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Can Ideas be Capital? Factors of Production in the Post – Induction Economy: A Review and Critique

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It is a widely accepted premise that we are in a midst of a radical change of economic and social relations, associated with terms such as the "knowledge economy", "weightless economy", "post-industrial society" or "information society". The intellectual capital literature appears to suggest the arrival of a distinct factor of production, replacing or supplementing land, labour and capital. Some exponents of intellectual capital analysis see knowledge, ideas, capabilities and skills as a new, perhaps overriding productive factor; others conceive of the changes within a widening of the traditional definition of capital to include business processes, intellectual property, product ideas, even customer loyalty; again others use "intellectual capital" as a rhetorical tool withholding any coherent definition.

In this article, we first give a historically informed theoretical exposition of capital as the durable result of past production processes, transforming future production while not being transformed itself, and associated with a particular economic actor. Second, we offer a taxonomy of the perceived characteristics and location of intellectual capital in the production process. Third, we argue that capital, and thus intellectual capital, is not a useful way of theoretically capturing knowledge and ideas.

INTRODUCTION

For over a quarter of a century, authors in both Management and Economics have diagnosed the coming of a post-industrial age. At first, such writing, not fully aware of the fundamental shift taking place in the global economy, focused on the decline in manufacturing and sought ways of bolstering and reviving the industrial economy (e.g., Eatwell, 1982; Bluestone & Harrison, 1982). More recently, the policy focus has shifted to an emerging new economic structure: variously labelled as information society (Bangemann report, 1994) or knowledge economy (OECD, 1997). The conception of knowledge as the "overwhelmingly productive resource" and "primary competitive factor" has spawned new theories of innovation and economic growth (Romer, 1989; Quah 1997) as well as new theories of the firm as the integrator of knowledge (Grant, 1991; Nonaka, 1991). In post-industrial economic relations, traditional factors of production are increasingly said to be made available if not replaced by a single factor: knowledge (Drucker, 1993: 38).

Knowledge, the intellectual capacity of employees to generate new knowledge via new ideas, indeed those very ideas themselves, when put to productive use in an economic context, has come to be categorized as intellectual capital. This reflects current style for labelling any durable factor used in the production process which transforms, rather than being transformed itself, and embodies past investment, as capital (e.g., human capital (Becker, 1975 [1964]), cultural or consumption capital (Becker & Murphy, 1988), symbolic capital (Bourdieu, 1977 [1972]), social capital (Jacobs, 1965; Bourdieu, 1986; 1993), environmental capital (Mäler, 1991; Thampapillai & Uhlin, 1997), and so on). It is also indicative of a general underlying conceptualization of knowledge and ideas as similar in character and behaviour to other forms of capital (Bradley, 1997; Stewart, 1997; Edvinsson & Malone, 1997; Ulrich, 1998; Nahapiet & Ghoshal, 1998; Granstrand, 1999; Dzinkowski, 2000; Teece, 2000). The term has captured public imagination and is in widespread use, as in the advertising campaign "Ideas are Capital, the Rest is Just Money" (Deutsche Bank, 2001).

In this paper we explore the implications of conceiving of ideas as capital. We ask what is meant by the term capital, what is required of a resource for it to be capital and to what extent knowledge/ideas[1] can be understood as fitting those requirements. Does the categorization of ideas as intellectual "capital" constrain our analysis of their function and position, both in the economic system at large and the organization in particular? Or does the use of the term "capital," borrowed by sociology and management scholars from Economics, imbue "intellectual capital" with a pre-established set of attributes and relationships to other inputs in the production process, giving it a legitimacy that would otherwise be more difficult to establish? Most importantly, does conceptualizing knowledge as capital better enable us to understand post-industrial organizations and their economic environment or does it impede our understanding, with its application of industrial era terminology to a post-industrial age?

Our paper begins by exploring the concept of capital and how it has evolved since the 17th century, arguably the dawn of the industrial age, to the present day. "Capital" has related but distinct

[1] In this article, we rely on a common pre-theoretical understanding of knowledge and ideas compatible with various epistemologies. Competing accounts include knowledge as justified true belief, as causally evidenced or reliably acquired beliefs, or as mental states of its own kind. (For a perceptive recent contribution to the philosophy of knowledge, see Williamson, 2001). Unlike "capital", which is a term of art, "knowledge" and "idea" have a secure meaning in ordinary language, entitling us to withhold a definition at this stage of our inquiry.

popular and economic meanings: as money invested; as circulating capital; as financial capital; as an accumulated stock of wealth; as resources, themselves a stock of wealth and the result of past production, used in further production; as *any* stock of productive assets that contributes to the further accumulation of wealth. We demonstrate how, as the industrial economy developed and its complexity increased over time, the concept of capital has expanded to encompass an ever broader range of productive resources, no longer confined to monetary or material assets, but also including intangible assets. Hence Marshall (1965 [1890]) at the end of the 19th century, "capital consists in a great part of knowledge," Stewart (1997) at the end of the 20th, "intellectual capital is intellectual material . . . that can be put to use to create wealth," and Gu & Lev (2001) at the outset of the 21st, "intangible (knowledge or intellectual) assets are the major drivers of corporate value and growth."

The second part of the paper offers a taxonomy of recent theories of ideas or knowledge as capital. While this may have intuitive appeal, suggesting a continuum and natural progression, maintaining a link to pre-existing economic and managerial analysis, to do so also raises many questions. This section of the paper makes explicit the attributes embodied in the concept of capital, summarizes the main characteristics of intellectual capital identified by the literature, and examines how closely the two match. To paraphrase Fisher in his contribution to the debates on capital at the turn of the last century (Fisher, 1896-1904), to define ideas as intellectual capital that definition must conform with the commonly held understanding of capital *while retaining the additional interpretative power that results from defining ideas as capital*.

In the final section of the paper we re-consider the appropriateness of conceptualizing ideas as capital. The shift in emphasis in the literature from revitalizing manufacturing to embracing knowledge industries suggests that the transition to a post-industrial, knowledge-based economy represents a fundamental sea-change. Productive ideas, embodied in intellectual capital, "the organization's defining asset" (Ulrich, 1998), are central to the creation of sustainable competitive advantage (Quinn, 1992; Bradley, 1997; Nahapiet & Ghoshal, 1998). Furthermore, the conceptualization of intellectual capital itself is becoming more complex, not simply the myriad of seemingly limitless, non-depreciating, productive ideas held in the minds of "knowledge workers," (Drucker, 1993), but the "knowledge and knowing capability of a social collectivity . . . created through a process of combining the knowledge and experience of different parties . . . [which]

occurs through social interaction and coactivity" (Nahapiet & Ghoshal, 1998). We argue that the explanatory value of intellectual capital analysis to post-industrial social and economic relations is severely limited.

THE CONCEPT OF CAPITAL

This section of the paper presents an overview of the evolution of the concept of capital in economics. This is necessarily a selective discussion of elements within the history of economic thought, not a full exposition of that vast and complex subject; nor is it an explanation of so-called capital theory. Rather we investigate the explanatory role the concept of capital has played in economic thinking and how the concept has changed to reflect both the changes in the socio-economic system under scrutiny and the needs of the scrutineers.

Fisher (1896:509), in a statement recalled by that of Ulrich (1997) concerning intellectual capital 100 years later, stated that, "of economic conceptions few are more fundamental and none more obscure than capital." While the question of what was capital was hotly debated for much of the latter half of the nineteenth century, for most of the twentieth it was largely assumed to be settled. Capital was generally held to comprise a stock of durable (usually tangible) assets, themselves often the result of past production, put to use in the production process thereby generating a flow of goods and services over time. Far more debate raged about how it behaved: its relationship to and interaction with other productive resources, other "factors of production." (For a discussion of the capital theory debates see for example, Harcourt, 1972). Only when attempts were made to push back the boundaries to include notions of intangible and collective capital, for example, human, social, and latterly, intellectual capital, has the assumption of a universally held and understood concept of capital again been thrown into question. A question which is perhaps best answered by our asking not what capital is, but what role it fulfills in the economic system -- what it does.

Pre-industrial capital

The earliest use of the term capital has been traced to Greek and Roman times when it was essentially used to denote the principal of a loan, that is, to distinguish "wealth" from the income

accruing to it. In most early economic writings, from the age of the Greek philosophers to that of medieval feudalism, it is money -- the medium of exchange, not capital -- accumulated wealth, which is the focus of attention. In pre-capitalist economies money was borrowed to satisfy personal needs rather than to finance production which would generate income. Land was understood to be the source of wealth. There was little need for a concept of capital beyond that given above and it was not until trade and commerce began to establish an ascendance over subsistence production that a need for a distinct concept of capital emerged.

With the birth of the age of merchant capital and the doctrine of mercantilism, we begin to see the emergence of "modern economics," with its terminology and concepts. In mercantilist economics trade was the source of wealth and while capital retained its popular meaning as money, or financial, capital, albeit now to support commercial activity rather than personal wants, a second definition of capital began to emerge, that of the value of the merchant's stock in trade (Venetian dictionary, 1612). Variations on this definition include: "wealth, worth; a stocke, a man's principall or chiefe substance," (Cotgrave (1611) quoted in Fisher (1904)); and, the original sum invested in the trade (Johnson, 1766). Thus, according to Fisher (1904: 395),

> "We see now the genesis of the [modern] term 'capital.' Originally applied to the principal of a debt as distinguished from the interest . . . it soon became applied to a merchant's stock in contradistinction to the flow of profits, if any, and hence to *any* fund or stock whatever."

The role of the concept of capital was, as before, to distinguish between accumulated wealth, the generator of income, from the income accruing to it. But by its links in these definitions with trade and the merchant, or trading company, capital was also being identified as a predominant element in the creation of further wealth or value. By association with an individual (merchant or company) ownership and (possibly) exclusivity are also indicated. The definition of capital as stock in trade also carries implications of the accumulation of surplus, of durability and persistence from one time period to another, although these were not made explicit.

In parallel with the broadening of the concept of capital by mercantilists, the physiocrats (a French movement led by François Quesnay, a physician in the court of Louis XV) who understood the primary source of wealth as agricultural production, also developed a broader, though different, concept. In the physiocratic framework, only agricultural production was deemed to be productive, that is, to generate a surplus. To the physiocrats capital was the stock of food and tools already

accumulated which was advanced to labourers at the start of the production cycle in anticipation of the returns from that production process (Coats, 1962: 38). In this concept of capital as an advance there remains an echo of its origins as the principal as a loan, but it also includes the idea of the surplus output of past production (food) being put to productive use in future periods (akin to the reinvestment of profit) and some notion of durable, physical capital (tools). Note also that agricultural production resulted from the interaction of two elements: land and labour; thus surplus accrues to both the owner of land and the labourer. This surplus, "these accumulated values," was, according to Turgot (1776:58), “what we name capital.” He further argued that all forms of capital could be expressed as money, "It is perfectly the same whether the amount of this capital consists in a mass of metal, or any other matter, since money represents all kinds of value as well as all kinds of value represent money." Although the physical nature of what comprised capital differed for the mercantilists and the physiocrats, the underlying characteristics and function were broadly similar: a stock of accumulated assets which could be used to generate further output to increase that accumulated stock.

The development of notions of private property, of private enterprise, of private exchange, and the accompanying emergence and growth of the market economy and production for exchange at the cusp of the 17th and 18th centuries saw the beginnings of “modern” economics. While in popular use “capital” comprised an individual’s (or enterprise’s) entire stock of wealth, in economics, “capital” was restricted to that portion of wealth actively engaged in economic production. This prompted a debate which lasted over 100 years, as to what was or was not productive, and the categorization of physical assets into “capital” and “not capital.”

As the dominant mode of production changed in the 18th century, trade gave way to industrial production, and the social and economic position of the merchant was largely usurped by that of the industrialist, so too was the merchant replaced by the industrialist as the major supplier of capital. What was understood by the term capital also changed. It came to include not only financial capital and stock in trade (the components of merchant capital) but also industrial capital; capital of a much more durable and immutable nature: tools, machinery, capital goods, factories. The term however, continued to embody tangible assets which could be measured and valued, whose ownership could clearly be determined but whose value was, ceteris paribus, independent of that ownership.

Capital in classical economics

Smith (1776), writing at the outset of the industrial revolution, understood capital very much as his predecessors had done as "circulating capital," that is, as capital in the form of stock in trade and work in progress. Capital for Smith, as for the mercantilists and physiocrats before him, was complementary to labour in the production process, it enabled labour to work more effectively, to be more productive, but did not replace it. However, with Ricardo (1817), writing some forty years later, well into the industrial age, we begin to see a transition from the classical to a neo-classical concepts of labour and capital. Capital, as used by Ricardo, differed from its use by Smith in two important respects. Firstly, Ricardo clearly separated circulating capital from fixed capital, making explicit its durability (1821: Ch. 1). Secondly, by the 3rd edition of *Principles*, he had begun to conceive of capital as substitutable for, rather than complementary to, labour. However, the majority of classical economists continued to perceive labour and capital as essentially complementary in the production process.

The appropriate distribution of economic surplus to factors of production, and thence to economic actors, was (and remains), a major concern of economists. Early classical economists deemed labour alone to be truly productive and the source of surplus. For Smith (1776), for example, while there were three types of economic actor involved in distribution, "their shares were not [to be] construed as returns from the productive employment of their factors." He argued essentially that it was labour that added value, was productive, and therefore the shares apportioned to land and capital were deductions from the return to labour. This presented a problem in determining what the distributive shares should/would be, and how profits should be treated. Similar problems also faced other classical economists who adopted a labour theory of value, e.g., Ricardo. Where Smith had problems distinguishing the return on capital advanced, interest, from the return to the capitalist, profits, Ricardo had difficulty accounting for profits at all. While some 19th century classical economists, for example Say (1803), overcame this by treating factors of production equally and apolitically, others (e.g., James Mill, John Stuart Mill and Marx) adopted a different approach, conceiving of capital as "stored-up" labour. Thus in one tranche of classical economics we find the concept of capital as the embodiment of past labour -- of past production.

It was partially in the attempt to resolve the problem of linking distribution and production that the debate over what to classify as capital on the basis of what was or was not productive arose. For our purposes this debate is a red herring and will not detain us. For us the essential

question is not the categorization of individual assets as capital, but the characteristics and role of capital in the economic system. On this, classical economists were much more in accord. For example, Ricardo (1821: Ch. 5): “Capital is that part of the wealth of a country that is employed in production and consists of food, clothing, tools, raw materials, machinery, &c. necessary to give effect to labour.” Senior (1836): “an article of wealth, the result of human exertion, employed in the production or distribution of wealth”; and Mill (1848: Book1, ch.4, §1): “[The] accumulated stock of the produce of labour is termed Capital . . . What capital does for production, is to afford the shelter, protection, tools and materials which the work requires, and to feed and otherwise maintain the labourers during the process. These are the services which present labour requires from past, and from the produce of past, labour. Whatever things are destined for this use -- destined to supply productive labour with these various prerequisites -- are Capital."

The last quarter of the 19th century saw a switch in focus, away from the distribution of shares of the surplus and macro-economics to issues of exchange and what we now know as micro-economics. The breakthrough in neo-classical economics (Jevons, 1871) was the concept of marginality. Marginality which explained the wage of a homogeneous, interchangeable workforce, also explained the return on capital: it was set by the value of the contribution to output of the last unit of investment employed. To achieve general equilibrium this makes a further assumption of the nature of capital: that it is reducible to interchangeable, homogenous units and that it is mobile. Clearly this is not the case for all forms of capital. There is therefore an underlying assumption that capital either takes its monetary or financial form or at the very least can be measured and valued, that its value is unequivocal and can be expressed in monetary terms, and capital can be reduced to its value form

Capital and economic actors

Important for the evolution of the concept of capital was the pairing, explicitly forged by the economists of the18th and19th centuries, between economic actors and social classes. According to Schumpeter (1954), while economic actors were essentially households and firms, not social classes, the pairing was achieved by the “turning of the social groups known to common experience

into three categories of economic types (or functional types): landowners, labourers and capitalists." (Schumpeter, 1954: 554).

> "How very short, simple and natural the step from the recognition of three categories of participants in the economic process . . . to a general schema of this process. The categories are characterized by a purely economic trait: they are respectively the suppliers of land, of labour, and of a stock of goods that is labelled capital. This seems to settle their role in production and . . . the famous triad presents itself, the triad of agents, or factors, or requisites, or instruments, of production." (Schumpeter, 1954:557).

In some 19th century schemata, the number of economic categories varied. Marx, for example, divided actors according to two economic traits: suppliers of labour and suppliers of capital, while Marshall (albeit briefly) had a fourth category: the entrepreneur with his corresponding factor of production, "organization," (a forerunner perhaps of entrepreneurial know-how as intellectual capital). However, for the most part, by the end of the 19th century neo-classical economics and its descendants had fixed on three classes of economic actor and three types of factor of production. Capital was firmly linked with the class of economic actor which supplied capital, the "capitalist," and with a social class whose economic characteristics this economic actor supposedly embodied. This linkage had powerful appeal, creating economic order with appeal to established social order in what must have appeared to the contemporary onlooker, to be an age of great economic disorder, against a backdrop of even greater political disorder.

This development in the concept of capital is still pertinent. While the original linkage to the social classes of the 18th century and their intervention in the economic process, is no longer relevant and largely forgotten, the triad of factors of production is still very much in place. The economic, social and political standing accorded to the social class associated with particular economic actors has also become entrenched. Regardless of the number of categories into which economic actors and agents are divided since Smith, capital has come to be associated with the occupant of a particular socio-economic class with a significant degree of economic (and political) power and to whom, in capitalist societies at least, accrues a significant proportion of the surplus generated.

Fisher (1904) marked the end of the debate over the classification of assets into capital and non-capital. His important contribution to the concept of capital being the reminder that capital was

a stock of wealth in existence at a moment in time, distinguishing once and for all between capital stocks and income flows. It also, according to Schumpeter (1954: 898), enabled a reconciliation of the economist's concept of capital with that embodied in the accountant's capital account. While, as Schumpeter (1954:899) claims, most economists continued to define capital as physical, tangible, capital other forms were beginning to (re)gain favour. For Böhm-Bawerk (1890) "Capital signifies a complex of produced means of acquisition -- that is, a complex of goods that originate in a previous process of production, and are destined, not for immediate consumption, but to serve as means of acquiring further goods." Further, when accessed by labour it permitted labour to be more productive than it could be otherwise. Developing from Bohm-Bawerk's (1890) treatise on capital, interest and the relationship between capital and value some adopted a concept of capital in which is was quantified as "a fund or sum of assets consisting of money or evaluated in money," (Schumpeter, 1954:899). Others, following the Knightian view that division of productive resources into three typologies was inappropriate, "assimilate[d] natural resources with capital goods on the ground that the former's peculiarities, if any, did not warrant separate treatment," (Schumpeter, 1954: 902). This foreshadows the developments of the 1980s and 1990s in which natural resources were re-classified by some as "environmental capital," (Thampapillai & Uhlin, 1997) reflecting perhaps a complete separation of factors of production from economic actors.

20th century developments

The major conceptual contribution of the 20th century has been two-fold: to take capital from the realms of the tangible to the intangible and from the individual to the collective. Human and social capital are two examples of this. The concept of human capital, as developed by Becker (1975 [1964]), is the knowledge, know-how, expertise, education, stock residing in individual workers, brought to bear in their productive work but distinct from their capacity to do manual labour. It is *human* capital, which when applied to labour, increases productivity, adding greater value (Drucker, 1985). Human capital is also the result of past effort. In these ways it resembles other, more traditional forms of capital. Drucker (1985) however, although he discusses knowledge as a "human capital resource" treats knowledge or intellectual capital as distinct from, rather than a subset of, capital. As another factor of production to be used in addition to physical labour he

postulates (in a manner reminiscent of the earlier substitution/ complementarity debate over capital itself) that unlike labour, intellectual capital cannot be substituted for by (traditional forms of) capital, but that investment in both should go hand-in-hand.

Social capital (Jacobs, 1965; Baker, 1990; Bourdieu, 1986) resides in the networks and relationships existing between economic actors, non-existent without those relationships. These networks "constitute a valuable [economic and] social resource, providing their members with the collectivity-owned capital," (Bourdieu, 1986). Social capital comprises both the networks and the resources which can be accessed through those networks (Bourdieu, 1986; Coleman, 1988; Burt, 1992; 1997). This view of capital as residing in relationships is repeated in notions of organisational and customer capital (Dzinkowski, 2000; Erickson & Rothberg, 2000). Here it is the notion of capital as catalyst, as magnifier of value that underlies the argument that because different relationships between economic actors can alter the value added by an otherwise identical production process, they must be included as factors of production. Into which category should they fall? If we are constrained by the three pre-existing factors of production then since they are neither fixed and immoveable nor physical labour they must be capital. The shift to capital residing in relationships between individuals (people or firms) rather than with an individual marks a large conceptual leap. It also raises questions of measurement and ownership (and hence valuation and rent distribution).

With the exception of this latter stretching of the concept to include notions of relational capital, the accepted concept of capital as a durable stock of assets, in existence at a moment in time, actively engaging in the production process, has changed little in the last 100 years. As Schumpeter (1954) argued:

> "At an early stage of analysis the triad of agents suggests itself primarily because it links up nicely with the three categories of participants in the economic processes that are derived from the layman's picture of society. But it so happens the triad also makes economic sense because it presents a complete list of the requisites of physical production, the items of which are both non-overlapping and distinguished by economically relevant characteristics."

We will return to this view in our discussion of the explanatory value of intellectual capital.

What is Capital? A Summary

What then are the distinguishing characteristics of capital in economic thought? The following tables provides brief summaries of the key features and the explanatory contribution of capital identified in our discussion above.

[Insert Tables 1 and 2 about here]

At the end of this brief tour of the history of the concept of capital what do we understand the term to mean? What is encapsulated in the use of the term? Capital consists of durable assets, (formerly tangible, but now also intangible) themselves the result of past production, engaged in production. Further, capital is frequently understood to be the enabler of the production process and/or to add further value to the process than if labour were applied alone. (That is, it facilitates the creation of value, even if it does not itself create value.) It explains how identical labour can yield very different results in otherwise identical production processes. Capital is one of a limited number (usually, but not always three) of key, quintessentially different, economic agents in the production process, which together embody all that take part in that process. It is distinct and distinguishable from other factors of production, with identifiably different economic characteristics. It stands in front of an economic actor who occupies a particular economic position in relation to other economic actors and represents the economic characteristics associated with a particular social class. All elements in capital must have broadly similar characteristics to other elements categorized as capital while having broadly dissimilar characteristics from elements categorized as other factors of production.

Capital brings a concept of time into our understanding of the production process, separate from that conveyed by its own durability. It is the means by which labour/effort expended in the past can be incorporated into current production, or by which current effort can be carried forward into the future. In other words, it is a store of labour. It can also represent investment, an advance against future returns. (Capital may be used up in production over time, but replaced by further surplus created as a result of its application. Note that nowhere have we found the claim that capital is not only durable but enduring.)

Capital is one element in an closed system of (usually) three factors of production. Within this system therefore all economically significant resources must be categorized as one of the existing factors of production.

A TAXONOMY OF INTELLECTUAL CAPITAL

To conceive of ideas as capital they must fulfill the same function in the production process as other forms of capital. Their economic characteristics must be more like those of capital than like those of other factors of production. To acknowledge ideas as an important economic agent in the production process but to conceive of them as something other than capital (or land or labour) would require the development of a new schema. If a further distinct category is to be defined there remain two theoretical options: (1) all remaining categories must be redefined, or (2) it has to be argued that in fact the system is not closed, i.e. there are elements and activities within it which cannot be explained: a schema in which ideas occupied a parallel, but distinct, role in production and distribution a schema in which they were associated with an economic actor identified by a purely economic trait: the supplier of ideas.

In this section, we review the intellectual capital literature and show that it is confused about these theoretical options. Some trend setting contributions are altogether silent about the theoretical location of their central concept.

Teece's Intellectual Capital is never explicitly defined, and his use oscillates between a narrow financial use (as in access to capital (2000: 40)) and a general equation of intellectual capital with intangible assets (in accountancy terminology), "of which knowledge, competence, and intellectual property are the most significant. Also included are other intangibles such as brands, reputations, and customer relationships." (Teece, 2000: 3). Others follow this pattern of equating intellectual capital with intangible assets. Gu & Lev (2001) treat the two as synonymous, arguing that intangible assets (intellectual capital) are "the major drivers of corporate value and growth) (Gu & Lev, 2001: 2). For Dzinkowski (2000: 32) intellectual capital relates to "the intangible, highly mutable assets of the firm", and defines it as "the total stock of capital or knowledge-based equity that the company possesses". It can be "both the end result of a knowledge transformation process

or the knowledge itself that is transformed into intellectual property or intellectual assets of the firm" (Dzinkowski, 2001: 33). This echoes Davies & Waddington (1999: 34) who argue that intellectual capital is not the latent creativity of an organisation but the output, the results of that creativity, separate from the individuals in whom the creativity resides. Stewart arguably adopts a pre-theoretical, at best metaphorical use of capital as "collective brainpower". (Stewart, 1997). Erickson & Rothberg (2000: 192) define intellectual capital simply as the "stored knowledge possessed in an institution". Other definitions while varying in detail are similar in characteristics: collective knowledge (or in some instances the capability to be creative) put to productive use to increase value.

According to Granstrand, one of the most thoughtful commentators (1999: 322): "Intellectual capital essentially comprises all immaterial resources that could be considered as assets, being possible to acquire, combine, transform and exploit, and to which it is possible to assign, in principle, a capitalized value. 'Intellectual' is thus used roughly synonymous with 'immaterial'. 'Human capital' is commonly used to refer to intellectual capital specifically embodied in humans, excluding IPR [intellectual property rights]."

Characteristics of Intellectual Capital

The following table summarizes some of the recent definitions of intellectual capital, identifies the way in which it has been characterized and where it has been located.

[Insert Table 3 about here]

While this is not an exhaustive list, it does give a general guide to the way in which intellectual capital has been conceptualized. As a number of authors have pointed out, the definition of what is and what is not intellectual capital has not yet solidified, so some are more all-encompassing than others (just as occurred in the definition of capital itself). Whereas accounting definitions focus on intangible assets, abstract things, management definitions focus more on capabilities and competencies, the ability to do. There is also discrepancy over the extent to which it includes the social and organizational processes dependent on inter-personal and inter-group relationships. However, as

Ulrich (1998) points out lack of definition does not rob the concept of relevance and some commonly-held ideas about the characteristics of intellectual capital can still be identified. It is not scarce, proliferates (and changes) rather than depletes through use, is intangible, and is enhanced by being shared within and among organizations. How does this compare with traditional notions of the characteristics of capital?

THE EXPLANATORY VALUE OF IDEAS AS CAPITAL

Factors of production are an abstraction that emerged in economic history when agents of economic activity became separated from traditional forms of living. Ownership of land had to become clarified as title (i.e. transferable), labour relations had to involve an element of contracting, tools had to become subsumed into a variety of more or less efficient production processes. Capital existed in a pre-industrial, pre-capitalist world in the sense of wealth but not as the engine of a market system.[1]

In section one, we have shown that the abstraction of capital as a distinct factor of production coincided with the economic and societal shift from agricultural subsistence production, to mercantilist trade and early industrial processes. *Prima facie*, it may be plausible to expect a post-industrial society to run on a different engine, constructed of different economic agents. The intellectual capital literature has thrown up a number of candidates which we listed in section two. They will now be matched against the criteria for capital extracted in section one.

To summarize: For ideas to be conceived as capital they must be durable, measurable and ownership exclusive. In economic terms, they should be a stock, not a flow. They should be actively engaged in the production process -- thus not all ideas can be capital, only those applied in the production process. Ideas should enable production to take place and magnify value created through production. Ideas as capital should embody a notion of depreciation over time and replacement. Ideas should be the economic agent of an economic actor occupying the same position in production and distribution as suppliers of other forms of capital. The economic actor should be economically distinct from the suppliers of labour and land. Finally, ideas as capital should convey

[1] As Heilbroner illustrates the pre-capitalist world order (1991 [1953]: 29): "Not the shortest and most efficient, but the longest and most labor-consuming process was the preferred technique of production. Advertising was forbidden, and the idea that one master guildsman might produce a better product than his colleagues was regarded as treasonable."

some notion of time in the production process, embody past labour, be a store of labour for the future.

Ideas located in Individuals

All definitions of intellectual capital refer prominently to ideas and knowledge contained in particular individuals, such as employees or partners. It is quite obvious that professional service firms, such as architectural practices, law firms or merchant banks, may lose their main generator of wealth when key employees leave. Much of this discussion has been anticipated in the economic literature on human capital (defined as the "imbedding of resources in people", through investment in training, education, better healthcare -- all of which raise productivity (Becker, 1962:9). In this approach the firm invests in human capital (those intangibles which increase human productivity) in expectation of increased returns; the loss of the human in whom the human capital (the outcome of the investment) resides therefore means the loss of the potential future returns on that investment (c.f. Becker, 1962: 18). In the context of the management literature on the rise of the "symbolic analyst" (Reich, 1991) or "knowledge worker" (Drucker, 1993) there is a temptation to conceive of the suppliers of ideas as a new class to which a new economic agent or factor of production should be assigned: i.e. intellectual capital. It may also fit with the layman's perception of categories of actors in the economic process: e.g. chief executives, star lawyers, heroes in film and sport [cf. Schumpeter (1954), quoted p. 13 above].

Two main criticisms can be advanced against the labelling of individual knowledge as capital. First is the question of ownership. While most firms contractually own the services and output of employees, this ownership is often temporary and not transferable at the employer's or employee's will. This may conflict with the durability constraint on capital. Secondly, human beings constantly have new ideas, forget others and sometimes consciously change their mind (Dolfsma, 2001, p. 80/1). Knowledge is itself being transformed while it is transforming production. Thus it appears problematic to conceive of individual knowledge as a stock from which a flow of goods is generated over time. If the stock of ideas cannot be measured, indeed identified, and is transformed in its use while ownership remains ambiguous, to what extent can ideas be classified as capital?

Ideas located in Organizational Structures

In the literature about organizational capabilities, a firm's production set is often referred to as the firm's knowledge about the possibilities of transforming commodities (Arrow & Hahn, 1971: 53; Nelson & Winter, 1982: 59-65) or anticipating technological and commercial opportunities (Teece & Pisano, 1994). It is tempting to conceive, for example, of technological knowledge, as "an attribute of the firm as a whole, as an organized entity, and ... not reducible to what any single individual knows, or even as any simple aggregation of the various competencies and capabilities of all the various individuals, equipment, and installations of the firms" (Nelson & Winter, 1982: 63). The intellectual capital discussion follows this line of thinking in referring to "business processes" (Edvinsson & Malone, 1997), "infrastructure assets, including systems and networks" (Dzinkowski, 2000), "knowledge and competence" (Teece, 2000), "innovations" (Bradley, 1997), even "collective brainpower" (Stewart, 1997) as generators of future wealth.

Should the productive and anticipatory capabilities of organizations be treated as capital? If organizational capabilities could be identified *independently* of the productive output associated with them, this might be a promising analysis. Organizational capabilities may then store past efforts, while transforming in time future production. If, however, specific organizational capabilities are only attributed when there are visible outcomes - for example in superior profits - this approach is likely to become tautological. In advancing intellectual capital theory, a low level of abstraction is initially desirable.

Suppose, there is an independently specifiable business process, such as Just-in-Time production, supported by a sophisticated, networked procurement system. Would such a system be capital? The answer must be twofold: As a functioning piece of information technology, there is no need to mobilize a new notion of *intellectual* capital. Computer systems should squarely fit within the traditional notion of capital: a durable depreciating tool transforming production. If Just-in-Time refers to a more abstract organizational capability formed around that IT system, even a R&D capacity to produce such innovative systems, organizational knowledge may come into play.

Nelson & Winter (1982: 61) question whether the results of R&D efforts "can be recorded, stored at negligible cost, and referred to when most needed". This is a pertinent observation.

Organizational capabilities cannot be easily deployed nor transferred. Intellectual capital theory may require detailed empirical research in tracing specific organizational configurations over time, identifying their durability and transformative effect as magnifier of value in the production process. A steep methodological hurdle to overcome.

Ideas located as Intellectual Property

Some elements of past R&D efforts appear to meet the challenges of recordability, deployability and transferability: namely knowledge formalized as intellectual property. The intellectual capital literature we surveyed gives due prominence to patents, but also copyright, trademarks and trade secrets - with the exception of Ulrich (1998) who stresses the location of intellectual capital in individual workers, and Nahapiet & Goshal (1998) who focus on "social collectivity".

Consider the example of Prozac, a popular anti-depressant drug. US pharmaceutical group Eli Lilly launched Prozac in 1986 on the back of a patented chemical compound. Decades of molecular research and clinical trials were "stored" in this patent, and put to use in a production process which generated a highly profitable flow of goods, reaching sales of $2.6bn in 2000. Prozac's intellectual property proved durable as capital -- until the patent expired on 2 August 2001 leading to an immediate sales drop by 80% in favour of generic drug alternatives.

In a case involving GlaxoSmithKline's best-selling antibiotic drug Augmentin, a U.S. federal court invalidated in May 2002 a patent on a derivative that was designed to extend Augmentin's monopoly (that was due to expire in December 2002) until 2018. GSK's sales of Augmentin had amounted to £912m per year, and the judgment wiped 9% from the value of the company immediately.

Prozac's and Augmentin's technology functioned as capital due to strong legal protection afforded by the patent system. Following the expiry of intellectual property rights, Prozac and Augmentin will continue to be produced on knowledge in the public domain, but such knowledge can no longer be appropriated as capital, or be accumulated in the licensing or cross licensing of technology.

Knowledge capitalised as intellectual property is more vulnerable than traditional capital, in that it is open to multiple legal challenges. Lawyers often point out that the only valid patents (of

165,504 granted by the USPTO in 2000) are those tested in court. Similarly, the enforcement of intellectual property rights is difficult, as some intellectual capital authors admit (Teece, 2000: 15). There is also a danger of intellectual property congestion. Rivette and Kline suggest (2000: 56) that patent licensing generates "largely free cash flow", using the example of IBM which increased royalties earned from patent licensing royalties from $30 million in 1990 to nearly $1 billion. This ignores the costs of conducting business in an environment where each new product is likely to depend on already protected pieces of technology (cf. Bessen & Maskin, 2000).

Ideas located in Social Networks

In referring to branding, reputation and customer loyalty as intellectual capital, the intellectual capital literature adopts a view of capital first developed by sociologists. They defined a concept of "social capital" as all resources embedded in the social network of an individual. Burt (1997: 339) contrasts the social capital with the human capital approach: "While human capital refers to individual ability, social capital refers to opportunity."

In Burt's theory of structural holes, social capital is a function of brokerage opportunities in a network - "a story about location effects in differentiated markets ... The structural hole is an opportunity to broker the information between people and control the form of projects that bring together people from opposite sides of the hole. (ibid, p. 340)"

Coleman offers two further forms of social capital apart from information channels: obligations and expectations; and social norms (1988, S98):

> Social capital is defined by its function. It is not a single entity but a variety of different entities, with two elements in common: they all consist of some aspect of social structures, and they facilitate certain actions of actors -- whether persons or corporate actors -- within the structure. Like other forms of capital, social capital is productive, making possible the achievements of certain ends that in its absence would not be possible. Like physical capital and human capital, social capital is not completely fungible but may be specific to certain activities. A given form of social capital that is valuable in facilitating certain actions may be useless or harmful for others. Unlike other forms of capital, social capital inheres in the structure of relations between actors and among actors. It is not lodged either in the actors themselves or in physical implements of production.

There is no doubt that social relations can function as a magnifier of value in otherwise identical production processes. This feature may be usefully highlighted by adopting a notion of capital. The

conceptualization of social relations into a factor of production, however, must remain metaphorical in several important respects. Nahapiet & Goshal point out (1998: 244) that "social capital cannot be traded easily". Moreover, if we are to preserve the link between factors of production and economic actors, with which economic actor should we associate social relations? Finally, social relationships themselves will be transformed in the process of production.

CONCLUSIONS

In order to summarize the key explanatory weaknesses of the capital approach, we return now to the three questions that motivated this paper: We consider these in turn:

1. Which constraints does the intellectual capital approach impose?

The "definition as capital" approach turns ideas and knowledge into something static, that can be stored and deployed at will. In this analysis ideas remain untransformed in their use, unchanging in their contribution to production. They may be depleted over time, "wear out", but it is possible to replace them in the same production process with identical ideas -- the constant reinvention of the wheel. In other words, neither learning nor experience, which transform knowledge within the same, existing production process can take place. If new ideas are to be created and put into action it must be in the guise of "capital goods", intentionally and knowingly generated in the production process. Within the "definition as capital" approach ideas must be separable from, and capable of being valued independently of, the individuals or groups within which they reside. Furthermore, they should have a knowable, potentially measurable value, separate from and prior to their application. However, intrinsic to the intellectual capital notion of knowledge is that it is not separable from the entities in which it resides. In the transfer of ideas from one individual to another, from one group to another, they are necessarily transformed and their value changes. Furthermore, the value of intellectual capital is only measurable after its application, as the difference between the value of the whole and the sum of the "capable of being valued" parts. Unless we adopt a broad definition of capital which encompasses all that is not visible or quantifiable but is capable of adding value in the

production process, the constraints imposed by labelling ideas as capital are immense and strip them of some of their key, defining characteristics.

Defining ideas as capital does not capture well the contribution and role of knowledge in the production process. Within management the tendency has been to focus on ideas as resources which have the potential, when put into action in combination with other resources, to become capabilities. Ideas are only productive when they are integrated with other resources of individuals or firms. They are not in themselves productive. Yet part of their value lies in their potential to be productive (i.e., their expected future productiveness) not just in their demonstrated productiveness. Through the integration of existing knowledge in new ways, new knowledge, new capabilities, are created. Ideas and knowledge develop and proliferate through their use and application, as do capabilities. Ideas, unlike capital, are not preserved unchanged in their non-use, but because they are context-specific with a shorter time frame than traditional forms of capital, deteriorate and lose value, through non-use. A resources and capabilities approach to conceptualising ideas captures better their dynamic growth, transformation and embedded value characteristics than does the "definition as capital" approach.

2. Why has the intellectual capital approach been so attractive?

Since the dawn of modern economics, economists have categorized productive resources as "factors of production", inextricably linking them with classes of economic actor. Embedded in this schema are political economy issues regarding the location of economic and social power (Schumpeter, 1986 [1954]) in which, in the industrial age, capital came to be seen as the ascendant, dominant factor, owned by the dominant class of actor. In a continuum of thinking, in the knowledge-based economy, in which knowledge and its skillful management is deemed essential for value creation, the owner of knowledge is key, and capital may plausibly expand.

As knowledge and ideas became increasingly important in the generation of economic surplus, definition as capital was an expedient way in which to signal that growing importance, by appeal to preconceptions of capital. This use was a valuable signalling device of a changing economic order. During the 1990s an immediate need appeared to explain and justify share valuations that took little account of the old factors of production. "Intellectual capital" appeared as

a concept that could analytically connect the correct diagnosis of a post-industrial economic transformation with the exuberant share prices of the dotcom boom.

3. What is the explanatory value of the intellectual capital approach?

The explanatory ambition of defining ideas as capital is twofold. First, it captures the inter-temporal nature of ideas. Ideas embody experience and knowledge from past effort, and as long as experience can be thought of as the result of past labour, so ideas embody that past labour. Knowledge allows the efforts of one production cycle to be re-applied in subsequent cycles. Experience from the past is preserved in the knowledge of the present, just as past labour is preserved in capital. In this way can they be conceptualised as capital. Second, in the notion of capital as catalyst, as enabler of value creation, a key feature of ideas is captured. The application of knowledge in conjunction with labour can lead to very different productive outcomes than if that labour were applied alone, or with different ideas. In this sense, ideas may appear close to capital.

However, knowledge and ideas are constantly being transformed while they are transforming production processes. Knowledge and ideas grow and develop through use. The intellectual capital approach fails to account for these individual and organizational learning processes. Furthermore, for ideas and knowledge, use by one party does not prevent use by another; they are "public goods". This important feature of the knowledge economy is denied in the conceptualization of ideas as capital since theorists may consider propertization as the only way to extract value from intellectual material. As Harold Demsetz (1967) has pointed out in a seminal article, property rights are not costless in that they deny (as rights to exclude) access to desirable goods and resources. Property rights are justified if their absence would impose even greater losses. The costs of turning ideas into capital, however, may be greater than the gains, both for society and firms which may suffer from intellectual property congestion. The knowledge economy may become overcapitalized.

Nelson and Winter (1982: 63) criticize accounts of "a latent capacity to organize, that, being totally disembodied from that which is organized, resides in nothing. It would have us believe that there is such a thing as an automobile firm that owns no plant, hires no workers, and produces no automobiles, yet retains the capability to produce automobiles and is ready to do so at the whim of

the market." In a similar spirit, we have argued that individual and organizational learning as well as issues of ownership and control resist a "definition as capital" approach. It may be a chief effect of the knowledge economy that the divide between factors of production, in particular labour and capital, is becoming more ambiguous and increasingly false. Hence we suggest that factors of production, with their concomitant notions of distinct economic actors and the reduction of difference to homogeneity, embodied in the term intellectual capital, should be abandoned in favour of a capabilities-based approach which focuses not on the provider (i.e. owner) of classes of resources but on the productive contribution of resources. The categorisation of ideas as resources or capabilities echoes the 19th century pre-Fisher debate over the classification of assets as capital only if they were *actively* engaged in the production process. In a similar vein, a resource only becomes a capability when it is put into action and combined with other resources or capabilities. But, as with Fisher's contributions on capital (1896-1904), what is key about ideas is their *potential* to be put into useful action (provided that ideas are not out of use for too long). 100 years on, we are still digesting that lesson.

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Table 1. Characteristics of Capital

Author	Definition	Characteristics	Explanatory role
Greek & Roman	Principal of a loan (to satisfy personal needs)	Money form; tangible, measurable, ownership clear	To distinguish the principal of a loan from interest accruing to it; monetary wealth from any income generated through its being loaned out
Mercantalists	Value of stock in trade; sum invested in trade; individual sum of wealth	Accumulated surplus from past trade or from investment (to enable another to trade); *supports* commercial activity; durable; takes form of financial capital or stock in trade; measurable; ownership clear	To distinguish between that which enabled trade and the flow of income resulting from trade; to enable the apportionment of income from trade and investment; to express/quantify wealth; enables time to be taken into account
Physiocrats (e.g., Quesnay, Turgot)	Stock of food/tools advanced to a labourer at start of production cycle	*Facilitates* agricultural production (the means of generating wealth); applied to land in conjunction with labour (complementary to labour & land in production process); accumulated surplus of past production; durable but depreciates over time; measurable; ownership clear	Represents accumulated surplus from past production; Enables the surplus of past (agricultural) production to be applied to future production so that agricultural production remains the generator of wealth; enables time to be taken into account
Smith	Circulating capital	Complementary to labour in production process; increased the productivity of labour but not itself a source of surplus; link with economic actor -- capitalist	Partially explains differences in output of similar labour, a facilitator of production but retains notion of labour as productive factor
Ricardo	Circulating capital; Fixed capital -- tools, machinery, capital goods, etc. The **part** of wealth used in production.	Tangible; durable; used in the production process (depreciates) but not transformed by it; substitutable for labour; measurable; ownership clear; link with economic actor	To account for industrial capital -- a direct participant in the production process enabling labour to be replaced
Mill, J. S. Mill, Marx	The product of past labour used to supply current productive labour	Tangible; embodies past labour; link with economic actor	Enables a labour theory of value to be adopted
Neo-classical economics (e.g., Jevons)	Investment employed (financial capital or physical capital expressed in value terms)	Tangible; reducible to homogeneous, interchangeable units, expressible in value (monetary) form; it and the return accruing to it are measurable;	To enable general equilibrium to be achieved -- enable the return to capital and wages to be treated as equivalents;
Böhm-Bawerk	A means of acquisition; capital goods	Result of past production; increases productivity of labour; evaluated in money terms; tangible;	Enables output of past production to contribute to current production; distinguishes between capital(production) goods and consumption goods
20th Century contributions	In addition to physical & financial capital		
Becker Drucker	Human capital: knowledge, expertise, education	Intangible; stock residing in individuals; increases productivity of labour; result of past effort; complementary to other forms of	Distinguishes mental effort from physical labour; enables learning (past mental effort) to be taken into account; accounts for non-

		capital; difficult to measure; value not necessarily separable form location	homogeneity of labour
Bourdieu, Coleman, Burt	Social Capital	Intangible; resides in networks & relationships; collectively owned; magnifies value, increases productivity of identical production processes; facilitates production; difficult to measure; value not separable from location	Enables the added value of organisational skills to be taken into account

Table 2. Explanatory uses of Capital concept

- To distinguish principal of a loan from the interest accruing to it
- To distinguish the sum invested in trade, or the stock in trade, from the flow of profits resulting from trade
- "fixed" vs. circulating: to distinguish between financial capital (funds invested/money) and physical capital (physical assets used in production, but not used up or transformed)
- To provide for the output of past production to be used in current production
- In labour theories of value, to enable labour of past periods to contribute to current production so that all surplus generated can be the product of labour expended
- By link with an economic actor in the production process, also linked to a social class whose economic characteristics the economic actor embodies; economic order reinforces social order
- To enable closure of a “closed” economic system; providing a category for all agents of production that cannot be categorised as labour (human effort) or land (natural resources)
- To enable the difference in productivity of identical labour/ land/ production processes to be explained

Table 3. Characteristics of Intellectual Capital

Author	**Defined as**	**Characteristics**	**Location**
Bradley, 1997	Ideas given form; innovations. The ability to combine physical inputs with relatively low intrinsic value into mixtures potentially worth significantly more.	Weightless; tradable; limitless; not scarce; cheap to reproduce; appreciates rather than depreciates with use; multiple, simultaneous application.	Firm
Stewart, 1997	Collective brainpower, formalized, captured and leveraged. Human Capital: "skills and knowledge of our people" Structural Capital: "patents, processes, databases, networks etc" Customer Capital: "relationship with customers and suppliers".	Transforms raw materials, making them more valuable. Weightless: expense and burden of carrying physical assets is eliminated Inexhaustible: ability to leverage knowledge capital is unlimited	Firm
Edvinsson & Malone, 1997	The gap between a firm's market value and its financial capital (book value of a firm's equity). Comprises 2 components: human capital (the value of its training) and structural capital (intellectual property, business processes, product ideas and customer loyalty).	Effective interface between information technology, business development and human resources	Firm
Ulrich, 1998	Commitment & competence of workers. (Knowledge, skill or ability applied to the organization's goals and purposes.)	Firms' only appreciable asset	Employees Firm
Nahapiet & Ghoshal, 1998	Knowledge and knowing capability of a social collectivity. 4 elements: individual, explicit knowledge; individual, tacit knowledge; social, explicit knowledge; social, tacit knowledge. (Borrowed from Spender, 1996).	Defined at the organizational level. Socially and contextually embedded knowledge greater than the aggregation of individually held knowledge resident in the firm. Closely related to social capital which is costly to create and maintain.	Firm Social Network?
Granstrand, 1999	Immaterial resources 1. Intellectual property: Patents, databases, know-how, licenses, trade secrets, trade marks, designs, software, copyrights, concessions 2. Goodwill and power in internal/external relations: 'relational' (trust, motivation) and 'organizational' (capabilities) capital 3. Human competence: managerial, technological, commercial, financial, legal, manual (p. 113)	R&D intensive Dominating as a means of production Ownership is central: capitalized value can be assigned only if possible to acquire, combine, transform, and exploit intellectual assets (p. 322)	Firm (technology, intellectual property) Employees [external relations]
Teece, 2000	Intangible assets: knowledge, competence, intellectual property, brands, reputations, customer relationships	Publicness: Use by one party does not prevent use by another Depreciation: Does not wear out but usually depreciates rapidly Transfer costs: Hard to calibrate (increases with the tacit portion) Property rights: Limited (patents, trade secrets, copyrights, trademarks, etc.) and fuzzy; enforcement relatively difficult (p.15)	Firm

Dzinkowski, 2000	Intellectual assets; knowledge assets. Total stock of knowledge-based equity possessed by a firm. 3 components: human capital (including knowledge, know-how, innovativeness; organizational (structural) capital (intellectual property & infrastructure assets, including systems and networks); customer (relational) capital.	Fixed (e.g., patent) or flexible (e.g., human capabilities); both the input & output of the value creation process; end product of a knowledge transformation. Human capital → organizational capital → customer capital.	Employees Firm (infra-structure, intellectual property) Customers