

ROLE OF EDUCATION AND TRAINING IN DEVELOPMENT*

Research Ass. M. Kemal BİÇERLİ

INTRODUCTION

Economic growth is a complex process that involves much more than physical capital formation alone. The buildings of modern nations depend upon the development of people and the organization of human activity. As technological developments have altered production techniques, types of mechanical equipment and varieties of outputs, society has begun to recognize that economic progress involves not only changes in machinery but also in man. Investment in people makes it possible to take advantage of technical progress as well as to continue that progress. That is, education can be considered as one of the main ways of providing improvement in the quality of manpower for economic growth. However, this does not mean that education will cure all the problems of society, but we think it will not be wrong to say that without education and training no cure for any problem is possible.

Although the precise measurement of education and training effects is still subject to debate, investment in education expands and extends knowledge, leading to advances which raise productivity and improve health.

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In this paper we tried to explain contributions of education and training to economic development. The first part of this paper includes introductory knowledge which is necessary to explain what the effects of education and training in development are. The second part attempts to explain contributions of education and training to economic development in terms of both agricultural and industrial growth.

PART ONE: THE ECONOMIC ANALYSIS OF EDUCATIONAL INVESTMENT

A. Historical Progress of the Idea of Investment In Man

Before starting to analyse educational investment economically, we think it is important to give a brief historical view of the idea of investment in man.

As an economic concept human capital is at least two centuries old but its incorporation into the mainstream of economic analysis and research is a new and lively development of the past three decades.

The concept that investment in human capital promotes economic growth actually dates back to the time of Adam Smith and early classical economists who emphasized the importance of investing in human skills. Adam Smith stressed the importance of education at various points in «The Wealth of Nations» and he specifically included the acquired and useful abilities of all inhabitants or members of society in his concept of fixed capital

“The acquisition of such talents, by the maintenance of the acquirer during his education, study or apprenticeship always cost a real expence which is a capital fixed and as it were, in his person. Those talents, as they make a part of his fortune, so do they likewise of that of the society to which he belongs” (1).

Another economist Alfred Marshall has also emphasized the importance of education as a national investment and according to his view investment in human beings was the most valuable capital (2). Marshall held that while human beings are incontestably

(1) Frederick Harbison-Charles Myers, *Education, Manpower and Economic Growth*, New York, Mc Graw-Hill Company, 1964, p. 3.

(2) Harbison and Myers, p. 5.

capital from an abstract and mathematical point of view, it would be out of touch with the market place to treat them as capital in practical analyses. Investment in human beings has accordingly seldom been incorporated in the formal core of economics, even though many economists, including Marshall, have seen its relevance at one point or another in what they have written.

Modern Economists, however, have not paid as much explicit attention to human resources in economic growth as some of the classical economists like Smith and Marshall did. Some modern Economists virtually ignored the human resource factor in economic development maybe because physical capital was measurable and a capital-output relationship was given an apparent quantitative respectability. But within past three decades a number of economists in the U.S. have called attention to the importance of human resources and particularly to investment in education. One of these economists is Theodore W. Schultz. According to Schultz, the failure to treat human resources explicitly as a form of capital, as a produced means of production as the product of investment has fostered the retention of the classical notion of labor as a capacity to do manual work requiring little knowledge and skill, a capacity with which according to this notion laborers are endowed about equally. This notion of labor was wrong now. Counting individuals who can and want to work and treating such a count as a measure of the quantity of an economic factor is no more meaningful than it would be to count number of all manner of machines to determine their economic importance either as a stock of capital or as a flow of productive services (3).

Schultz classified some of the important activities that improve human capabilities on five major categories: 1. Health facilities 2. On-the-job Training, including old style apprenticeship organized by firms 3. Formally organized education 4. Study programs for adults 5. Migration of individuals and families to adjust to changing job opportunities.

Edward F Denison is one of the other economists who did some computations about human capital. Both Schultz and Denison

(3) T.W. Schultz, «Investment in Human Capital», THE AMERICAN ECONOMIC REVIEW, Vol. 51, March 1961, p. 3.

have some computations about the trends of educational capital and growth of real national income between 1900-1957 (4).

As a result, the contribution of human capital theory to economics does not lie in a reformulation of economic theory but in pushing back the boundaries of economics beyond the sphere of market transaction. The application of the human capital concept to economic growth and to labor economics were initially pioneered independently. The concepts are the same problem: Individual economic growth at the micro level and growth of the economy at the macro-level.

B. Characteristics of Educational Investment

The main characteristic of educational investment is the difficulty of making an adequate investment decision in the field of education because this is a very long term investment which affects production several decades ahead. Indeed one of the most significant aspect of human investment lies precisely in the length of the gestation period. As an example it is obvious that medical doctors can not be created in a short period out of people with a low level of literacy (5). The gestation period can be varied within wide limits and one main problem from the point of view of growth is how far to prolong education with regard to its marginal effect on production. In comparison, while physical plant and equipment can be acquired or built quite rapidly, the development of significant and broadly based level of human capital of a nation is a lengthy process which involves profound social and cultural changes.

The other characteristic is that the human character of educational capital as distinct from that of real capital creates a special problem for analysis and policy. By educating students we create people better able to invent and innovate in the field of technology, political life, organization and culture. This will affect the trend of technology and production in a way that is unique, when compared with investment in other factors.

(4) We are going to give some numerical findings about these studies in the second part.

(5) Harvey Leibenstein, «Shortages and Surpluses in Education in Underdeveloped Countries», EDUCATION AND ECONOMIC DEVELOPMENT, Ed. C. Arnold Anderson and M. Jean Bowman, Aldine Publishing Company, Chicago, 1965, p. 52.

C. Criteria For Educational Investment

The main economic problem that all governments face with is how to allocate scarce resources between competing ends. These sources include capital, labor, land and other natural resources. The competing ends are consumption and investment. Here the choice between consumption, which satisfy needs and wants immediately, and investment, which creates the capacity to produce future goods and services, is a matter of time preference and is depend on society's objectives.

If expenditures on education are thought of as a kind of investment in human capital, then the allocation of resources to education becomes an investment problem in which rates of return to education must be compared with rates of return to alternative types of investments in guiding the commitment of scarce resource to new investment projects among them education (6).

While economists since Adam Smith recognized the importance of education as a type of private or social investment, only recently economists have undertaken rigorous conceptual and statistical examination of the evidence on costs, returns and rate of return to education.

The cost of education simply borne by the student or his parents consist not merely of tuition and other school expenditures, but also of foregone earnings. Similiarly the loss of what the student could have earned if he had spent the scholl years in gainful employment instead. Beyond early schooling, foregone earnings are the largest compenent of schooling cost (7). This opportunity cost must be considered in the evaluation of investmen projects, because every investmen decision involves a sacrifice of alternative opportunities. In investment decisions the justification for any must be that it will make the greatest possible. Therefore ihe choice of investment must be based on an analysis of the «external efficiency» of all competing uses of resources from the point of view of society's objectives as well as the internal effici-

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- (6) W. Lee Hansen, «Human Capital Requirements for Educational Expansion», EDUCATION AND ECONOMIC DEVELOPMENT, Ed. C. Arnold Anderson and M. Jean Bowman, Aldine Publishing Company, Chicago, 1965, p. 120.
- (7) Jacop Mincer, «Human Capital and Economic Growth», ECONOMICS OF EDUCATION REVIEW, Printed in Great Britain, V. 3, N. 3, p. 196.

ency of resource use. Both internal and external efficiency must be at a maximum level if the best use is to be made of scarce resources. In other words, investment choices must be based both on cost-benefit analysis, which is concerned external efficiency and on cost-effectiveness analysis, which measure internal efficiency (8).

Comparisons of rates of return to education with rates of return on other investments can indicate the desirability of existing allocations or of changes in them since equality of rates in all types of investments are required for a social optimum. From this point of view education itself maybe attractive and it may enhance future enjoyment of life, apart from the monetary gain. Employers pay higher wages to the more educated workers because their skill and productivity are seen and experienced as greater than that of less educated workers. In the absence of strong barriers to supply the wage differential translates into a rate of return comparable to those on alternative human or other investments. Increases in demand favoring more educated workers raise the rate of return on schooling inducing growth of enrollments until the increased return has been reduced back to an equilibrium level. However, we have to mention that there are some difficulties with the measures of the returns from education. First of all earnings at different educational or age level are not solely the result of formal education, but reflect on-the-job training, experience, differences in natural ability, social status, family income and the other factors. Another difficulty is that one level of education leads to another, so that comparisons of those with a primary education and those who lack it may underestimate the value of primary education as a stepping stone to further education.

D. Determining Optimum Level of Educational Investment- The Necessity of Planning Education for Economic Growth

Once we consider education as an investment we have to determine the optimum level of educational investment like we do for other types of investments to provide effectiveness in resource allocation. At this point some questions become important: education for what?, education for which occupations?, and education

(8) George Psacharopoulos and Maureen Woodhal, *Education for Development*, Oxford University Press, NewYork, 1985, p. 23.

until which point? From this point of view the length of education as well as the choice of the types of education has to be economically adjusted to the pattern of future production of the country concerned, whether underdeveloped or highly developed. The choice is complicated by the fact that labor with different types and levels of education is in a position of complementarity from a production point of view. Too many lawyers in otherwise underdeveloped environment will yield a low or even negative marginal return. Similarly the university engineers must be balanced against the number of lower level technicians. The marginal return of increasing the engineer density of the population may decline beyond a certain point, at least, if we extend the concept of growth beyond what is included in national accounts as production we should not presume that under all circumstances, the marginal return of higher education in art, humanities and social sciences is necessarily lower than that of education in science and technology (9). The conclusion at this point is obvious: «it is necessary planning education to determine the optimum level of educational investment and to obtain developmental targets of the society».

Because planning educational investment can be a topic for another research paper here, we just will give **brief information** to emphasize the relationship between determining optimum level of educational investment and planning education for economic growth.

Where general economic development plan exist, it is clear that educational planning must be related to the overall production targets established by the economic plan. But even in the absence of economic planning, education is in all countries primarily a public responsibility, and decisions with respect to the amount and nature of educational expenditures are continuously being taken by public authorities, presumably in terms of some conception of all the social goals that are to be served. It is important to mention that not only must there be educational planning but the nature of the problem dictates that this planning be long term. This is because there are significant time lags in the formation of human capital. To make educational plan firstly a country's needs for

(9) Ingvar Svernilson, «Education, Research and other unidentified factor in Growth», HUMAN CAPITAL FORMATION AND MANPOWER DEVELOPMENT, Ed. Ronald A. Wykstra, The Free Press, NewYork, 1971, p. 47.

education must be determined. In other words «educational requirements» to establish certain targets for social and economic development must be determined (10). Thus «timing» and «sequence» must be the essence of intelligent planning and attempts to impose uniform educational targets ignore the fact that the importance of educational investment will vary from area to area. In some areas agricultural development needs emphasis while in other areas the development of road networks may seem a more pressing need (11).

It is obvious that without planning education in some kinds of occupations will be over-invested while others will be under-invested. This situation causes to a problem that nowadays most of the countries such as India, Turkey, Spain .etc. have. This problem is called as «educated unemployed» (12).

PART TWO: CONTRIBUTIONS OF EDUCATION and TRAINING TO ECONOMIC DEVELOPMENT

A. Role Of Education and Training in Development

The education and training system has four major functions with respect to the labor market: (1) to prepare to work force to meet the nations job requirements (2) to facilitate adaption to structural change in the economy (3) to improve economic performance and (4) to promote more equal access to employment (13). The education received by a nation's labor force is everywhere recognized as one determinant of the level and rate of increase in its output per man or per man hour. There is however no consensus as to how important a determinant it is and no agreed way to find it. Nevertheless we can say that more education may contribute to growth in two distinct ways. Firstly it may raise the quality of the labor force, defined to include all occupations from the highest to the lowest. This may be presumed to increase labour producti-

(10) Herbert S. Parnes, *Forecasting Educational Needs For Economic and Social Development*, OECD, Paris, 1962, p. 12.

(11) Gabriel Carron-Ta Ngoc Chau, *Regional Disparities in Educational Development*, UNESCO, Paris, 1980, p. 35.

(12) For the example of unemployed trained in Spain see Morris A. Horowitz, *Manpower and Education in Franco Spain*, Archon Books, Hamden/Connecticut, 1974, p. 129.

(13) Peter B. Doeringer, *Work Place Perspectives on Education and Training*, Martinus Nijhoff Publishing, Boston, 1981, p. 2.

vity independently of any tendency for a larger number of educated people to speed the enlargement of the society's stock of knowledge relevant to production. Secondly an upgrading of the educational background of the population may accelerate the rate at which society's stock of knowledge itself advances (14). Educational background decisively conditions both the types of work a person is able to perform and his proficiency in any particular occupation. It has enhanced the skills of individuals within what is conventionally termed an occupation, often with considerable changes in the work actually performed; it has also permitted a shift in occupational composition from occupations in which workers typically have little education and low earnings toward education and earnings are higher. Education and training also heightens a person's awareness of job opportunities and thereby the changes that he is employed where his marginal product is greatest. A more educated work-force from top management to down also is better able to learn about and use the most efficient production practices.

From this point of view we can say that the effects of education and training are not limited to those who receive the schooling; others are often directly affected. We must therefore distinguish between the private benefits which accrue to individual students and the social benefits which accrue to all members of society. Some of the external benefits may be directly related to production. It has been observed that the better educated more likely both to invent and to innovate. Recent economic work on production functions suggests that the quality of labor measured by years of schooling completed, exerts a large and statistically significant influence on production. It is observed that well-educated labor is more productive than less-educated labor.

In addition, the behavior of firms which are willing to pay substantially more for a relatively well-educated workers suggests that they perceive some productive difference. Of course it may be that educated labor is not in fact more productive, and that the employment of educated labor at higher wages is some sort of irrational «conspicuous production» but if we accept the extreme view that education is not productive, we must be prepared to

(14) Edward F. Denison, «Measuring the Contribution of Education to Economic Growth», THE JOURNAL OF BUSINESS OF THE UNIVERSITY OF CHICAGO, April 1962, p. 42.

believe that in 1959 U.S. employers were willing to pay \$43 billion, or over a fifth of the total male labor earnings for the privilege of hiring labor with more than eight years of schooling for jobs that elementary school graduates could have done just as well (15).

Most economists and educators will accept the proposition that education makes some contributions to productivity. However, our knowledge of the relationship between education and productivity is still primitive. Here the answer lies not in the occupational skills transmitted by the schools, but in the ability of educational system to equip youth successfully to fill adult roles, occupational or otherwise. This socialization function of education accounts for the greater ability of the educated to cope with their entire environments. Successful performance of a job requires many of the same attitudes that are required for success in all roles; discipline ability to communicate and some basic reasoning capabilities. The school is particularly important as a socializing institution in many poor countries where training within the family and other traditional socialization agencies is inadequate for successful performance in the modernizing sector of these nations. However, as we mentioned before, the consequences of education will not always increase social and individual welfare. Negative effects, or costs associated with outputs rather than inputs, may be considerable important. Education and training may give rise to attitudes toward manual labor or work in rural areas that introduce rigidities into the labor market and contribute to the problem of the unemployment of educated labor thus reducing the allocative efficiency of the economy. Negative effects of a noneconomic type are undoubtedly important to some groups, particularly in countries under going a process of rapid modernization.

In conclusion, educational investment fulfills a number of society's vital objectives. First of all, it satisfies a basic human need for knowledge, provides a means of helping to meet other basic needs, and helps sustain and accelerate overall development. Education and training also provides essential skilled manpower for both the industrialized and informal sectors of the economy, provides the means of developing the knowledge skills and produc-

(15) Samuel Bowles, *«Planning Educational Systems For Economic Growth»*, Harvard University Press, Cambridge, Massachusetts, 1971, p. 23.

tive capacities of the labor force and acts as a catalyst in encouraging modern attitudes and aspirations. Even though some times there are some negative effects, like unemployment of educated labor, it is hard to deny the role of education and training in economic development. We think some examples that we are going to give in the next step will make more clear this positive effects of education and training in economic development.

B. The Link Between Education and Industrial Growth

As we mentioned before, human capital activities involve not merely the transmission and embodiment of available knowledge in people but also the production of new knowledge, which is the source of innovation and of technical change. Without new knowledge it is doubtful that larger quantities of existing physical capital and more widespread education and health would create a continuous growth in productivity on a global scale. In a fundamental sense, a modern economy is a result of the scientific revolution, that is, of the growth of systematized scientific knowledge.

The geographic origin and spread of the industrial revolution since 18th. century supports this view and the pivotal role of human capital in generating and facilitating it. The industrial revolution started with the scientific revolution in the northwest of Europe and spread most rapidly to those areas where educational development has made the transfer of technology most feasible. It is clear now that the process of growth and diffusion is worldwide. Human capital as embodiment of skills is a convenient conceptualization of its role as coordinate factor of production in its contribution to national economic growth. Human capital as a source of new knowledge shifts production functions upward and generates world wide growth (16).

In 1960's Schultz (1961) and Denison (1962) showed that education contributes directly to the growth of national income by improving the skills and productive capacities of the labor force. This important finding led to a flood of studies on the economic value of investment in education.

The early attempts to measure the contribution of education to economic growth were based either on the growth accounting

(16) Mincer, p. 20.

approach, used by Denison and others or on the rate of return to human capital, an approach adopted by Schultz and others. Growth accounting is based on the concept of an aggregate production function, which links output (Y) to the input of physical capital (K) and labor (L). The simplest form of production function assumed in many of these studies is a linearly homogenous production function $Y = f(K, L)$. The results of Denison's estimating procedure are as follows;

Table 1
ESTIMATES OF THE CONTRIBUTION OF EDUCATION TO PAST
AND FUTURE GRWTH OF REAL NATIONAL INCOME FOR THE
UNITED STATES

	1909-1929	1929-56	1960-80
Growth rate of total real national income	2.82	2.93	3.33
Amount of growth rate ascribed to education	0.35	0.67	0.64
Percent of growth rate ascribed to education	12.00	23.00	19.00
Growth rate of real national income per person employed	1.22	1.60	1.62
Amount of growth rate ascribed to education	0.35	0.67	0.64
Percent of growth rate ascribed to education	29.00	42.00	40.00

Source: Edward F. Denison «**Measuring the Contribution of Education to Economic Growth**», THE JOURNAL OF BUSINESS OF THE UNIVERSITY OF CHICAGO, April 1962, p. 35.

The calculations indicate that improvement in the quality of the labor force through additional education made a very large contribution to the United States growth rates in the period of 1929-1957, equal to 23 percent of the growth rate of total real national income and 42 percent of the growth rate of real national

income per person employed. According to the table, in terms of percentage points in the growth rates, the contribution was only about half as large in 1909-1929 and will continue at about 1929-1957 level in 1960-1980.

Denison's attempt to explain United States economic growth between 1910 and 1960 in terms of increases in labor and physical capital immediately established, however, that there was a large «residual» that could not be explained in this way. Therefore later studies which made by using both Denison's and Schultz's method found the contribution of education in the United States to be only 15 percent while that in other advanced countries varied considerably like shown in Table 2.

It can be easily conclude from the table that increased education of the labor force appears to explain a substantial part of the growth of output in both developed and developing countries since 1950. However, these estimates rest on a wide variety of theoretical assumptions that have been challenged. Recent attempts to use econometric techniques to relate inputs to output, nevertheless have again demonstrated the link between education and growth of output. For instance, one study which was made by Norman Hicks in 1980 for World Bank examined the relationship between growth and literacy as a measure of educational development and life expectancy for the period of 1960-1977 found that the twelve developing countries with the fastest growth rate had well above average levels of literacy and life expectancy.

Table 3 shows that not only literacy levels rise with the level of national income, but these twelve countries have higher levels of literacy and life expectancy than would be predicted. In the case of Korea and Thailand, for instance, the considerable difference between actual and expected literacy levels suggests that rapidly growing countries have well developed human resources

However all the studies which we have mentioned so far fail to prove causality; educational expansion may be a result of economic growth rather than vice versa. Some economists have worked on this causality, though. Peaslee (1967), for example, draws on historical and contemporary data to show that sustained economic growth was not achieved in his sample of countries until 10 percent of the population was enrolled in primary school. Ramos

Table 2.
THE CONTRIBUTIONS OF EDUCATION TO ECONOMIC
GROWTH

COUNTRY	PERCENTAGE CONTRIBUT. TO ANNUAL GROWTH RATE
NORT AMERICA	
Canada	25.0
United States	15.0
EUROPE	
Belgium	14.0
Denmark	4.0
France	6.0
Germany, Fed. Rep.	2.0
Greece	3.0
Israel	4.7
Italy	7.0
Netherlands	5.0
Norway	7.0
United Kingdom	12.0
U.S.S.R.	6.7
LATIN AMERICA	
Argentina	16.5
Brasil	3.3
Chile	4.5
Columbia	4.1
Ecuador	4.9
Honduras	6.5
Mexico	0.8
Peru	2.5
Venezuela	2.4
ASIA	
Korea, rep. of	15.9
Japan	3.3
Malaysia	14.7
Philippines	10.5
AFRICA	
Ghana	23.2
Kenya	12.4
Nigeria	16.0

Source: Psacharopoulos, p. 18.

Table 3. Economic Growth and Life Expectancy, Selected Economies

Economy	Growth rate, 1960 - 77 (percent)	Life expectancy, 1960 (years)	Deviations from expected levels	Deviations from expected levels
			of life expectancy (years)	Adult literacy, 1960 (percent)
Singapore	7.7	64.0	3.1	n.a.
Korea, Rep. of	7.6	54.0	11.1	71.0
Taiwan	6.5	64.0	15.5	54.0
Hong Kong	6.3	65.0	6.5	70.0
Greece	6.1	68.0	5.7	81.0
Portugal	5.7	62.0	4.7	62.0
Spain	5.3	68.0	1.8	87.0
Yugoslavia	5.2	62.0	4.7	77.0
Brazil	4.9	57.0	3.0	61.0
Israel	4.6	69.0	2.0	n.a.
Thailand	4.5	51.0	9.5	68.0
Tunisia	4.3	48.0	-0.5	16.0
Average: top 12	5.7	61.0	5.6	64.7
Average: all	2.4	48.0	0.0	37.6

n.a. Not available.

a. Growth rate of real per capita GNP.

SOURCE: PSACHAROPOULOS, p. 17.

(1970) also found that in Latin America rapid growth in manufacturing output between 1960-1970 was based on significant improvements in the quality of the labor force. Obviously these two studies also support the findings of previous studies showing that there is a causality from education to development (17).

C. The Link Between Education and Agricultural Development

A major concern of agricultural development in newly developing countries is to promote the transformation from traditional to modern agriculture. Traditional agriculture is in large part subsistence, self sufficient farming. But the more agriculture modernizes, the more it ties in with the economy of adjacent urban areas of the nation and even of foreign countries. Many of the personnel needs for modern or modernizing agriculture are off the

(17) Lyn Squire, *Employment Policy in Developing Countries: A Survey of Issues and Evidence*, Oxford University Press, New York, 1981, p. 194.

farm. Just as essential to efficient modern farming as the tiller of the soil himself are the suppliers of necessary inputs, such as fertilizers, seeds, insecticides and implements and the marketers and processors of farm product. An education and training program to aid in the modernization of agriculture especially if it is directed not only at agriculturalists in the narrow sense but also at personnel for agriculture related industries and services in the villages, towns and cities has positive effect on agricultural education and developmental education can be considered to effect agricultural progress.

The first one is the education of farmers. By farmers we mean those persons who work the land to grow crops, operators, tenants ..etc. There is growing evidence of the importance of links between educational investment and the productivity of farmer. To make clear the effect of education on agricultural development we can see the relationship between the stages of agricultural technology and educational requirements from table 4.

As we can see from table 4 traditional farming where techniques are handed from father to son requires little or no formal education. The second stage involves to use of a single modern input, for example, the utilization of fertilizer required to have rudimentary literacy and knowledge of addition, subtraction and division. In the third stage, which is the stage of fully improved technology, the farmer should take his own initiative requires an understanding of long division, multiplication and other mathematical procedures, ability to read and write; and rudimentary knowledge of some chemical and biological principles. Finally full irrigation-based farming, which is the fourth stage, requires farmers to calculate the effects of changes in crops, climate, to understand basic concepts drawn from chemistry, biology, physics ...etc. Here the important point is that agricultural education and training of farmers must include not only instruction in new techniques but also information on new and profitable cash crops and potential local markets. Such agricultural education and training must be directed towards the farmer himself and not towards school pupils (18).

(18) Philip J. Foster, «The Vocational School Fallacy in Development Planning», EDUCATION AND ECONOMIC DEVELOPMENT, Ed. Arnold Anderson and M. Jean Bowman, Aldine Publishing Company, Chicago, 1965, p. 159.

Table 4.

FOUR BASIC STAGES OF AGRICULTURAL, PRODUCTIVITY AND THEIR LEARNING REQUIREMENTS

farmer-entrepreneurs technology level	Agricultural inputs	Minimum learning requirements
Level A:		
Traditional farming	local varieties of seeds and implements	addition and subtraction
Level B:		
Intermediate technology	Small quantities of fertilizer.	addition and subtraction division and rudimentary literacy
Level C:		
Fully improved technology	high - yielding varieties: proven seeds, seed rates/acre, fertilizer rates/acre, pest control rates/acre	Multiplication long division and other more complex mathematical poc. reading and writin. rudimentary knowledge of chemistry and biology
Level D:		
Full irrigation - based farming	all above inputs: tubewell access during the off - season and water rates/acre	Mathematics independent written communication, high reading comprehension ability to research unfamiliar concepts, elementary biology, chemistry etc.

Source: Stephen P. Heyneman, "Improving the Quality of Education in Developing Countries", FINANCE AND DEVELOPMENT, March 1983, Vol. 20, Nu. 1, p. 19.

The second area in which general education and developmental education can be considered to effect agricultural progress is the education of those serving farmers directly: such people as extension agents, district agricultural officers, community development

experts and so forth. The level of training and education required by extension agents is basically determined by the level of technical competence and economic skill of the farmers being served. If the average level of the farmer is low, the technician does not require as much subject matter technical training as if the average level of farmers is high.

The third area is the education of those serving farmers indirectly: businessman who buy and sell goods produced or used by farmers, manufactures who produce items used by farmer in production ...etc.

Fourth, the education of those who are leading the farmers by making policies. The leader and policy makers for agriculture include not only the members of political parties involved in the legislative process but also the top stratum of the government, ministries, agencies, bureaus ...etc. These persons affect farmers and agricultural growth in the early stages lagely through the policies and programs which they formulate for agriculture.

At this point, an attractive example can be given from Denmark to show what education and training can do for agricultural development. In rapid succession in the mid-nineteenth century Denmark lost land and national prestige in the wars against Prussia an then grain markets and prosperity as the New World prairies were opened up and the Atlantic freight rates were slashed. Yet in this period the Danish residential colleges were started and thrived and the Danish peasant who had been described as unprogressive, sullen, suspicious, averse to experiment and incapable of associated enterprise became forward-looking cheerful, scientifically minded, resourceful and cooperative. A Danish Education Inspector remarked in the early days how quickly the young man and women learned: he was impressed not so much by the knowledge they have acquired as by the fact that, they leave the schools different: people, having learned to hear, to see, to think and to use their powers. These became the young peasant farmers who within a generation transformed Danish agriculture into the most efficient butter and bacon producing economy in the world. The peasant helped himself. He adepted his methods to the new circumstances. He was open to new ideas and willing to apply them. The mobility, the capacity and the culture that such a radical change calls for, when it is to be made by voluntary effort, the Danish

peasantry then possessed, and this fact is certainly due to the influence of the Danish Folk High Schools (19).

SUMMARY

Since the time of Adam Smith, economists have known that people are an important part of the wealth of nations. However, «human capital» and «education» concepts did not get enough attention from the modern economists up until 1960's. The main reasons for this lack of interest were our values and beliefs which inhibit us from looking upon human beings as capital goods, except in slavery. In 1960's this faulty reasoning had ended by some economists like Theodore W. Schultz, Edward F. Denison, Frederick Harbison .etc. proving that improvement in the quality of labor force through additional education made a very large contribution to economic growth.

Once we consider education as an investment we have to determine the optimum level of educational investment to provide effective resource allocation. This need requires to have an educational planning. since education is a very long term investment this planning should be long term. Also the rates of return to education must be compared with the rates of return to alternative types of investments.

Education and Training may contribute to growth in two different ways. Firstly, it may raise the quality of the labor force which may be presumed to increase labour productivity. Secondly an upgrading of the educational background of the population may accelerate the rate at which society's stock of knowledge itself advances. Empirical researches have showed that there is a link between educational expansion and both agricultural and industrial growth. According to Denison, for instance, percent of growth rate ascribed to education in the U.S.A. was 23 between 1929-1956. Ramos also found that in Latin America rapid growth in manufacturing output between 1960-1970 was based on significant improvements in the quality of labor force through education.

(19) Eugene Staley, *Planning Occupational Education and Training for Development*, Praeger Publishers, New York, 1971, p. 43.

Education and training can also make contribution to agricultural development by helping to the transformation from traditional to modern agriculture. Agricultural education and training reduces fertilizer using to the optimal point as well as it may also give knowledge about pest control/acre, water rates/acre .etc. which are the sources of agricultural growth. Studies in Korea, Malaysia, Nepal and Denmark demonstrate that education increases the physical productivity of farmer.

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