

## **HUMAN CAPITAL FOR SUSTAINABLE ECONOMIC DEVELOPMENT**

**G. Edward Schuh**

*Humphrey Institute of Public Affairs, Minneapolis, USA*

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### **Summary**

Human capital refers to the various dimensions of the human being that yield services or income over time, and refers to the various qualitative dimensions of human beings, in contrast to their ability to deliver physical labor. These dimensions include education, vocational skills, nutritional status, health, culture, and values. More inclusively, they also refer to knowledge and institutional arrangements, both of which are sometimes defined as social capital. We consider human capital to be every bit as important an element of sustainable development as is the physical environment, both because human capital is the major source of economic growth in modern economies, and because that capital can depreciate and become obsolescent in the same way as physical or tangible capital.

The characteristic pattern of the economic development process is that countries or regions start from a situation in which the bulk of their resources are comprised of unskilled labor, land, and physical or conventional capital. As the development process proceeds, an ever-increasing share of a nation's resources is accounted for by human capital in all its dimensions. Investments in human capital, and especially in the production of knowledge, are therefore not subject to diminishing returns.

This chapter is divided into four main parts: (1) a brief historical overview of the

evolution of the concept of human capital; (2) a discussion of how human capital contributes to economic development; (3) the household as the producer of human capital; and (4) a discussion of some of the issues that arise from considering human capital as a source of economic growth and development.

## 1. Introduction

Capital, broadly defined, is anything that yields a stream of services or income over time. It is a produced means of production, used for further production in the economy.

Human capital, for its part, refers to the various dimensions of the human being that yields services or income over time, and tends to refer to the various qualitative dimensions of human beings, in contrast to their ability to deliver physical labor. These dimensions include education, vocational skills, nutritional status, health, culture, and values. More inclusively, they also refer to knowledge and institutional arrangements, both of which are sometimes defined as social capital. We prefer to include them as human capital, since they are imbedded in the human agent, and in the case of institutional arrangements, govern the way individuals in the society relate to each other.

Sustainable development, from our perspective, refers to economic development which sustains the welfare – or *per capita* incomes – of a population. Sustainable development as a concept had its origins in concerns about the environment, and for many observers refers to sustaining and protecting the environment as the means of sustaining economic development. We consider human capital to be every bit as important an element of sustainable development as is the physical environment. We take this perspective because human capital is the major source of economic growth in modern economies, and because that capital can depreciate and become obsolescent in the same way as physical or tangible capital. These concepts will be further elaborated below.

This paper is divided into four main parts: (1) a brief historical overview of the evolution of the concept of human capital; (2) a discussion of how human capital contributes to economic development; (3) the household as the producer of human capital; and (4) a discussion of some of the issues that arise from considering human capital as a source of economic growth and development. At the end there will be some concluding comments.

## 2. Historical Evolution of the Concept of Human Capital

This historical overview is of necessity brief and selective. The objective is to show how the important dimensions of the concept emerged over time.

Human capital in the narrow sense that refers to the innate skills and abilities of human beings has a long history in the study of economic development, although it is only in recent decades that it has been referred to in that way. Adam Smith, in the *Wealth of Nations* (1776), gave a great deal of attention to the skills and abilities of a nation's population and to the entrepreneurial skills of the owners and managers of its

enterprises. Later, Alfred Marshall (*Principles of Economics*, 1890) also emphasized these same issues.

The Great Depression of the 1930s shifted the focus of the economic community to an analysis of economic stagnation, recovery, and stabilization. John Maynard Keynes was the intellectual leader of that period with his *General Theory* (1935). The world then became engaged in World War II, and economists in the developed countries, at least, focused on the issues associated with that conflagration.

As the post-World War II period emerged into economic recovery and sustained growth appeared to be feasible, the importance of stagnation and stabilization receded in relative importance. Economists turned once again to the analysis of economic growth. In the beginning, their analysis was strongly influenced by the emphasis on physical or conventional capital the Keynesian analytical framework had brought to the fore, with its investment functions, consumption functions, and the sum of consumption and investment as the determinants of national income.

The rediscovery of human capital in the modern literature is associated with the efforts of analysts to understand the growth over time in labor productivity in the U.S. economy. To the considerable surprise of many imbued with the Keynesian perspective, these analysts found that the stock of conventional capital explained little of that growth. That posed a significant challenge to students of economic growth and development.

Another important insight came from Robert Solow (1957) and his estimates of the aggregate production function for the U.S. economy. Solow found that when he estimated the parameters of that production function with cross sectional data for a given year, that production function underestimated realized growth in the economy when data from a later year were used to make projections into the future. Solow referred to the difference between projected and realized output as a residual and attributed it to technological change. At the time, the technological change was described by many as an “ignorance variable”, since so little was known about it.

With Solow's discovery, however, the search began to identify the source of the gap – to identify our ignorance, so to speak. Much of the ensuing work was done by agricultural economists, who distinguished themselves with empirical research, as well as at the University of Chicago, under the intellectual leadership of the late Nobel Laureate in Economics, Theodore W. Schultz. Parallel work at the University of Chicago by Gary Becker, another later-to-be Nobel Laureate in Economics, who pioneered the development of the new household economics, also contributed importantly. The new household economics became important because much of a society's human capital is produced in the household (see below).

Zvi Griliches contributed greatly to flesh out the issues surrounding technology. Much of Griliches' early work was on agriculture, but he later broadened his work on technology and technological change to include the study of patents and patenting behavior. His work on agriculture, and the work of others in this field such as Hayami and Ruttan, are useful because they illustrate how some of the ideas on human capital

evolved over time.

Griliches' first contribution (1957) was from his PhD dissertation at the University of Chicago, in which he investigated the social rate of return to investments in hybrid seed corn research. Using a standard project analysis approach and treating the expenditures on agricultural research as an investment, he obtained the startling result that the external social rate of return was 700 percent. Each dollar expended yielded a stream of income over time of \$7 per year!

It turned out that the use of the external rate of return was inappropriate since the measured income stream changed directions over time. However, this research attracted attention to the potentially high social rate of return to investing in research. (The internal rate of return Griliches found was a more modest, although still attractive, 35-45 percent.) Griliches' research led to a long series of studies of the rate of return to public investments in agricultural research from studies all around the world. That research consistently shows high social rates of return, ranging to 100 percent and more.

Recognizing that hybrid seed corn was essentially an improvement in quality compared to open-pollinated seed, Griliches eventually turned to the more difficult analysis of improvements in the quality of machinery and equipment. With this research he demonstrated that much of new knowledge and technology is imbedded in modern inputs. In the case of machinery and equipment, most of the R & D effort is done in the private sector.

Prior to his work on machinery and equipment, Griliches tried to understand why fertilizer consumption was growing so rapidly in the United States, a phenomenon that was widely interpreted as a technological change in agriculture. He found that the consumption of fertilizer was increasing in large part because of a dramatic decline in the real price of fertilizer. That decline, for its part, was due in large part to technological innovations in the *fertilizer industry*. This was another important new insight.

Later, drawing on the research of Schultz and others on education, Griliches drew this research together by estimating the parameters of an extended production function for U.S. agriculture (1963). The production function was extended by introducing additional variables such as education, and by correcting for the change in quality for the conventional physical capital inputs. When he analyzed the growth in agricultural output over time he found that he could explain almost all the increase in output by the included variables. In other words, the Solow residual had disappeared. The sources of the gap had been identified for this sector of the economy, and they were found to be due to investments in human capital and in improvements in the quality of the conventional inputs. This was a significant contribution to our understanding of economic growth and the role of human capital.

Another finding from Griliches' work with the aggregate production function was that the coefficient for education in his Cobb-Douglas production function was identical to the coefficient on the conventional labor variable. That indicated that education and

conventional labor were perfect substitutes. The significance of this was that the number of workers in agriculture had declined significantly over time, while the schooling of the labor force had increased significantly. In effect, the education of the labor force was offsetting the reduction in conventional labor – an important finding for the analysis of economic growth.

Consider now the contributions of Theodore Schultz. One of his important contributions was an early attempt to understand the growth of U.S. agriculture. Without the use of a formal aggregate production function, Schultz was able to attribute much of the residual gap to investments in agricultural research and to changes in the quality of the agricultural labor force. He produced one of the first estimates of the social rates of return to such investments.

Professor Schultz is best known for his pioneering work on education or formal schooling (1961). His was the first modern treatment of the economics of education. He argued that education is an investment good, not a consumption good as had been conventionally assumed, and addressed the economics of these investments. He also made estimates of the social rates of return to such investments, and found them to be relatively high.

A large stream of literature has ensued on the economics of education. The treatment of education as an investment good has contributed significantly to our understanding of economic growth. Becker's (1965) work on human capital provided the analytical framework for understanding investments in education, but also an analysis of on-the-job training, vocational education, and other forms of human capital.

Schultz's book *Transforming Traditional Agriculture* (1964) was another important contribution to understanding the role of human capital in agricultural modernization and development. He argued that the traditional agriculture of the developing countries was poor not because the producers did not use their limited resources efficiently, but because they were in a low-level equilibrium trap. The way out of this trap was to invest in agricultural research to produce the technology for a modern agriculture, and to invest in the education of the agricultural labor force.

Another contribution of Schultz was his analysis of economic disequilibria. He argued that the elimination of these disequilibria can be an important source of economic growth. Moreover, the innate abilities of the population, plus the cognitive skills acquired through schooling, provide the means for reducing or eliminating these disequilibria.

Hayami and Ruttan (1971, 1985) also contributed importantly to our understanding of agricultural modernization and economic development. Their 1971 edition is based on an induced innovation model which argues that biological and mechanical innovations ease the production constraints implied by inelastic factor supplies of land and labor (the primary inputs), respectively. Biological innovations facilitate the substitution of fertilizer for land; mechanical innovations facilitate the substitution of capital for labor.

This induced innovation model, which puts human capital in the form of new

production technology and education at the heart of the modernization process, can explain the completely divergent growth paths of economies as disparate as Japan (labor-abundant) and the United States (land-abundant). It is also capable of explaining much of the disparate growth rates of agriculture in a large number of countries around the world.

The first edition of their book also emphasized the necessary institutional arrangements (an additional form of human capital) to bring about the process of induced technical change. In their 1985 edition they carry this analysis forward by developing a theory of induced institutional change. The Hayami-Ruttan analysis, with its emphasis on human capital, is now the most widely accepted interpretation of agricultural development. It is also the most widely used framework for guiding policy for agricultural development.

In addition to his work on human capital, Becker also contributed to the literature on human capital with his work on the new economics of the household (1981, 1991). This significant contribution is derived from his earlier analysis of the allocation of time, and is rich in its analytical framework for studying the allocation of resources (including the time of members of the household) within the household and of how the members of the household relate to the market economy.

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### **Biographical sketch**

**G. Edward Schuh** is Regents Professor of International Economic Policy at the University of Minnesota, and Orville and Jane Freeman Professor of International Trade and Investment Policy at the Humphrey Institute of Public Affairs in Minneapolis. He has contributed internationally as an educator, administrator, adviser, consultant, and author in the areas of economics and agriculture, with particular interest in subjects including agricultural and food policy, economic development, international trade, and exchange rate policy. His work has included extensive travel throughout the world with particular emphasis on South America and Latin America. He is the author or co-author of six books, has edited an additional six books, and has over 100 technical and scientific papers to his credit.

Schuh chairs the Board for International Food and Agricultural Development, which advises the Administrator of the U.S. Agency for International Development. Schuh also chairs the University of Minnesota Rural Development Council, and is a member of the Board of Trustees of the International Food Policy Research Institute.

He has also served as program advisor to the Ford Foundation in Brazil, as senior staff economist on President Ford's Council of Economic Advisors, as Deputy Under Secretary for International Affairs and Commodity Programs at the US Department of Agriculture, and as the World Bank's director of agriculture and rural development.