Measuring Intangible Investment

Introduction: Main Theories and Concepts

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ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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INTRODUCTION: MAIN THEORIES AND CONCEPTS

1. Introduction

It has long been argued that economic growth and development are dependent on and, in some cases, a function of the accumulation of physical capital. This view was even more prevalent at the time when potential markets were still growing and when competition was mainly based on economies of scale and specialisation. For economists and policy makers the focus was on how to achieve a higher rate of growth by identifying factors affecting the accumulation of physical capital.

However, since the mid-1950s, it has become apparent that the accumulation of physical capital by itself could not explain why some countries performed better than others, or even why growth rates differ between industrial countries. Many other factors could affect growth, development and productivity of a firm or a country. Empirical work by Kendrick (Kendrick, 1956 and 1976); Denison (Denison, 1962 and 1967), Jorgenson (Jorgenson and Griliches, 1967), and others (OECD, 1964) have shown that a large proportion of productivity improvement could not be explained by just the inputs of capital and labour, but also by "residual factors" such as investment in health, education and skill, research and development and more generally in the acquisition and transmission of "know-how". More recently, empirical studies in various OECD countries (e.g. in France, Finland, Netherlands and Sweden to name only a few) have shown that investment in these complementary assets has outgrown that related to the gross formation of fixed capital.

Also, it appears that the nature of competition has changed dramatically. Markets are not expanding at the same pace anymore and therefore the simplistic view of maintaining high rates of growth via the exploitation of economies of scale through the accumulation of physical capital is no longer sufficient. Because competition between firms is no longer the simple search for new market opportunities, but rather fierce battles to increase market shares, firms have to diversify in order to realise economies of scope through increased flexibility in their use of all their inputs (e.g. physical and intellectual capital, organisational structures, R&D and other forms of "know-how"[1] In fact, as Paquet and others (Paquet, 1990; Starr, 1988) suggest, the notion of competition has been replaced by a broader notion of competitiveness that goes beyond the narrow concept of the clearing-price market mechanisms and now takes into consideration the socio-political, organisational and institutional context of the innovation process.[2]

In this context, it appeared clear to many that in order to explain, and more importantly, to achieve economic growth, more attention had to be devoted to the less tangible forms of capital accumulation (e.g. R&D, training and various forms of organisation). The term "intangible investment" was coined to describe such activities in the mid-1980s by analogy with the tangible investments which they complement or even replace. At least to begin with, no special conceptual framework was set up but rather the stress was on adapting the established framework for capital analysis, notably in the framework of the revision of the System of National Accounts.

Of course, from a theoretical and empirical point of view it has been long recognised that the accumulation of physical capital is not the only factor influencing economic growth and development. In fact, long before the "renaissance" (or renewed interest) in "intangible investment", some aspects of it were already taken into account in industrial, economic and organisational change theories. For example, economic theory has often stressed the importance of at least two types of factors as essential influences

on economic performance: human resources and research and development (R&D) (Becker, 1975). The other factors being more difficult to quantify were often "black boxed" in a convenient category called "residual factors".

On the other hand, the theory of organisations has focused more on changes in a firm's organisation of work and production, e.g. quality-circles, marketing, training and re-skilling, rather than on research and development. This is to say that, not only are there many views on what is considered as intangible investment, but they also refer to different theoretical frameworks. Nevertheless, it appears that the most important contributions to the understanding of intangible investment have arisen from two major bodies of literature: human capital theory and innovation theory.[3] The theory of "intellectual investment" can be seen as underpinning work on intangible investment and the latter can also be expressed in terms of the new growth theories, including endogenous growth theory and evolutionary theory.

Presenting a complete review of the theoretical literature would go much beyond the scope of this set of practical guidelines. The following sections will focus on a few theoretical and empirical considerations on intangible investment, derived mainly from these four areas of economic theory.

2. Human capital theory

Change in human resources (e.g. human intellectual capacity) has long been recognised (Becker, 1975; Kendrick, 1976; Schultz, 1969, 1971, to name only a few) as an important factor of economic growth and an essential element of the production process. Also, because of its complementarity with investment in physical capital and its importance as a factor of production, it is generally referred to in the literature as "human capital".

Like the treatment of the firm in physical capital theory, the human capital theory emphasizes the notion that individuals are investors. Put simply, it is assumed that individuals will invest in their education, which will involve high cost and result in a short-term loss of revenue, in order to achieve higher incomes in the years to come. Human capital theory explains the income of an individual by examining the labour demand as a function of the individual educational and training characteristics. Human capital is considered as an asset, similar in many respects to physical or financial assets.

In their seminal work, Becker (1975) and Schultz (1969) have stressed that human resources are a major production factor and therefore contribute in a large portion to the increase in productivity.[4] Moreover, as for physical capital, intangible investments can also generate externalities which can provide costs and benefits to society which are not reflected in the private income (discrepancy between private and social rates of returns). General education is an example of investment that provides positive externalities in the sense that it fosters the efficient acquisition and transmission of knowledge.[5] For example, in a recent study Romer finds that an initial level of literacy does help predict the rate of investment and indirectly the rate of growth of a country (Romer, 1989).

In fact, early on, the theory of human capital tried to explain the complementary nature of human resources and their pervasive effects not only in terms of their contribution to the production process (as inputs of labour), but more importantly, in terms of their contribution to the acquisition and transmission of know-how. For example, investment in specialised training may be viewed as a complement to the purchase of sophisticated machinery, as well as a direct benefit to acquire new forms of know-how. It is also through the mobilisation of trained human resources, that a firm can achieve higher degrees of competitiveness. In other words, the key aspect of firm's competitive performance resides in its intellectual capital (e.g. its ability to enhance its own knowledge base).

Put briefly, the contribution of the human capital theory is well summarised by Mincer: "human capital plays a dual role in the process of economic growth: *i)* as a stock of skills—produced by education and training—it is, factor of production, co-ordinated with physical capital and with 'raw' (unimproved, unskilled) labour, in producing total output; *ii)* as a stock of knowledge it is a source of innovation, a basic cause of economic growth" (Mincer, 1989*a*). It is from this perspective that the human capital theory contributes to the concept of intangibles.

Early empirical studies by Kendrick (Kendrick, 1976), Jorgenson and others (Denison, 1962), show quite explicitly that the impact of human capital on productivity is positive. Griliches (1969) for instance found high complementarity between high skilled workers (better educated) and physical capital. Bartel and Lichtenberg (1987) argue that technological innovation also alters demand in favour of better educated workers because they have a comparative advantage in implementing new technologies. Similarly, Berndt *et al.* (1992) found that the increase in the high-tech composition of capital is positively related to the growth of white collar workers, and that skill upgrading toward more educated workers generally occurs with capital deepening.

But the impact of the human capital theory on the concept of intangible investment goes even further. Indeed, recent empirical work is devoted to the economic impact of investing in training and re-skilling. For instance, Bartel (1991) finds a positive link between the implementation of training programmes and labour productivity growth, not only at the individual level, but also at the organisational level as well[6]. In fact, in a more recent study, Bartel (1992) finds that training has a "positive and significant effect on wage growth which translates into a company rate of return of at least 13 per cent. Besides, Mincer (1989*b*) shows that the rates of return on training investment generally exceed those usually observed for schooling investment. He concludes that training remains profitable for firms even in a time of increased worker mobility.

Many other empirical studies have presented strong evidence of the effect of educating and training human resources on productivity and growth. However, the intent here is to present a representative review of results, which establish the link between the human capital theory and the intangible investment concept.

3. Technical change theory

The other body of literature that has contributed significantly to the concept of intangible investment relates to technical change or innovation.

It is now well accepted that scientific and technological activity is not an exogenous factor of economic growth. Instead it is viewed as generated by economic agents responding to economic incentives. Innovation is a key element of firm's competitive strategy and the driving force behind national science and economic policies to improve global competitiveness and economic progress.

In fact, as in the case of the human capital, the importance of technical change as a factor of economic growth has long been recognised by economists. Adam Smith, David Ricardo and Karl Marx, for instance, made direct reference in their work to technical change as a factor of economic progress. Others have introduced technical change in the form of an overall rate of technical progress which has been treated exactly like and symmetrically to the rate of growth (Pasinetti, 1981).

In this respect, the first attempt by Harrod in the modelling of economic growth incorporating technical change was followed by various contributions from both the Keynesian (Domar, Kaldor and Robinson)

and the neo-classical schools (Solow and Meade). Although the neo-classicals have not made it central to their models, many of them have examined the general question of technological change. Indeed, one need only think of the seminal work of Solow (1957), and of the stream of studies developed in industrial economics by Arrow (1962), Mansfield (1968), Griliches (1957), Scherer (1980) and many others[7] to realise the diversity of the approaches and the close link between some of them and the Schumpeterian hypotheses (e.g. Scherer, 1982) overlapping some aspects of the heterodox approaches to technical change[8] basically, the cumulativeness of technical change, the technological opportunity and the private appropriability of the effects of technical change.

But regardless of the theoretical approach, innovation is important, and as Freeman (1982) emphasized, not only to economists but to everyone: " Innovation is critical, therefore, not only for those who wish to accelerate or sustain the rate of economic growth in this and other countries, but also for those who are appalled by the narrow preoccupation with the quantity of goods and wish to change the direction of economic advance or concentrate on improving the quality of life".

Traditionally, innovation studies focused mainly on research and development (R&D) activities, where the R&D expenditures and personnel were examined in isolation with very few other input variables such as labour, material and physical capital.[9] However, it became quite clear that innovation (or technical change) involved a larger spectrum than just the R&D activities. This view has been systematised in the *Oslo Manual* (OECD, 1992*a*; OECD/Eurostat, 1997), which sets up guidelines for business "innovation surveys".

In fact, recent studies[10] have shown that most innovations are continuous and cumulative by nature (e.g. involving incremental change) and are mainly new combinations of techniques rather than completely novel products and processes or systems, which means that a firm's learning process is localised, cumulative and dependent on the accumulation already embodied in its products. It also implies that firms and sectors are characterised by different innovative capacities, various degrees of concentration and of technological opportunities, different levels of entry barriers and different degrees of cumulativeness of technical change.

Therefore, in order to stay competitive, firms and individuals are involved in a complex learning process, where not only the funding of R&D is essential, but also the gathering of public and proprietary (e.g. patented information or firm-specific knowledge) "know-how" through shop-floor production, marketing, training, inter-firms agreements, joint ventures, strategic alliances and consortia, licensing, trade marks, copyright, etc., in other words through **intangible investments.**

The empirical literature on technical change is quite extensive. It ranges from the estimation of the residual factor (as a proxy of technical change) to the more detailed and complex analyses introducing R&D and payments for technology (e.g. intra-firm transfers) as a factor of production, including the exploration of its spillover effect on productivity.

In the context of the intangible investment, the empirical literature on the private and social rates of return of R&D (and payments for technology)[11] provides evidence of the impact of innovation on productivity. For example, Mansfield *et al*. (1977) indicates private rate of return of 25 per cent versus 56 per cent for the social rates of return. Similarly, Bernstein (1989) using a different approach shows a net social rate of return on R&D varying between 20 and 25 per cent. Soete and Patel (1985), constructing an external R&D stock variable based on payments made for licensing and patenting for five OECD countries, show a private rate of return of 21 per cent. Mohnen and Lepine (1991) find that payments made for licensing and patenting are complementary to the level of R&D, suggesting that the volume of transfer of technology through acquisition of machinery and equipment and other types of intangible investments

(e.g. industrial design, goodwill) made by foreign-owned firms is dependent on a threshold level of R&D (e.g. innovation).

As in the case of the human capital theory, the theoretical and empirical literature on technical change have contributed quite clearly to the development of the concept of intangible investment. This is even more so, as technical change is often characterised by the various components normally associated with intangible investment.

4. Intellectual investment

The two sets of theories outlined above feed into but do not correspond directly to intangible investment.

Along the latter lines, there is a broader view of intangible investment which goes even further as it refers to the general understanding of the natural world and its social interactions as well as to the notion of an industrial culture.[12] This view of investment called "intellectual"[13] is based on the fact that the efficiency of a firm depends on the mobilisation of resources (including the general knowledge and culture of the firm) to appropriate technology and market opportunities. With this kind of definition, resources devoted by management to anticipate needs of clients, pre-competitive research, market intelligence, quality-circle, performance review of employees, creation of industrial and multinational networks, consulting services, alliances, joint ventures and consortia, etc., can be considered as "intellectual". As Caspar and Afriat (1988) put it: intellectual investment is not only a different kind of investment (e.g. intangible), but more importantly it refers to a general way of thinking (e.g. culture) where the use and development of the "grey matter" is at the forefront of a firm's strategies.

There is, nevertheless, some conceptual difference between what is commonly called intangible investment and intellectual investment. The latter refers to a broader concept which includes all the elements of intangible investment plus the notion of the industrial, scientific and technological culture. Caspar and Afriat (1988) in their essay on the immaterial economy on the one hand, and Machlup (1962), Dosi (1984), Freeman and Perez (1988)[14] on the other hand would argue that intangible investment cannot be limited only to expenditures that can be costed. For them, the concept of intellectual investment encompassed the creation of a proper environment to stimulate innovation. Although there is little disagreement on the idea, it is still difficult to transform the concept into a workable framework for the collection of data. With this in mind, it appears more practical to concentrate on the intangible aspect of the broader concept of intellectual investment.

5. New growth theories

The two main branches of this new work are endogenous growth theory and evolutionary theory.

Endogenous growth (Romer, 1986, 1990; Lucas, 1988; Grossman and Helpman, 1991; Barro and Sala-i-Martin, 1995) goes further than earlier growth theories in analysing and modelling technical change and factors accumulation, drawing on other fields of economics (industrial organisation, human capital, economics of technical change). Endogenous growth focuses on knowledge accumulation as the basic source of growth and analyses its economic mechanisms (which make it endogenous). Knowledge is viewed in a broad sense, which encompasses human capital, organisational capital, some aspects of physical capital (embodied technology), and above all technical change. New knowledge is generated by profit-seeking firms and agents. Knowledge production is a source of externalities, in the sense that any discovery draws on other discoveries and will be used itself as an input in further technical advance. The

resulting discrepancy between the private and the social rate of return on knowledge-producing activities is viewed as a market failure. It justifies in turn some role for government and for market and non-market institutions in the process of technical change. Moreover endogenous growth theory analyses carefully the way these various forms of technology are related, in a production function framework. Working in a general equilibrium framework gives a consistent analysis of the mechanisms at work in the growth process, but it suffers from the limitations of economic modelling, i.e. the need for strong and somewhat fragile hypotheses (Guellec, 1995).

Evolutionary theory (presented in detail in Paper 2 in this compendium; see references above in note 7) takes a different approach, focusing on the role of "routines" in the behaviour of firms (as opposed to optimisation) and on the cumulative nature of technical change, which is a source of lock-in in technological trajectories.

Both theories provide an understanding of the "knowledge-based economy" (David and Foray, 1995), the present stage reached by advanced economies in which intangible assets contribute for a great deal to economic activity and growth. General work on its testing and development is in progress via the OECD project on "National Innovation Systems". The next paper presents a version adapted to the study of intangible investment.

NOTES

1. When underlining factors influencing competitiveness, some authors refer to the concept of economies of scope, but to a new concept of economies of flexibility, which emphasises the capacity of firms to adapt all factors influencing production and (including the organisational structure of production and work).

2. See the work of Freeman and Perez (1988), where the innovation process is viewed in a broader context taking into account social, organisational and institutional changes.

3. These two segments cover a large spectrum of contributions that goes from Schultz and Becker for the human capital to Schumpeter, Freeman, Nelson and Dosi for the innovation theory.

4. See for example the debate around the Leontief Paradox

5. One could also mention the contribution of health to growth and productivity [See Riboud (1978) and Kendrick (1976)].

6. Bartel (1991). Bartel (1989) has shown elsewhere, "that the increase in productivity attributable to training is largely due to the screening of job applicants which significantly enhance job productivity" (p.27).

7. For a more detailed view of these studies, see the survey of literature done by Kamien and Schwartz (1982) as well as by Stoneman (1983).

8. Many schools of thought fall into this category: the French school "de la régulation" [e.g. Aglietta (1998), Boyer (1988)], and obviously the neo-Schumpeterian and evolutionary approaches [e.g. C. Freeman (1982, 1986), Nelson and Winter (1977, 1982), to name only a few].

9. In the early 1960s, the OECD put together the first manual of standards and practices for the collection of statistics on research and development, better known as the *Frascati Manual*, now in its fifth edition (OECD, 1994).

10. See Pavitt (1984), Dosi (1984), R.B. Freeman (1986), Nelson and Winter (1982) to name only a few.

11. Many surveys of literature have been done, looking at disparate facet of the contribution of R&D to economic growth: among them see Griliches (1988), Hanel and Palda (1989), Mairesse and Mohnen (1990) and Mohnen (1989, 1990) to name only a few.

12. Or post-industrialised culture as presented by Bell (1974).

13. The expression was first coined by Machlup (1962) and used to emphasize the importance of general knowledge as a basis to allow training and prepare people to the acquisition of specific and practical knowledge, essential to the growth and development of a firm. Caspar and Afriat (1988), also refer to the expression in their essay on intangible economy stressing today's challenge: the use of technological and social knowledge in the organisation of competence and in the firm's decision making.

14. To name only a few. Mainly, most of the authors identified to the neo-Schumpeterian and evolutionarist school of thoughts would recognise the firm's culture as an important aspect of innovation and intangible investments.

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