at the third level of education

Country	Year	Total number of students	Number of students per 100,000 inhabitants	Total rate of increase in the number of students per 100,000 inhabitants
Irān	1950	5,502	34	255.8
	1965	29,683	121	
India	1950	404,019	113	107.9
	*1965	1,145,554	235	
Pakistan	1950	69,898	93	177.4
	1965	265,588	258	
Turkey	1950	24,815	118	154.2
	1965	93,491	300	

*The total number of students at the third level in India in 1964 was 1,675,630, and the number of students per 100,000 inhabitants was 344. But, even if we use this figure, the rate of increase comes to 204.4, which is still less than Irān.

Source: UNESCO, *Statistical Yearbook, 1968,* (Paris: UNESCO, 1969), pp. 193-195.

Supply and demand for skilled manpower in Irān during the current development plan, 1968-1972: As was mentioned before, the objectives and programmes of the Fourth Development Plan are qualitative and quantitative balance in the manpower required for the Plan. The main shortages in industry are at the medium and skilled worker levels and in services are at the medium, high, and particularly the skilled worker level. It has been indicated that these shortages will be relieved by on-the-job training by the private sector and by short courses, as well as instruction at non-government schools. Table 4 shows the detailed forecast of the

Table 4. Irān: Manpower demand, supply and balance under the Fourth Plan

Skill Level	Demand for skilled manpower				Supply of manpower			Shortage of skilled manpower			Methods of meeting the shortages
			Services								
	Agr.	Ind.	Ind. admins.	Ordinary level	Agr.	Ind.	Services	Agr.	Ind.	Services	
Medium level	6,030	12,460	23,700	147,000	6,030	12,000	91,000	0	460	79,700	On-the-job training by the private sector and training at non-government schools
High level technicians and managers	2,080	2,930	13,130	25,000	2,080	2,930	30,590	0	-	7,580	Utilization of short-term courses run by the Industrial Management Organization
Skilled workers, administrative personnel in industry and ordinary level of services	292,000	171,000		151,000	292,000	90,000	46,000	0	81,000	105,000	On-the-job training by the private sector and training at non-government schools

Source: The Imperial Government of Irān, Plan Organization, *Fourth National Development Plan*, 1968, p.264.

Note: This table appears in Imperial Government of Irān, Plan Organization, *Fourth National Development Plan, 1968-1972*, (Tehrān, Irān, 1968), as Table 3, pp. 264-265.

supply and demand for manpower during the Fourth Plan period.

Social and private rate of return

Educational planning as a tool for efficient allocation of resources for educational purposes has been widely acknowledged. Nations as well as individuals are trying to allocate the limited resources available to the most beneficial projects.

In this study the internal rate of return to social and private investment in higher education in Iran have been calculated. The specific interest is related to the following fields:

1-4 years degree (B.A.) in Literature and the Humanities compared with the secondary diploma (equivalent to high school diploma in the United States).

2-4 years degree (B.S.) in Science compared with the secondary diploma.

3-4 years degree (B.A.) in Business and Public Administrations and Economics compared with the secondary diploma.

4-4 years degree (B.S.) in Agriculture compared with the secondary diploma.

5-4 years degree (B.S.) in Engineering compared with the secondary diploma.

According to the definitons of Gary S. Becker, W. Lee Hansen, and Mark Blaug, internal rate of return on investment in education is the discount rate which equates the present value of lifetime earnings to the present value of costs.[15] We encounter difficulties and handicaps in determining what part of the costs of education can be considered

as annual, or operating costs, and what part can be considered as fixed investment.

Since the investment in education occurs over a period of time, some of the models used for calculating the internal rate of return have taken the whole costs as annual costs and put them at the right hand side of the equation. In this case, K, or fixed investment, will be equal to zero. Blaug presents the following equation for calculating the internal rate of return.[16]

$$\sum_{t=15}^{t=65} \frac{E_t - C_t}{(1 + r)^t} = 0$$

Where E is the earning before and after taxes,[17] C is the cost of education, t=65 is the year of retirement, t=15 is the legal school leaving age, and r is the internal rate of return. Blaug indicates that r, the internal rate of return, "is simply the discount rate that sums the present value of the net lifetime earnings to nought."[18]

W. Lee Hansen defines the sum of school costs incurred by society - such as teachers' salaries, supplies, interest and depreciation on capital as opportunity costs incurred by individuals (which in this case means earnings foregone during school attendance) and the individual's incidental cost related to schooling (such as books and travels) as total resource costs. The sum of earnings of foregone, incidental school-related cost, and tuition and fees paid by individuals are defined by Hansen as being private resource costs.[19]

Formulation: With respect to the above mentioned definition the formulation for calculation of internal rate of return can be presented. A present value of lifetime earnings and a present value of costs can be calculated through following equations:

1) $E_p = \sum_{t=1}^{T} \frac{E}{(1 + R)^t}$ 2) $C_p = \sum_{t=1}^{T} \frac{C}{(1 + R)^t}$

where:

E_p = Present value of lifetime earnings

T = Earnings period starting from first year of studying

E = Earnings

C_p = Present value of costs

C = Costs of education

R = Discount rate

In order to find a discount rate (internal rate of return) which equates E_p to C_p the right part of equation 1 and 2 has to be equal:

$$3) \quad \sum_{t=1}^{T} \frac{E}{(1+R)^t} = \sum_{t=1}^{T} \frac{C}{(1+R)t}$$

or

$$4) \quad \sum_{t=1}^{T} \frac{E}{(1+R)^t} - \sum_{t=1}^{T} \frac{C}{(1+R)^t} = 0$$

equation 4 can be put as follows:

$$5) \quad 0 = \sum_{t=1}^{T} \frac{E - C}{(1+R)^t}$$

From equation 5, R is the internal rate of return which is to be computed.

The point has to be mentioned that in equations 1 and 2, R is as an external discount rate, whereas in equations 3,4, and 5, R turns to be as an internal discount rate, which in this case is called internal rate of return.

Social and private benefits from higher education: Presently there are no precise data regarding the earnings for the separate levels and fields of education. However, a study on the manpower problems in urban communities of Iran, done in 1964, does present some data on average earnings.[20] Taken from a sample survey, the data show the average earning according to job categories and the skill level of the work

for public and private sector. The survey also indicates the average earnings for productive and non-productive job groups.The data indicates average earnings for the following levels: a) Agricultural workers; b) Non-skilled workers; c) Skilled workers; d) Specialized workers; e) Highly specialized workers.

Since the data from the above mentioned survey do not indicate earnings according to the levels and fields of education, one must be cautious in the interpretation of this data. The data can, however, be used as a guide for representing and calculating the age-earnings profiles.

The data on the educational situation of the employed population of Iran obtained from the manpower study in 1964 and the general census of Iran's population in 1966 give a clue to a reliable estimation of earnings. The data from the manpower study in 1964 indicate that only 0.3 per cent of the independent employers and employees and 0.3 per cent of the salaried and wage-earner workers have had higher education, whereas the percentage of highly educated persons in the public sector (government) was 9.4.[21] The data from the general census of Iran in 1966 show 96.4 per cent of the highly educated population to be in urban areas and only 3.6 per cent in rural areas. With respect to the number of college degree holders in Iran,[22] the number of employees in public sector,[23] and the above mentioned percentage of highly educated manpower in different sectors, the fact can be stated that a great part of the country's highly educated manpower is working in government services.[24] Therefore the government salary schedule will widely affect any calculation of average earnings.

Considering the above cited fact, an estimation of average earning and age earning profiles has been made with the help of the manpower survey and the government salary-schedule for non-official employees.[25] The reason the salary-schedule for non-official employees was taken is because the average earnings estimated from the figures given in this schedule are closer to the results obtained in the sample survey and the beginning-earnings are also closer to those in the private sector. The salary-schedule for non- official employees indicated four different levels in the category of

degree holders at a B.A. or B.S. level. It has been assumed that the first or the lowest level which shows a beginning-earning of 172,800 Rials per year reflects the earning for Literature and Humanities, the second level, a yearly earning of 199,200 as a beginning-earning for Science, Business and Public Administration and Economics, the third level, 228,000 Rials per year, as a beginning earning for Agriculture and lately the highest level, a yearly earning of 256,800, as the beginning-earning of Engineering. The above cited assumptions are based on the results obtained in the sample survey. An average of a primary school teacher's salary and the minimum beginning-salary for secondary diploma holders has been assumed to be a secondary education level of earnings, which is almost 75,600 Rials per year. The justification for this is that at the present time the best financial opportunity for a secondary diploma holder is to be hired as a primary school teacher. Taking the other chances into consideration the above cited average has been estimated. It has been assumed that the retirement age will be 60 and the peak-earnings will be reached after 25 years of service. On the basis of governmental regulation and the average earnings in the sample survey a yearly increase of 5 per cent of the beginning-earnings were estimated. Earning for secondary level graduates starts at the age of 19.[26] Earning for a college graduate starts at the age of 23. The investment period for the fields of higher education considered in this study is four years. Table 5 shows the age - earning profile for those with only a secondary diploma and for those with degrees in the five fields of higher education. The figures are in Rials. Dollar equivalents can be calculated by dividing the figures by 75.750. The following adjustments have been made to these earnings:

Tax adjustments: Considering the standard procedure concerning the distinction between social and private monetary earnings from education, the pre-tax earning of an individual has to be taken as a measure of his productivity to society. The gross earnings (unadjusted) have been taken on the benefit side for calculation of social rate of return. For calculation of the private rate of return, earnings have been adjusted by the salary tax table of Iran.

Life probability adjustments: Taking this uncertainty

Table 5. Irān: Annual earnings by level of education (In Rials: 75.750=$)

Age	Secondary diploma	College graduates, B.A. and B.S. Degree				
		Literature & Humanities	Science	Bus. & Pub. Administration & Econ.	Agr.	Eng.
19	75600	-	-	-	-	-
20	79380	-	-	-	-	-
21	83160	-	-	-	-	-
22	86940	-	-	-	-	-
23	90720	172800	199200	199200	228000	256800
24	94500	181440	209160	209160	239400	269640
25	98280	190080	219120	219120	250800	282480
26	102060	198720	229080	229080	262200	295320
27	105840	207360	239040	239040	273600	308160
28	109620	216000	249000	249000	285000	321000
29	113400	224640	258960	258960	296400	333840
30	117180	233280	268920	268920	307800	346680
31	120960	241920	278880	278880	319200	359520
32	124740	250560	288840	288840	330600	372360
33	128520	259200	298800	298800	342000	385200
34	132300	267840	308760	308760	353400	398040
35	136080	276480	318720	318720	364800	410880
36	139860	285120	328680	328680	376200	423720
37	143640	293670	338640	338640	387600	436560
38	147420	302400	348600	348600	399000	449400
39	151200	311040	358560	358560	410400	462240
40	154980	319680	368520	368520	421800	475080
41	158760	328320	378480	378480	433200	487920
42	162540	336960	388440	388440	444600	500760
43	166320	345600	398400	398400	456000	513600
44	171100	354240	408360	408360	467400	526440
45		362880	418320	418320	478800	539280
46		371520	428280	428280	490200	552120
47		380160	438240	438240	501600	564960
48		388800	448200	448200	513000	577800
49						
50						
51						
52						
53						
54						
55						
56						
57						
58						
59						
60	171100	388800	448200	448200	513000	577800

into consideration, the age earning profiles must be adjusted downward to reflect the effect of life probability. In this study the earnings have been adjusted by the percentage of persons alive at the beginning of their 19th year who were expected to be alive at the end of each earnings period. At the present time there are no statistical data presenting the surviver rate in Iran. The surviver rate of the Asian country which has the closest rate to that of Iran was taken for adjustment of age earning profiles.[27]

Ability adjustments: The differential in earnings obtained because of a higher level of education is not entirely due to education. There are other factors, such as ability, motivation, family status and the like which cause a differential in earnings. In order to take this into account in the estimations, some earnings adjustments are required. Becker indicates that "almost two thirds of the apparent gain from college can be attributed to education itself."[28] In a recent work on the rate of return on investment in schooling in the United States, a motivation and ability adjustment factor of 64 per cent at ages 18-34 and 88 per cent at ages 35-74 were applied to the earning differential between college and high school graduates for calculating the rate of return.[29] Yet for Iran no study has been done which presents the effects of ability and other factors other than education on earning differential attributed to a higher level of education. But the correlation between ability and higher education can be stated from the fact that in Iran usually the abler students are admitted to the universities and colleges. The justification for this statement is that admission to all the Iranian universities and colleges requires passing a competitive entrance examination which allows the abler students a chance of admission. Usually the number of applicants is several times as great as the number of accepted students.[30] The entrance exam is arranged so that those in the top range have the choice of entering any field of study; the preference usually being the medical and engineering schools. This indicates an ability difference among the fields of study at the higher level.

However, these facts do not indicate any quantitative index which can be used as an ability adjustment factor. Irrespective of the difference in ability among the fields of higher education, in this study two different ability

adjustment factors have been applied equally for all fields. It was assumed that 60 per cent, as an upper limit, and 40 per cent, as a lower limit, of the differential in earnings between high school and college graduates is due to education.

The effect of unemployment: Considering the need for the highly educated manpower,[31] and the point that the number of unemployed persons holding higher education degrees makes only 0.3 per cent of total unemployed population,[32] the effect of unemployment as an earnings adjustment factor has not been taken into account in this study. The effect of unemployment on secondary graduates level of earnings is greater than college graduates. But it is assumed that the estimated earnings for secondary graduates, which has been calculated with respect to the earnings opportunity, reflect the effect of unemployment.

Sensitivity analysis: In order to consider the ramifications of economic growth on expected earnings and on the internal rate of return, and in order to find out the sensitivity of the internal rate of return to the growth in real per capita income, the internal rate of return was calculated under three different assumed rates of growth in real per capita income. It was assumed that the economy may undergo 5 per cent, 3 per cent, and 0 per cent rate of growth in real per capita income in Iran in the last decade has been close to 5 per cent.[33] However, a rate of 5 per cent increase in real per capita income seems to be unlikely over a long period of time. Therefore a rate of 3 per cent and 0 per cent growth in real per capita income, were also applied.

Social and private costs of education: The costs of education were measured in terms of direct and indirect costs. A sum of educational expenditures by universities - such as teachers salaries, administration costs, supplies, interest and depreciation on capital, and the cost of books and incidentals incurred by individuals - was taken as the direct social cost. From the detailed and comprehensive budgets of the universities and colleges an average current cost per student accrued to government was computed for the five above mentioned fields of higher education. A rental value and depreciation on education capital per student was computed

from the data on increase in capital expenditure in relation to the increase in number of students in scientific, technical, and also in literary and theoretical fields given by the Plan Organization of Irān.[34] It has been assumed that this value can replace the cost of buildings and equipment. The discount rate of the Central Bank of Irān was used in making these calculations.[35] The indirect social costs of education were measured by the before-tax earnings foregone, which were the pre-tax earnings of holders of secondary diplomas. A sum of tuition and books was taken to be the direct private cost. An estimation of average expenditures on books and stationary has been made with respect to the author's 8 years of teaching and several years of administrative responsibilities at Irānian universities.The indirect private cost of education consists of the tax- adjusted earnings foregone. Table 6 shows the average direct social and private cost of education for one academic year. The total annual cost of study in each case has been a sum of the above cited costs and the appropriate earnings foregone.

No travel costs have been taken into consideration. It was assumed that the summer earnings of the student would equal such costs. All earnings and costs have been estimated on 1968-69 basis.

Social and private rate of return: Tables 7 and 8 contain the estimated social and private rates of return to investment in higher education in Irān.

As far as the hypotheses listed earlier in this paper are concerned, the estimated social and private rates of return, under each of the circumstances, confirm the first and second hypotheses completely and the third hypothesis partly. The results indicate that the private investment in higher education in Irān under each circumstance can be considered as profitable. With 60 per cent earning differential to education and 0 per cent growth, even Literature and Humanities show a considerable private rate of return of 14.0. This is much higher than the 8 per cent discount rate of the Central Bank of Irān, or the return from two years interest on National Bonds, which is 9 per cent per annum.

Private rates of return are considerably higher than

Table 6. Irān: Yearly average direct social and private cost of education per student for five fields of higher education (Rials 75.750 = $1)

Fields of study	Current costs to government	Capital costs to government	Tuition	Books	Total yearly social direct costs of education	Total yearly direct costs to individuals
Literature & Humanities	37710	25093	8500	1000	63803	9500
Science	86746	39724	10500	1000	127470	11500
Bus. & Pub. Administration & Econ.	36604	25093	8500	1000	62697	9500
Agriculture	151180	39724	10500	1000	191904	11500
Engineering	100333	39724	10500	2000	142057	12500

Table 7. Irān: Social rate of return for five fields of higher education

Fields of study	0% Growth in real per capita income			3% Growth in real per capita income			5% Growth in real per capita income		
	No A.A.(a)	60% Earn. Diff.(b)	40% Earn. Diff.(c)	No A.A.	60% Earn. Diff.	40% Earn. Diff.	No A.A.	60% Earn. Diff.	40% Earn. Diff.
Literature & Humanities	15.3	10.5	7.5	19.1	14.1	10.9	21.6	16.4	13.2
Science	14.2	9.7	6.8	18.1	13.3	10.3	20.7	15.7	12.6
Bus. & Pub. Administration & Econ.	18.5	12.9	9.4	22.4	16.6	12.9	25.1	19.0	15.3
Agriculture	13.8	9.3	6.5	17.7	13.0	10.0	20.3	15.5	12.4
Engineering	18.2	12.6	9.2	22.3	16.4	12.8	25.1	19.0	15.2

(a)No ability adjustment.
(b)60% differential in earnings due to education.
(c)40% differential in earnings due to education.

Table 8. Iran: Private rate of return for five fields of education

Fields of Study	0% Growth in real per capita income			3% Growth in real per capita income			5% Growth in real per capita income		
	No A.A.(a)	60% Earn. diff.(b)	40% Earn. diff.(c)	No A.A.	60% Earn. diff.	40% Earn. diff.	No A.A.	60% Earn. diff.	40% Earn. diff.
Literature & Humanities	20.0	14.0	10.3	23.7	17.5	13.7	26.1	19.8	15.9
Science	23.6	16.6	12.4	27.4	20.2	15.8	30.0	22.6	18.1
Bus. & Pub. Administration & Econ.	23.9	16.9	12.6	27.8	20.5	16.1	30.3	22.9	18.3
Agriculture	27.4	19.5	14.6	31.4	23.2	18.1	34.0	25.6	20.5
Engineering	30.7	21.9	16.5	34.8	25.7	20.1	37.5	28.2	22.5

(a) No ability adjustment
(b) 60% differential in earnings due to education
(c) 40% differential in earnings due to education

Table 9. Iran: Differences between social and private rates of return under different circumstances

Fields of study	0% Growth			3% Growth			5% Growth			Private share of direct costs of education
	No A.A.(a)	60% E.D.(b)	40% E.D.	No A.A.	60% E.D.	40% E.D.	No A.A.	60% E.D.	40% E.D.	
Literature & Humanities	4.7	3.5	2.8	4.6	3.4	2.8	4.5	3.4	2.7	14.88
Science	9.4	6.9	5.6	9.3	6.9	5.5	9.3	6.9	5.5	9.02
Bus. & Pub. Administration & Econ.	5.4	4.0	3.2	5.4	3.9	3.2	5.2	3.9	3.0	15.15
Agriculture	13.6	10.2	8.1	13.7	10.2	8.1	13.7	10.1	8.1	5.99
Engineering	12.5	9.3	7.3	12.5	9.3	7.3	12.4	9.2	7.3	8.79

(a) A.A. = ability adjustment
(b) E.D. = earning differentials

social rates of return. The explanation is that higher education in Iran is highly subsidized by government. The government's share of direct costs is several times as great as the private share of direct costs. Considering the private share of direct costs and the differences between private and social rate of return, we see a higher difference in Agriculture and Engineering which have a lower private share of the direct costs and lower differences in Literature and the Humanities and Business and Public Administration and Economics, which have a higher private share of direct costs. Table 9 shows the differences between social and private rate of return under different circumstances and the private share of the direct costs.

The social and private rates of return obtained in this study do not indicate that technical fields are necessarily the most profitable fields for investment. Although the social rates of return for Business and Public Administration and Economics are not significantly higher than for Engineering, they are considerably higher than for the other fields. If we consider the benefit-cost ratio and net benefit (B - C) for Business and Public Administration and Economics and Engineering, we would find Engineering the best field of investment, even from the point of view of society. From the point of view of private investment, Engineering can be considered the best and Agriculture the second best. Business and Public Administration and Economics, a theoretical field, has a higher rate of return than Science, which is a scientific and technical field. The fact that the Plan Organization of Iran estimated a shortage of 7,580 high level managers during the Fourth Development Plan 1968-1972, supports these findings.[36] Literature and Humanities is considered as the least profitable field for individuals and Science as the least profitable field for society.

In comparing these results to the rates of return on investment in higher education in the United States, as calculated by Gary S. Becker and W. Lee Hansen,[37] we see a higher rate of return for Iran. The private rates of return for college graduates in the United States computed by Becker are slightly higher for 1959 and 1961. The internal rates of return to investment in schooling from grade 13 to grade 16 (college education) in 1949, for men in the United States estimated by Hansen are as follows: 10.2 for total

resource investment (social investment), 11.6 for private resource investment, before tax (private investment), and 10.1 for private resource investment, after tax (private investment). The possible explanation for this is the admission limitation in the Iranian universities and colleges, and also because of the lower income for persons holding only secondary diplomas without any additional training. As mentioned before, the Plan Organization recommendations regarding reduction in the rate of growth of secondary education have not been considered, because there have not been any limitations on secondary education. This unbalanced increase in the number of secondary school graduates has induced relatively lower earnings for them. With respect to the fact that at the present time the Iranian authorities responsible for educational planning follow the policy of developing the quality of higher education rather than its quantity, it can be hoped that at least for some years there will not be any over-production of highly educated manpower. Considering the growth of real per capita income, we recognize a higher rate of return for all fields.

Consideration of the budget constraint: Before deriving a conclusion from this study the following point should be mentioned. In the calculation of social rate of return the budget constraint on the allocated resources for educational investment has not been considered. It was assumed that there would be no investment on time zero, and the investment occurs over a period of time, starting at time 1. Therefore the investment on education was defined as costs of education and hence no fixed investment was considered in formulation and calculation. Taking the budget constraint in resource allocation to investment in education into account, some investment even in the time zero has to be considered. It means that a part of cost will be determined as fixed investment. In computation of R (internal rate of return) this has to be taken to the left part of the equation. Equation 5 will be put as follows:

$$6)\quad K = \sum_{t=1}^{T} \frac{E - C}{(1 + R)^t}$$

Where K is as fixed investment and the definition of other symbols are the same as in equation 5.

The differences between these two ways of calculation (through equation 5 and 6) will be reflected in the rate of return. In computing the rate of return through equation 5 the entire costs of education will be discounted by R (the internal discount rate) whereas by calculating through equation 6 the part of costs which has been considered as fixed investment, K, would not be discounted at all. This results in a lower rate of return in calculation through equation 6.

In order to get a clear view and have the above cited statement justified the social rates of return were calculated also through equation 6, in which a part of costs of education has been discounted by a discount rate of 8 per cent. In this calculation the costs of education during the period of investment (the period that the person is studying) have been discounted and put as fixed investment K. Table 10 shows the social rates of return obtained by this way of calculation and Table 11 shows the differences between the above mentioned ways of calculation.

One might argue that discounting the costs and using them as the fixed investment is against the concept of rate of return approach. The objective of this calculation has been to clear the following point that if some part of the cost of education is being considered as fixed cost, the rate of return would be lower than considering no fixed investment. Tables 10 and 11 show that where the discount rate, 8 per cent, has been close to rates of return there is no differences in rates of return. This indicates that if a discount rate the same as the rate of return were applied in each case, there would not have been any differences at all. Not considering any fixed investment, where it has to be, and putting all costs at the right hand of the equation would result in a higher rate of return. Now, if a rate of return is used in cross comparison of profitability of investment, the rates of return calculated with no consideration of budget constraint would have an unreal bias towards the educational projects.[38]

Conclusion

Estimates of social and private rates of return have

Table 10. Irān: Social rate of return for five fields of education (with fixed investment)

Fields of Study	0% Growth in real per capita Income			3% Growth in real per capita income			5% Growth in real per capita income		
	No A.A.(a)	60% Earn. diff.(b)	40% Earn. diff.(c)	No A.A.	60% Earn. diff.	40% Earn. diff.	No A.A.	60% Earn. diff.	40% Earn. diff.
Literature & Humanities	13.9	10.1	7.5	17.0	13.1	10.5	19.0	15.1	12.5
Science	13.1	9.4	6.9	16.3	12.5	10.0	18.4	14.6	12.0
Bus. & Pub. Administration & Econ.	16.1	12.1	9.2	19.5	15.1	12.2	21.5	17.1	14.2
Agriculture	12.8	9.2	6.7	16.0	12.3	9.8	18.1	14.3	11.8
Engineering	16.1	11.8	9.1	19.3	15.0	12.1	21.5	17.1	14.2

(a) No ability adjustment
(b) 60% differential in earnings due to education
(c) 40% differential in earnings due to education

Table 11. Irān: Differences in social rates of return obtained through two different ways of calculation, K = 0 K = x

Fields of Study	0% Growth			3% Growth			5% Growth		
	No A.A.(a)	60% E.D.(b)	40% E.D.	No A.A.	60% E.D.	40% E.D.	No A.A.	60% E.D.	40% E.D.
Literature & Hum.	1.4	0.4	0.0	2.1	1.0	0.4	2.6	1.3	0.7
Science	1.1	0.3	-0.1	1.8	0.8	0.3	2.3	1.1	0.6
Bus. & Econ.	2.4	0.8	0.2	2.9	1.5	0.7	3.6	1.9	1.1
Agriculture	1.0	0.1	-0.2	1.7	0.7	0.2	2.2	1.2	0.6
Engineering	2.1	0.8	0.1	3.0	1.4	0.7	3.5	1.9	1.0

(a) A.A. = ability adjustment
(b) E.D. = earning differentials

been presented under different circumstances and assumptions, upon which the following inferences can be stated:

1. The return to private investment in higher education in Iran is great enough to encourage individuals to invest in higher education for themselves. The lowest private rate of return is for Literature and Humanities when a 0 per cent growth in real per capita income and a 40 per cent earning differential are assumed. However, even under these conditions it is still worthwhile for the individual to borrow money at 10 per cent interest and invest in this field of higher education.

2. The social rate of return is lower than the private rate of return. But under most assumptions the rate of return is so high that social investment in this field can also be considered profitable.

3. The high private rate of return could easily induce a private over-investment if there were not any restrictions on admission to the universities and colleges. With respect to the unbalanced number of pupils at the secondary level and the rate of increase in the number of students at the higher level, only precise planning can prevent private over investment in some fields. It is hoped that the new system of education at the primary and secondary levels will reduce the unbalanced number of students at the secondary level. At the present time less than 3 per cent of the secondary school pupils are undergoing technical and vocational training.[39] The new system will create interest in and direct the pupils toward the technical and vocational fields required for the economic development of the country.

4. Business and Public Administration and Economics shows a higher rate of return, particularly on the social side. Engineering can be presented as the field with the highest private rate of return. The Benefit-Cost ratio and net benefit (B - C) for Engineering is higher than for Business and Public Administration taking these two criteria into account, even from the social point of view, Engineering is the most profitable field of investment among the five fields mentioned. The manpower forecast of the Plan Organization which shows shortages in high level managers(Table 4, p.10) and the rates of return calculated in this study

recommend a quantitative development of high level managers.

Notes

1. Fredrick H. Harbison and Charles A. Mayers, *Education, Manpower and Economic Growth*, New York, McGraw-Hill Company, 1964, p.13.
2. K. Eide, "Educational Development and Economic Growth in OECD Member Countries," *Economics of Education*, ed. by E. A. G. Robinson and J. E. Vaizey. New York, St. Martin's Press, 1966. p.174.
3. Mary Jean Bowman and C. Arnold Anderson, "Concerning the Role of Education in Development," *Readings in Economics of Education*, ed. by Mary Jean Bowman. Paris, UNESCO, 1968, p.120.
4. Burton A. Weisbrod, "Investment in Human Capital," *The Journal of Human Resources*, I, No. 1, Summer 1966,p.13.
5. Adam Curle, *Educational Strategy for Developing Societies*, London, Tavistock, 1963, p.88.
6. UNESCO, *UNESCO Statistical Yearbook of 1968*, Paris, UNESCO, 1969, pp. 297-333.
7. Weisbrod, *Op.Cit.* p.19.
8. Samuel Bowles, *Planning Educational Systems for Economic Growth*, Cambridge, Massachusetts, Harvard University Press, 1969, pp. 134-175.
9. T.W. Schultz, "The Rate of Return in Allocating Investment Resources to Education," *The Journal of Human Resources*, II, No.3,(Summer 1967),295-296.
10. Details follow under the title "Social and private benefit from higher education."
11. Arnold Anderson, "The Social Context of Educational Planning," Paris, International Institute for Educational Planning, UNESCO, 1967, p. 18.
12. The material for this chapter is largely taken from the following: Imperial Government of Iran, Plan Organization, *Fourth National Development Plan, 1968-1972*, Pt. 4, Tehran, 1968, Ch. 17, pp. 259-281. Imperial Government of Iran, Ministry of Science and Higher Education, *Universities and Institutions of Higher Education in Iran*, Tehran, 1969. UNESCO, *World Survey of Education*, Vol. IV, Paris and New York, UNESCO, 1966. UNESCO,

Statistical Yearbook, 1968, Paris, UNESCO, 1969.

13. Ministry of Science and Higher Education, *Universities and Institutions of Higher Education in Irān*, Ministry of Science and Higher Education, Tehran, Iran. Appendix pp. 13-15.
14. *Ibid.*, Appendix pp. 16-17.
15. Gary S. Becker, *Human Capital*, New York, Columbia University Press, 1964, p. 39; W. Lee Hansen, "Total and Private Rate of Return to Investment in Schooling,"*Readings in the Economics of Education*, ed. by Mary Jean Bowman, Paris, UNESCO, 1968, p. 487, Mark Blaug, "Approaches to Educational Planning," *The Economic Journal*, LXXVII, No. 306, June 1967. 265; and Mark Blaug, "The Rate of Return on Investment in Education," *Economics of Education* ed. by Mark Blaug, Baltimore,Penguin Books, 1968, p. 216.
16. Blaug, "Approaches to Educational Planning," *loc. cit.*
17. Before tax earning for calculation of social rate of return, and after tax earning for calculation of private rate of return.
18. Blaug, *Op.Cit.*
19. Hansen, *Op.Cit.*
20. Imperial Government of Irān, Ministry of Labour and Social Affairs, Research Group on Manpower Problems,*Study on Manpower Problems in Urban Communities in Irān*, Tehran, 1964, pp. 2317-2323.
21. A. Ahmadi, "Study of the Educational Situation of the Active Population in Iran," paper presented at the Seminar on Manpower Planning in Iran held by the Iranian Plan Organization and the European Institute of Economic Co-operation and Development, Tehrān, 1969.
22. According to the general census of 1966 of Iran, there were at that time 63,222 persons holding higher education degrees.
23. The General Office of Manpower of the Irānian Ministry of Labour and Social Affairs gives the number of government employees about 474,730.
24. With respect to the above figures and percentages in 1966 approximately 44,624 persons out of 63,222 persons holding higher education degrees were working in government services.
25. Imperial Government of Irān, Plan Organization, *Regulation for Employment of Contract Employees*,Tehran, 1969, p.5.

26. Usually a secondary school diploma can be earned by age 18 if the student enters primary school by age 6 and has 6 years of primary school and 6 years of secondary school.
27. The surviver rate for Japan has been used. See United Nations, Statistical Office, *Demographic Yearbook, 1966*, pp. 350-351 and 612-613, and *Demographic Yearbook, 1968*, p. 38. New York, United Nations, 1967, p. 38 and 1969.
28. Becker, *Op.Cit.*, p. 87.
29. Fred Hines, Luther Tweeten, and Martin Redfern, "Social and Private Rate of Return to Investment in Schooling by Race-Sex Groups and Region," *The Journal of Human Resources*, V. No. 3, Summer 1970. 333.
30. According to the Ministry of Science and Higher Education the number of applications for taking part in the entrance examination to universities and institutions of higher education for the academic year 1970-71 was 62,976; of those only about 8,975 could be admitted to all of the public universities, institutions of higher education under the supervision of the Ministry of Science and Higher Education, and the 2 private universities. The other institutions of higher education have their own entrance examination.
31. A. Ahmadi, *Op.cit.*, p. 4.
32. A. Ahmadi, *Op.cit.*, Table 15.
33. United Nations, Statistical Office, *Statistical Yearbook, 1968*, New York, United Nations, 1969. p.579; also the author's calculation.
34. The Imperial Government of Irān, Plan Organization, *Fourth National Development Plan*, Tehran, Iran. 1968.p. 273.
35. *Monthly Bulletin of Statistics*, Statistical Office of the United Nations, XXIV, No.7, July 1970, p.225.
36. See Table 4, p.11.
37. Becker, *Op.cit.*, p.128; and Hansen, *Op.cit.*, pp.497-500.
38. Cross comparison here has been used as comparison between the different sectors of economy such as education, health, transportation, etc.
39. Imperial Government of Iran, Plan Organization, *Fourth National Development Plan*, Tehran, Iran, 1968. p.263.