

The Triumph and Tragedy of Human Capital: Foundation Resource for the Global Knowledge Economy

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Farewell Address

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Introduction

We enter the 21st century in the early phase of a fundamental transformation of the global economy. The industrial economy of the 20th century is being transformed into an information and knowledge economy. This is changing the character of local, national and international economic, social, cultural and political activity. European Union (EU) integration and the drive to create European, as opposed to national policies, technologies and markets is just one illustration of these changes.

The primary forces driving this transformation are dramatic changes in technologies, policies and markets – the combination of the development and increasingly pervasive applications of information and communication technologies and services (ICT) on the one hand, and the world-wide movement to market liberalisation and deregulation on the other. The conversion of telecommunication (telecom) networks and all forms of communication and information content to digital standards is creating an electronic network foundation that facilitates exchanges and transactions of all kinds. Electronic commerce and the next generation Internet represent the next step in this process. Together with liberalised markets and reduced barriers to trade, this will ensure the 21st century knowledge economy is primarily an international, or even global economy. The research, teaching and extended training and policy advisory activities at the Economics of Infrastructures section that I had the privilege of establishing in the Faculty of Technology, Policy and Management, Delft University of Technology (TU Delft) five years ago is contributing to a better understanding of these issues.

In an agricultural economy, land is the most valuable resource attracting investment capital. In an industrial economy, manufacturing plants and machinery are the focal point of investment activity. In the knowledge economy, the expectation is that people will be the central resource attracting investment because knowledge is essentially produced, stored and applied by humans. Whereas the industrial economy was an era of physical capital with labour employed to facilitate its needs, the knowledge economy is expected to be an era of human capital with investment in the skills, competences and capabilities of people being the central activity.

This suggests that the knowledge economy will provide for a considerably higher level of human development than the industrial economy, for the conversion of what we know as the “labour force” into “knowledge workers”, and for a significant expansion in investment in education, training, research and development – the major formal knowledge generating activities. It also suggests a more widespread distribution of the wealth generated in the knowledge economy because the human resources attracting this increased investment are also workers and consumers.

In this presentation I wish to examine two aspects of the idea of human capital in a knowledge economy. The first is how efficiently existing human capital is being allocated and used, and the direction of policy changes necessary to improve it. The second, following directly from the first, is how established knowledge institutions, such as the Delft University of Technology, can meet the challenge of building the human capital needed for the 21st century knowledge economy. The success of the knowledge economy may depend critically upon the ability of knowledge institutions to adapt to the rapidly changing environment, and produce human capital and knowledge output that generates a high level of economic productivity.¹

*The future has a hard substantiality
and may be even more intelligible than the past.
It is, of course, the present that is hardest to understand.*

– Charles Van Doren
A History of Knowledge

The Allocation of Resources in the Industrial Economy

The Accomplishments

In many respects the economic well-being of people today is better than at any time in human history. Indicators of the number of people employed, average wealth, income, gross national product, real wage rates, life spans, health, unemployment and welfare benefits, in most developed countries are greater than they have ever been. Average levels of literacy, education, training and skill development are higher than they have ever been. More people go to university than ever before. A significant level of human capital is clearly evident in advanced economies, and large investments in building human capital are being made continuously. The historical evolution of the typical worker from the peasant farmer to the blue collar factory worker, to the white collar administrator, and now preparing for the knowledge worker, provides evidence of a triumph of human capital and individual development through a series of very different techno-economic systems.

Resources and Markets Under Capitalism

The idea of "capital" of course is a central concept of capitalism, the overwhelmingly dominant economic system in the world today. Capital refers to valuable endowments that can be applied for a productive purpose over a future time period, what we might more readily recognise as assets. The allocation of capital to its most productive uses is done primarily through the interaction of supply and demand in markets. Traditionally many industries and markets have been regulated by national governments for a variety of reasons, primarily to protect domestic producers and employment in particular industries. However, the global trend to increasing deregulation of markets, at the same time as information and communication technologies and services are facilitating the expansion of markets to global dimensions, is dramatically increasing the role of markets in allocating money capital as well as the production and sale of goods and services on a global basis. Throughout the history of capitalism the priority resource for efficient allocation through markets has been money capital. Precious little money capital lies idle (in mattresses or safe deposit boxes) when there is interest to be earned or profits anticipated from investment. The unemployment rate of money capital is less than one percent and global markets now facilitate the instant transfer of money capital around the world to the point where it can destabilise national currencies and entire national economies, as most recently illustrated in Argentina.

The second most important resource in industrial capitalism has been physical capital, i.e., the production facilities of industry and other inanimate physical assets that we can see and touch, like the building we are in or your personal computer. Although investments in physical capital are always made with expectations of efficient and profitable use, the uncertainties of demand, unexpected competition, the business cycle and other factors sometimes create inefficiencies, wasted resources and bankruptcies. But even here, in the vast majority of cases the remaining value for future productive use stimulates careful attention to the preservation and enhancement of the physical capital assets. The lost investment from the abandonment of physical capital assets – as illustrated by derelict plants and buildings – as a percentage of the total investment in physical capital assets is relatively small, although in a global market this can be devastating to specific localities and even small countries.

To illustrate, a few years ago the utilisation and profitability of telecommunication long distance transmission capacity in the US, Europe and across the Atlantic was high, and expectations for explosive growth and continued technological improvement great, so that capacity was expanded by several orders of magnitude using the most advanced fibre optic cable. Today there are a number of bankrupt companies and substantial excess capacity waiting to serve the growth in demand that now has been postponed to a more distant future. The value of these assets is a lot less than anticipated, but they are still valuable physical capital. They are still assets and very serious attention is being paid to preparing these unemployed but valuable assets for future productive use. Comparable attention is not being paid to the associated excess capacity created in the human capital employed by the bankrupt companies. These human assets are being abandoned by the old and new owners in great numbers, without regard to their capabilities for future production.²

Under industrial capitalism, the efficient allocation and use of the labour resource has been a third tier consideration for several reasons. First, the major demand has been for unskilled and low skilled labour for which there generally has been an ample supply. Shortages in one country can be met by immigration from another. Second, the societal rejection of slavery and indentured service has removed the property rights in direct ownership of labour in most parts of the world, so organisations do not consider employees as assets. Not only can employees leave an employer on short notice, they can be dismissed on short notice – particularly in relation to the long lives of investments in physical capital. Physical capital assets are a fixed cost. Labour costs are variable and flexible. The labour resource bears the primary uncertainty and inefficiency imposed by market instabilities.

The essential characteristics of human freedom make it difficult to capture the value of investments in human capability as a property right of an investor or an institution. Even organisations that are totally devoted to investment in human capital, such as this university and others, only recognise physical assets in their balance sheets. The faculty and students, the quality of whom determine a university's output, productivity and reputation, are not counted as assets, although the funds they attract to the university for long term research, and the equipment those funds buy, will be counted. I note that as my human capital is being withdrawn from this university on this occasion, there will be no decline in the value of the university's assets. To my smiling colleagues, I call to your attention to the fact that the university's asset list does not even recognise you are here.

This differential treatment of money capital, physical capital and labour or human capital under industrial capitalism has meant that less attention is directed to the efficient use of labour than to the other resources. Despite the enormous achievements in what I have called the triumph of human capital, there are some demonstrable inefficiencies in labour markets that are not only wasting potentially valuable human resources, but also contributing to significant human misery.

The Market for Human Capital

Employment and Unemployment in the EU

Economically these are good times in Europe, and in The Netherlands in particular. The economy is doing very well, unemployment has been reduced pretty much to what economists call the “natural rate of unemployment”, i.e., the minimum achievable in a dynamic economy, and there are even labour shortages in some areas. This means that an unemployment rate of about 5% and a half million people in The Netherlands, and 9% and 17 million people in the European Union is about as good as can be expected. The natural rate of unemployment in a full employment EU economy is an unemployed labour force a little larger than the population of the Netherlands, and growing faster (OECD 2001).

The youth of today represent the backbone of the knowledge economy of tomorrow. If one unpacks the aggregate statistics, and looks particularly at youth employment, i.e., people under 25, the statistics tell a very different story. Across Europe, youth unemployment is typically two to three times average unemployment rates, and sometimes higher. After implementing a massive program to reduce youth unemployment between 1995 and 2000, that is now being marked for its outstanding success, Spain reduced its youth unemployment from 40 to 28%.

If we examine the definition of employment that is used in gathering these statistics, we will note that governments have sought to get employment numbers up and unemployment numbers down over the years, and the definition of employment has expanded to include part-time employment and relatively short-term employment, especially as women have been more active in the labour force. In The Netherlands, about 30% of employment is part-time, almost twice the EU average. And a third category of people has been created for those not actively seeking work – usually because of a lack of success in previous efforts – who are considered to be employable, but are not counted in the unemployment statistics. In addition, among those in employment, a significant percentage of people are not in positions that utilise their basic skills and training. They have jobs, but their existing human capital is not being used most productively.

All of these factors suggest that even under current conditions of relative full employment, there is a massive underemployment of human capital capability in The Netherlands and the European Union, a level of underemployment that, if applied to physical capital or money capital would be considered a massive depression. A similar story can be told from the statistics of other developed countries.

The Global Labour Market

But the knowledge economy is increasingly a global economy. Resources and markets for this economy must be examined on a global basis. I need not recite to you the dismal state of employment in most developing countries, where official unemployment rates of 20% are considered pretty good and 40% common.

Youth unemployment is alarming. About half the world's population is under 25 years of age. The International Labour Organization (ILO) estimates that 66 million young people are unemployed in the world, about 41% of total unemployment. Across Latin America, youth unemployment rates range from 36% to 66%. Comparable statistics are reported for Africa, the former Soviet Union countries and even southern Europe. Even with significant economic growth in the world economy between 1995 and 2000, world youth unemployment increased by 8 million. (ILO 2000a).

Despite the fact that a significant number of the most skilled people in many developing countries have been attracted to the developed countries to meet skill shortages there, and the existence of large informal and black economies functioning in developing countries, the available evidence indicates that the underemployment – i.e., unused and under-utilised skills – of people is also far greater than it is in developed countries. Today there are more refugees in the world than at any time since the second world war. The vast majority of these refugees are economic refugees, people looking for jobs to sustain a better life. For the future some experts fear the possibility of a tidal wave of unemployment across the globe over the next 10-15 years.

All of this has prompted the conservative *Financial Times* to report, “If the world were a company, the chief executive would be dismissed for making such poor use of its assets” (Guthrie 2002). The assets being referred to here are unemployed labour, and particularly young people. This has been the tragedy of human capital in the industrial economy – the monumental and increasing waste of human resources.

The Global Knowledge Economy

Within this larger picture of both a triumph and a tragedy of human capital, the employment trends suggest a continuing increase in the numbers of skilled jobs, with the information and communication technology (ICT) and knowledge industries driving economic growth. Is it likely that the ICT revolution and the transformation to a global knowledge economy will change the current trend to inefficiency and waste in the use of labour? Will the continued liberalisation of markets bring about a more efficient allocation of human capital resources? Can the latent potential of human capital be unlocked by exploiting the opportunities made possible by next generation Internet capabilities, liberalised markets and an expanded role in the economy for the human capital production sector – i.e., education, training, research and development?

I suggest that these developments do make it possible to reverse the global trend of increasing unemployed and underemployed human resources, but they by no means guarantee it. This will depend in part on national and international government policy and funding priorities, and also on how effectively the Internet infrastructure resources can be used by transformed education and training institutions to serve a vastly expanded number of people with an increasing variety of education and training needs. This is a formidable challenge – but what an exciting opportunity!

The Unbalanced Structure of Market Liberalisation

The world-wide deregulation of markets has proceeded at a very uneven pace. The virtually complete deregulation of the financial markets, in combination with new global information and communication financial networks, has provided for such rapid movements of money capital around the world that it has become a cause of instability. Some analysts think it has gone too far, encouraging financial speculation and “casino capitalism” rather than investment in productive activity. The liberalisation of production and services markets is proceeding more slowly through negotiations at the World Trade Organization and related regional organisations on a sector-by-sector and industry-by-industry basis, but major steps in liberalising markets have been taken over the last 15 years. More industries are subject to global competition, and consumers can buy more products and services in global markets. Deregulation has had, and is having a demonstrable impact on product and services markets and on resource allocation.

But the liberalisation of labour markets has yet to get off the ground, due primarily to the fear in the rich countries of being invaded by the army of surplus unemployed from developing countries. The impeccable logic of the efficiency of markets and the improved productivity from resource allocation on a global scale, which is immediately accepted for money capital, accepted in principle for physical capital in product and services markets, somehow doesn't apply to human capital, which remains highly regulated, with even tighter restrictions being adopted by many rich countries today. Neither this inefficiency in the allocation of human capital, nor its accompanying hypocrisy in the rich countries, is sustainable. In the “so-called” global knowledge economy, the policies of liberalisation must be extended to the labour market. A global knowledge market can only function efficiently if there is a global market for human capital. Global markets must function in the best interests of the people of the globe, not just those in rich countries.

Clearly there is considerable evidence of market failures in some labour markets, as there is in some capital and product markets. An immediate deregulation of the world's labour markets might create even more instability than deregulation of the capital markets. The challenge is to consider steps to the efficient deregulation of all resource markets in a coordinated and balanced approach. This suggests a very clear policy agenda to improve the allocation efficiency of all resources in a global knowledge economy.

- 1) Increased regulation in financial markets to reduce incentives for speculation and market manipulation, to achieve greater stability and efficiency.
- 2) Decreased regulatory protection of economic sectors in the rich countries for which poor countries have an international comparative advantage – especially agriculture and textiles.
- 3) A gradual liberalisation of international labour markets to improve the efficiency of the market allocation of labour resources.
- 4) Significantly increased levels of investment in building human capital by all sectors of the economy, including governments and corporations.
- 5) An order of magnitude increase in access to education, training and skill development institutions and resources, now made possible by innovative applications of next generation Internet capabilities.

Building Human Capital for a Global Knowledge Economy

The Investment Environment

As there is widespread acceptance by politicians and governments everywhere of the transformation to a knowledge economy now underway, one would expect this to be associated with an increased allocation of financial resources to education and training, and the establishment of government commissions to examine how the education and training sector can be restructured to meet the enormous demands that will be placed upon it in the evolution to a global knowledge economy. Most national governments in the world have issued information society policy statements; the European Commission has an Information Society Directorate; the annual meeting of the G-8 country leaders last year highlighted the information society development issues, with particular emphasis on overcoming the "digital divide" between the rich and poor countries.

But government funding of universities and training institutes, and of research and development, when measured as a percentage of total resource allocation, has been declining steadily for several years across most of the rich countries. Although this can be attributed in part to a failure of governments to comprehend the contradictions in their policies and the magnitude of the task ahead, it is primarily due a lack of confidence that existing education and training institutions can deliver the knowledge and human capital that is needed for the new economy.

Rather it is hoped – and the correct word is definitely "hoped" – that in a deregulated market environment the private sector will provide a major contribution to building new knowledge and human capital, as well as providing a competitive stimulus for some fundamental reforms by public sector educational institutions. As the OECD has described it, "Reduced public funding, in combination with greater demands for economic relevance and increasing student enrolments, are forcing universities to adjust." (OECD 2001).

Creating New Network Universities and University Networks

Clearly the market for education and training will be transformed over the next decade with public sector institutions like TU Delft subjected to increasing competition from new private sector entrants and from universities in other countries. In this respect North American, Australian and a few British universities have at least a decade head start over continental European universities. Operating increasingly in a global education and training market, these countries now count education and training exports in the trade accounts.

Historically, educational institutions have been highly resistant to change. The basic organisation and structure of how universities go about their business hasn't changed much in the last 300 years. Universities, with a few exceptions, have been very slow to take advantage of the potential of the Internet. Yet the learning and knowledge business is more ideally suited to benefit from information sharing over communication networks perhaps than any other. Almost everyone can be an effective teleworker. The capacity to teach students, or undertake research in many areas, is not constrained by the physical capacity of buildings, classrooms and offices.

Many leading universities will become quasi-virtual organisations. Although seminars and meetings with a physical presence are an essential part of learning, they will no longer be the dominant foundation of university courses or most research projects. Rather each course and research project will be a virtual network of people, with a faculty leader. Student access to courses will become much easier. Professors and most staff will no longer need private offices. In fact, based on hours in residence, most Professors don't need offices today. The capacity of a university to serve students well and undertake high quality research need no longer be constrained by the capacity of physical resources, but only by the capacity of the human capital employed by the university. This permits an order of magnitude increase in the capability of universities to provide programs at a dramatically reduced cost per student. For the sceptical among us, I call your attention to the fact that today one-third of the employees of IBM world-wide have no offices. IBM is primarily a producer of physical products; TU Delft is primarily a producer of intangible learning and research services.

The next generation Internet also will make possible the sharing of university resources even more widely. The productive twinning of universities, university programmes, and individual faculty and students in rich countries with those in poor countries can help to improve both the quality and quantity of education and training in poor countries. Electronic access to university libraries, course materials, and even direct participation in virtual courses in the rich countries can enhance the productivity of universities in poor countries by an order of magnitude at very little additional cost. There is no reason why TU Delft, for example, couldn't double its European student numbers, and double that again by establishing twinning relations with poor country universities. This kind of quantum leap in the capacity and service of universities and training institutes in the rich countries is not only possible, it is essential if the size of the surplus army of unemployed youth in the world is to decline, and if the global knowledge economy policies are to be converted from rhetoric into reality.

Creating More Relevant University Programmes

But what about the relevance question? If government and corporate leaders do not believe that existing education and training institutions can deliver the knowledge and human capital needed for a knowledge economy, there will be no opportunity for these institutions to make the major structural adjustments necessary to respond to the opportunity I have outlined. The restructuring of university programmes that is necessary can be seen by examining those universities and programmes that are succeeding in this new environment. MIT is one with particular relevance to TU Delft, as it is the university that Delft likes to talk about the most, although Delft rarely emulates MIT's best practices or innovative programmes.

One distinguishing characteristic is direct and productive linkages between the university and a variety of external institutions, including government agencies, corporations, foundations and others. These linkages do much more than simply cultivate funding for university research. They provide a basis for specialised training programs, and exchanges of personnel for short and even long periods, with considerable flexibility in how they are implemented. This helps the university get a better understanding of the real needs and requirements of external institutions,

including funders, and gives the external institutions continuing benefits throughout the programs. TU Delft is attempting to move in this direction through a number of its interfaculty research programs, but they have yet to reach the stage of maturity and high productivity relations between academic researchers and external organisations that one finds at leading US universities. Productivity and relevance will improve when these programmes are given a higher priority on the university's agenda and considered to be an integral part of, rather than a minor appendage to the University's mission.

A second characteristic is the broadening of the disciplinary foundations of traditional engineering and technology programs. I am reminded that the most well known and widely read textbook in economics was written by a young economist more than 50 years ago in response to a request from the engineering deans at MIT to write a book that would tell the engineers something about economics. Nobel prize winner Paul Samuelson continues to roll out new editions of his textbook to an ever-expanding global audience. The Sloan School of Management at MIT grew out of a survey sent to engineering graduates about 50 years ago asking what kind of work they were doing three years after graduation. The vast majority had significant management responsibilities. At TU Delft I have been surprised at the extent to which the great majority of work in the engineering disciplines, to the extent I have been able to know it, proceeds in the total absence of any consideration of economic resource requirements or limitations. The broadening of engineering and technology programs to make them more relevant to the needs of society does not imply the dilution of engineering knowledge or the weakening or replacement of engineering programmes, as the experience of MIT demonstrates. It does imply a fundamental reassessment of the knowledge base and skill sets that are needed by engineering university graduates in the new knowledge economy (www.MIT.edu).

Following the Bologna Declaration recommending a revised curriculum structure for European Universities, now being implemented by TU Delft and most other leading European Universities, the EU established an initiative called "Career Space" that brought together the leading information and communication technology companies in Europe and 26 leading technical universities and training institutes from 13 EU countries to develop curriculum guidelines for 21st century ICT educational programmes. In its report last year it stated,

It should not be forgotten that other disciplines are relevant to ICT curricula, as well as technical ones. Economics, business studies, creative design, social sciences and psychology all have important and increasing parts to play in ICT training. Indeed, for some ICT careers these aspects have greater importance than the technical skills. Again, university structures may sometimes inhibit the adoption of innovative cross-disciplinary ICT curricula incorporating those elements (International Co-operation Europe, 2001, 12).

In September I will have the privilege of assisting a new multidisciplinary Center for ICT at the Technical University of Denmark implement the first modules of the new curriculum recommended by the Career Space initiative. It is unfortunate that TU Delft was not one of the leading technical universities that participated in this initiative. Nevertheless it is clear that the TU Delft ICT programmes in several faculties would be strengthened and made more relevant if the Career Space report recommendations were implemented.

Full-fledged multidisciplinary programs, such as that provided by the Faculty of Technology, Policy and Management at TU Delft have been and are being established at many universities around the world to bring closer linkages that connect the relevance of the academic teaching and research programs and the knowledge and skill sets of the matriculating students, to the needs of the external organisations employing them and of the knowledge societies in which they will live. I had the good fortune to be a member of a group of faculty that set up a small multidisciplinary program at the University of Pennsylvania almost 30 years ago, focusing on the implications of computer-communication, in association with the Bell Laboratories, the U.S. National Science Foundation and other organisations. The principal question being addressed was, what will be the implications of connecting computers to the telecommunication network on a large scale? Only a multidisciplinary team of faculty, PhD students and experts from the external organisations could hope to address such a question comprehensively. Of course we did not even dream of anything like the Internet, but we did make contributions to program changes at the university, and policy changes in government and in corporate management that were a step in that direction.

It is that experience that led me back to my native Canada, and then on to the UK, Australia, Denmark and finally TU Delft to take up challenging opportunities to develop new multidisciplinary programs integrating engineering, economic and policy disciplines on important issues centred around fundamental technological change, its opportunities and implications. The economics of infrastructures program that my group has built up at TU Delft over the past five years is examining these issues with particular reference to the ICT, energy and transport sectors. It is now well-established and making significant contributions to the Faculty, and to external communities in the Netherlands, Europe, and the world at large. This was confirmed once again last week when my Associate Professor Rolf Künneke received the Outstanding Teacher Award for our Faculty.

On Retirement

Now, with more universities in still more countries setting up new multidisciplinary programs, the combination of formal retirement and the Internet will allow me to become a true virtual professor, while assisting universities in several countries at the same time. In leaving TU Delft, I would like to thank colleagues, students and friends for the support and friendship I have received during my relatively short time here. I look forward to seeing many of you in our common mission to support the development of human capital in the knowledge economy. I will be guided by one of my favourite philosophers, the retired comic strip character Pogo, who observed,

Too soon we breast the tape, to learn the fun lay in the running.

I think I am compelled to be a long distance runner.

Thank you.

End Notes

1. The concept of a global knowledge economy is highly abstract and used here to simplify the analysis and permit a more direct focusing on some generic issues relating to human capital. In fact, the economies of different countries will differ dramatically in the 21st century, as they do now. It is anticipated that all countries will have opportunities to benefit from the trend to globalise markets, and that poor regions and countries in particular may be able to overcome some current disadvantages.

2. KPN Qwest has constructed a high capacity fibre optic cable communication network across Europe, for which there is now little demand. The firm is about to enter bankruptcy and is feverishly negotiating the potential sale of the physical assets for a small fraction of their investment costs. There are no discussions underway with respect to its human capital assets, most of whom already have been dismissed.

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