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UNDERSTANDING TODAY'S ECONOMY AND ITS RESIDUALS

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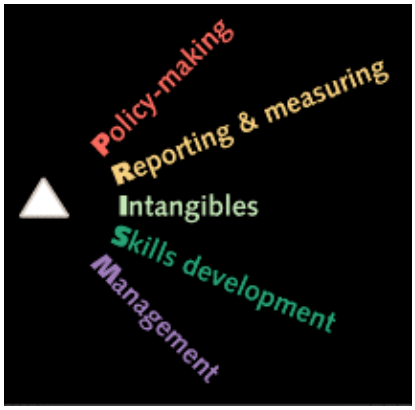

This paper is one of a series of papers that have been written by Peter Hill and Richard Youngman as part of their deliverables to the PRISM project. Other papers available on the PRISM website are entitled:

- Charting the development of the 21st century economy
- Measuring tomorrow's economy: why it matters and what needs to change
- Capital formation activities in today's economy
- Assets and property rights - sources of confusion
- Intangible assets in the SNA: originals, innovation and human capital formation
- The Final Report: the measurement of intangibles in macro-economic statistics

PRISM is a multi-disciplinary European initiative aimed at gaining a deeper understanding of the issues surrounding the management and measurement of intangibles in the modern economy. The PRISM group believes that intangible investments are *the* drivers of both competitive advantage and economic value creation, and that they are inadequately evaluated by current measurement and management tools which were devised for an economic context that no longer exists.

PRISM is funded by the European Commission's IST programme. Its findings are being published in the course of 2003, and an "open" conference will be held in London on July 4th 2003. For more information, visit www.euintangibles.net.

Understanding Today's Economy and Its Residuals

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Abstract

This paper explores the language used to describe today's economy, with a view to establishing our own view on whether there have been some fundamental changes in the economy.

The paper finds that no "New Economy" as such has emerged in the last few years. Instead, we are inclined to believe that a "new-look" economy has emerged – that is to say, one that has marked differences from 50 years ago, but is clearly its progeny. There has been a shift in emphasis, one that has taken root gradually and one that has largely gone unnoticed as our measurement and statistical systems were not set up to capture some of the underlying dynamics. In fact, what actually may be new about the economy might, perversely, be our degree of ignorance of the underlying dynamics and our ability to explain and track them through conventional measurement systems.

A soft revolution, it is argued, has gradually taken place, in which those assets, which hitherto we have inadequately and inaccurately described as soft, immaterial or intangible and treated as residuals in economic measurement parlance, are in fact the key economic goods. This "new-look" economy is propelled by a combination of factors such as knowledge, innovation and creativity, new forms of technology-rich capital assets (ICT capital), and a growing ability, in some cases, to effectively combine labour and capital.

We believe that the end result is that we need to re-align our conceptual frameworks, models and toolkits – including, for example, the System of National Accounts (the SNA) – to the realities of the production processes of today's economy.

A fundamental difference between the 20th and 21st century economies might simply be that we can no longer rely on tangible assets to provide a reliable guide to the rate and direction of economic change.

1. Introduction

Whether it is the start of a new millennium or the psychological impact of the global economic malaise, this seems like an ideal time to reflect on today's economy – what is driving it, and what determines growth and economic value creation.

Serious debate on these issues has been ongoing for many years, mainly in specialist circles of academia, economists and statisticians. This debate was fuelled by the apparent take-off in growth and productivity in western economies in the 1990's after two seemingly "flat" decades. The debate was also hijacked in a sense by the widespread popularisation of the idea that something new was going on in the economy, which went so far as to declare that a "New Economy" had been born.

The rapid acceptance of this idea at the end of the last century may say as much for our lack of historical perspective as anything else. It may be fashion, vanity or a combination of the two to believe that we are living through a time of unprecedented change. Imagine someone transported from 1800 to 1900 to view the transformation of economies from ones based on small, self-sufficient agricultural communities powered by animals to ones whose principal units were now large, urban-based manufacturing companies powered by machines. The changes we are experiencing today seem small and incremental in comparison.

Notwithstanding, a proliferation of vocabulary and terminology used to refer to today's economy has resulted. The concern is that the widespread use of such language and labels creates the illusion that we actually understand today's economy, that we agree on its development path.

In this paper, we will explore the language used to describe today's economy, with a view to establishing our own view on whether there have been some fundamental changes in the economy. We will explore the language and our understanding in this paper from the following perspectives. Was this growth real or illusory? Where does growth and economic value creation actually come from? Have there been fundamental changes in the underlying production process?

Our ability to find answers is hindered by cognitive barriers. We have no widely-accepted language, models or conceptual frameworks with which to engage in the debate. Instead, as this paper will show, a proliferation of descriptions and explanations exist which leave us with a complex jigsaw puzzle to solve. We are destined to try and solve this problem, knowing that we have neither the box (to illustrate what the end solution might look like) nor all the pieces.

It is, nevertheless, a worthy cause since, only with a clearer perspective on today's economy, on what drives growth and value creation, can we hope to be able to measure tomorrow's economy better. A parallel paper, "Charting the development of today's economy", provides empirical insights into the changes which have been taking place over the last few decades.

The data collected have reinforced the view that a gradual shift has been taking place for many years within our economy, within the drivers of growth and productivity. No longer is it sufficient to trace the investment into physical capital and the hours worked by labourers to track change. Factors which have up to now been hidden from us, mis-classified, or lumped together as "residuals", have gradually emerged as important factors in our economy.

These factors are crudely described as intangibles, but more meaningfully can be identified with expenditure and time investment made into the development of skills and talents, and into the stimulation of ideas, creations and scientific breakthroughs. Investments in so-called intangibles are of an order of magnitude of 10% of GDP of developed economies – that is to say, highly significant sums, the mis-classification of which, distorts our picture and understanding of economic realities.

A clear picture emerged from this data collection exercise of how strained and inadequate are our current measurement frameworks to systematically provide routine information on all the important facets and key drivers of today's economy. The inadequacy and misalignment of our measurement toolkit is a theme explored in more detail in another paper, "Measuring tomorrow's economy: why it matters and what needs to be changed."

This is a daunting problem. Our measurements systems, with the SNA at its heart, are inadequately aligned with the new-look economy and the one that will continue to develop in the 21st century. They are not telling us the full story of what we need to know about the economy, and all the while the proportion of "residuals" in macro-economic statistics – such as multi-factor productivity – continues to rise.

And whilst it would not be healthy to be panicked into a series of short-term fixes, it would be even worse to not recognise that real changes are ongoing and that the existing tools and systems we use for trying to track and understand these changes are unsatisfactory and are only going to become more so.

We need a truly long-term strategic plan to overhaul our accounting and statistical systems. This is as appropriate to business accounting standards as it is to the SNA. Indeed, ideally the two would be planned in unison given the extent to which national accountants rely on a data feed from companies. This long-term plan would not only include tackling some specific issues within the current set-up – as indeed we have done in the course of our work – but also undertaking a comprehensive appraisal of the measurement business as a whole. In so doing one must be cognizant and realistic as to how quickly changes could actually happen. Such considerations place limits on the changes that may be considered, and in some cases it may be preferable to first of all develop new concepts through satellite accounts rather than in the core accounts.

The structure of *this* paper is as follows.

In section 2, we collect various pieces of the jigsaw together, setting out some of the main terms that have been used to conceptualise today's economy and what is "new" about it. In so doing, we see the economy through different lenses and from different perspectives and catch glimpses of what today's economy looks like, without seeing the full picture.

In the third section, we argue that a new-look economy has developed, one that has evolved gradually, not one which represents a complete departure from the past. A soft revolution has taken place which has rendered our economic measurement systems and their reliance on "residuals" inadequate for the 21st century.

In the fourth section, in the light of these observations, we revisit our macro-economic conceptualisation of the production process with a view to better incorporating some of the missing elements. We believe thinking through the processes from the inputs side is more beneficial than, as many do, starting with a classification of the outputs and then trying to trace the production process backwards to find the inputs. In particular, this section is concerned with the System of National Accounts (the SNA) and its ability to incorporate into its production models the flows of expenditures committed to the build-up of so-called intangible assets.

2. In Search of a New Economy

This section will explore the various terms used to describe today's economy and what is "new" about it.

At its broadest, the new economy has been described as an open and globalised world where capital, ideas and information all flow freely and speedily across the world (Jonung 2000). The European Central Bank (ECB, 2001) define what is new in the economy as the higher potential growth of production underpinned by the substantially increased effectiveness of economic processes. Hagsten (2002) identified the main items of structural change as higher productivity, increased competition and larger markets.

Alternatively, Jagren and Morell (2000) conceive of a new economy arising from the combination of a number of ongoing changes and trends. These include, inter alia:

- New basic technologies
- New deregulated and increasingly global markets
- The higher importance attached to knowledge and intellectual capital
- New organisational structures in companies

- New economic policies
- Low inflation
- New values and attitudes

Others have preferred to define it more narrowly, focusing on a particular aspect of change and labelling it accordingly. Notably such approaches stretch back many years, hinting that the idea of newness in the economy may not be so new after all.

In 1994, Peter Drucker coined the term a "post-capitalist society" to describe the ongoing changes he was observing. Many years previously, he had started to use the notion of a "knowledge worker". In a capitalist system, he reasoned, capital is the critical resource of production, and is totally separate from, and indeed in opposition to, labour. In a post-capitalist society, into which, he argued, we are gradually moving, the knowledge residing in human beings (in labourers) is *the* key resource. It cannot be bought with money nor created through investment in quite the same way as other resources. Capital and Labour are no longer opposites but are becoming one and the same.

Such a viewpoint is apparent today in the widespread usage of the referent, the Knowledge Economy. This in itself is a widely applied and variously defined term. The OECD's 1996 report, "The Knowledge-based economy", argued that the term is intended to recognize more obviously the role played by knowledge and technology in economic growth, in the production of final output and in employment. Elsewhere it is taken to describe the process by which knowledge inputs are transformed into economic goods and services (Skyrme, 2002). In such an economy, however, cause and effect can be hard to determine, since they are not directly linked by separately identifiable, tangible assets or activities, thus presenting traditional measurement methodologies with severe challenges (Carss 2002).

There is certainly no consensus as to what precisely we mean by a "knowledge economy". However, it has certainly gained widespread usage. Witness Tony Blair's foreword to the UK's 1998 Competitiveness paper:

"Our success depends on how well we exploit our most valuable assets: our knowledge, skills, and creativity. These are the key to designing high-value goods and services and advanced business practices. They are at the heart of a modern, knowledge driven economy."[1]

Growth in such an economy requires ongoing and unsentimental innovation and creative destruction. The speed and spread of commoditisation is such that the only way to stay alive is to re-invent. Sources of competitive advantage are rarer and temporally shorter. Vast sums are plied into the development of new products, in spite of the fact that success rates are falling. The cost of launching new products, however, is rising: tens of millions for a new movie, hundreds of millions for a new drug, billions for a new car (Goldfinger, 1996). This is giving rise to what Goldfinger calls a "wager economy" – higher and higher stakes against lower and lower odds of success.

A different approach has been to view the introduction of a "new" economy as a direct result of the emergence (or in some eyes the explosion) of information and communication technologies. These changes are deemed to have been powered by two principle forces. One is the incredible rise in processing power. Total computing power, according to calculations made by Lawrence

[1] "Our Competitive Future: building the knowledge driven economy" (White paper presented to UK parliament, December 1998)

Summers and Brad DeLong, increased something in the order of four billion-fold in the 40 years since the end of the 1950s, representing an average annual growth rate of 56% per annum. This figure compares to the 5% per annum growth delivered between 1869 and 1939 by steam and then by electric engines (Coyle, 2000). The second force has been the dramatic fall in the cost of computers – within one generation, the price of computers has fallen 10,000-fold.

The development of our knowledge and our technological capabilities have given rise to what Diane Coyle (1998) has termed a "weightless world". Alan Greenspan has frequently commented on the fact that economies are getting lighter. This excerpt, for example, is taken from the "Wall Street Journal":

"By conventional measure, the gross domestic product -- the value of all goods and services produced in the nation -- is five times as great as it was 50 years ago. Yet "the physical weight of our gross domestic product is evidently only modestly higher today than it was 50 or 100 years ago," Mr. Greenspan told an audience in Dallas.
When you think about it, it's not so surprising that the economy is getting lighter. An ever-growing proportion of the U.S. GDP consists of things that don't weigh anything at all -- lawyers' services, psychotherapy, e-mail, online information."[2]

To illustrate this point further, we have reproduced the table below, showing how the relationship between price and weight has evolved during the last century.

Product	**Price (US$)**	**Weight (lbs)**	**Unit $ price per lbs**
Pentium III	851	0.001984	42893.00
Viagra	8	0.00068	11766.00
Gold	301	0.06254	827.00
Mercedes Benz E-class	78445	4134.00	19.00
Hot rolled steel	370	2000.00	0.20

Source: G Colvin, *Fortune*

In such a world, Coyle argues, an ever-increasing share of GDP resides in "economic commodities that have little or no physical manifestations." Some have described this as the service economy, referring to the fact that in some developed economies services represent more than 70% of output; or, put another way, the manufacture of non-agricultural goods represents less than 25% of the GDP of some countries.

In this short review, we have by no means covered all the terms. There are more - such as Third Wave, Digital Economy, Information economy, Post-Industrial, etc.

What is clear, though, is that there are different perspectives as to what today's economy is and what it amounts to, and there are different ways of describing it. It also makes it clear that many respected authorities believe that something or some things have changed or are changing. The question remains as to what exactly is new, how new it actually is, how it has developed and what, if anything, this means.

[2] "Greenspan Weighs Evidence And Finds a Lighter Economy" by David Wessel, Staff Reporter of THE WALL STREET JOURNAL (http://anasazi.umsl.edu/FIN455/NonLinear/GreenspanWeighs.htm)

In 1999, the OECD launched a project to investigate why different OECD countries exhibited different growth patterns in the 1990's. Their report concluded that the following factors were central to the growth of the 1990's (OECD 2001):

- New capital (in particular Information and Communication Technologies (ICT) capital)
- Increased use of labour
- Rising quality of labour, underpinned by a rise in the educational attainment of the workforce, and the skills learnt "on the job".
- Greater efficiency in how capital and labour are combined (multi-factor productivity)

What is clear is that growth is not the result of one single policy or input factor. ICT is but one important factor in explaining growth and its cross-country disparities. Other conditions need to be satisfied in areas of innovation, business creation and human capital. The evidence the OECD has accumulated suggests that if ICT is to cause a lasting improvement in productivity and growth, it must lie in the *application* of ICT, not merely in its production. That is to say that countries that do not produce ICT can benefit from it just as much as those, like the US, that have a substantial ICT production industry, so long as the right complementary skills and training are in place and work is appropriately re-organised.

This line of reasoning highlights the importance of human capital in the growth of the 1990's. These thoughts are reminiscent of the so-called human capital movement (Schultz, 1961, Becker, 1964). These Nobel Prize winners - and others such as Jacob Mincer and Milton Friedman – had noted the existence of higher growth in output than could be explained by the expansion rates of the two main economic inputs, capital and labour (both as traditionally defined and measured). The unaccounted-for growth was attributed, they argued, to a residual factor assumed to be wrapped up in untracked rises in the knowledge and skills of the labour force. Mincer (1989) put it like this:

"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 a factor of production, co-ordinated with physical capital and with "raw" (unimproved, unskilled) labour and (ii) as a stock of knowledge, it is a source of innovation."

They began to argue that expenditures on education and training (amongst others) were investments in capital just as much as any expenditures on plant and equipment. They also recognized they were different, however, in as much as they formed human, not physical or financial, capital and that human capital is embodied in, and inseparable from, its individual owners.

3. The emergence of a new-look economy – and the growth of the "residual"

Our own position is that no new economy per se has developed: there is no need to throw out all our economic principles and models. It is probably fair to say that we may have been seduced into thinking of a new economy by the unprecedented growth in the use and versatility of ICT – and the speed at which this has taken place. However, there have been no real discontinuities in economics or in the way we live our lives. We still drive in much the same cars as we did 30 years ago; we still burn the same fossil fuels (albeit more efficiently); and treatments available to us have improved only incrementally. The same could not necessarily have been said of the invention of the printing press or of the steam engine, or the successive improvements in transportation, from the canals and railroads through to commercial aircraft.

Others may point to the emergence of knowledge as a departure from the past. However, as others have pointed out, the idea that people's knowledge is an important factor in production was something scholars as far back as John Stuart Mill (1848) recognised:

"The skill, and the energy and perseverance, of the artisans of a country, are reckoned part of its wealth, no less than their tools and machinery. According to this definition, we should regard all labour as productive which is employed in creating permanent utilities, whether embodied in human beings, or in any other animate or inanimate objects…."

In more recent history, Howitt (1996) says that the idea "that there is something new about growth being based on knowledge..is misleading". In fact, Shapiro (1999) argues, what we are witnessing is a "shift in emphasis, as networks, interconnection, compatibility, interfaces, and intellectual property rights have become increasingly important sources of competitive advantage." What is new is the emphasis and attention knowledge is (rightly) receiving.

We are inclined, therefore, to believe that a "new-look" economy has emerged – that is to say, one that has marked differences from 50 years ago, but is clearly its progeny. There has been a shift in emphasis, one that has taken root gradually and one that has largely gone unnoticed as our measurement and statistical systems were not set up to capture some of the underlying dynamics. And what really matters are these profound changes that have been taking place for many years, not what today's economy should be labelled – these are tools to help shift mindsets.

This shift to a "new-look" economy can be clearly seen in the growth of so-called "residuals" which are, in the words of Moses Abramovitz, "a measure of ignorance". So what actually may be new about the economy perversely might be the extent of our ignorance. Zvi Griliches observed a few years back that the share of the economy which is measured by official statistics with a degree of accuracy is declining (Griliches, 1994). Between 1947 and 1990, the fraction of the economy for which productivity data can be deemed reasonably accurate, he argued, fell from close to 50% to about 30%. It is presumably lower again today. As a result, he commented:

" Our ability to interpret changes in aggregate total factor productivity has declined, and major portions of actual technical change have eluded our measurement framework entirely."

What were deemed to be either unexplainable or statistically insignificant (and therefore treated as residuals), seem to have gradually emerged out of the negligible category and are too important to ignore. They have been important factors in the production model for some time but we have not paid enough attention. We needed the drama's of the 1990's Internet and dot-com bubble to highlight things which have been clear to others for some time. What may have seemed (to some of us) like a sudden and dramatic intervention by computers and micro-chips was, probably, more like the result of a long, cumulative and path-dependent development of knowledge and technology, spanning many years.

The service sector still "suffers" somewhat from having effectively started out as a residual category for those activities which could not be classified as either manufacturing or agriculture. This definition introduced heterogeneity from the outset which has only become more pronounced as the sector has gradually grown to become the dominant portion of western economies, representing more than 70% of output in most cases.

In its 1991 survey of service business, INSEE, the French national statistical office, acknowledges that it covers "heterogeneous activities, whose only common point is that they are neither industrial nor financial."[3]

Indeed Hill (2000) has traced the historical background of services in the economic literature. In doing so, it is clear to see how goods have become identified with material objects and services with immaterial products, a term first coined by Jean-Baptiste Say. It is also made clear in this paper how the concept of productive activity has become pervaded with the idea of a stock of material wealth. This has meant that flow concepts such as production or income have become subordinated to a stock concept, the end result of which has been that today's taxonomy of goods and services is inadequate and inaccurate. Immaterial or intangible goods are erroneously subsumed within the service sector, thereby denying us good data on this production factor.

A major form of residual would be that of total (or multi) factor productivity. The NewKInd project used an econometric approach to estimate what was driving growth in the 1990's in their sample of 8 countries – Denmark, Finland, France, Germany, Italy, the Netherlands, the UK and the US (Meijers & Hollanders, 2002). A significant proportion of growth, they found, could be explained by knowledge investments. Their calculations were based on investments made in IT hardware, IT software, telecoms equipment and R&D.

However, they also found that total factor productivity (TFP) growth accounts for a major share of the growth experience by these countries. This is illustrated in Figure 1 below. As a residual, TFP is effectively a measure of our ignorance of the underlying drivers of growth, meaning there is much left for us to explain about today's economy, much of which lies uncharted by today's macro-economic measurements systems, thinking in particular about the SNA.

[3] INSEE (1993), Les entreprises des services en 1991, Paris, August 1993.

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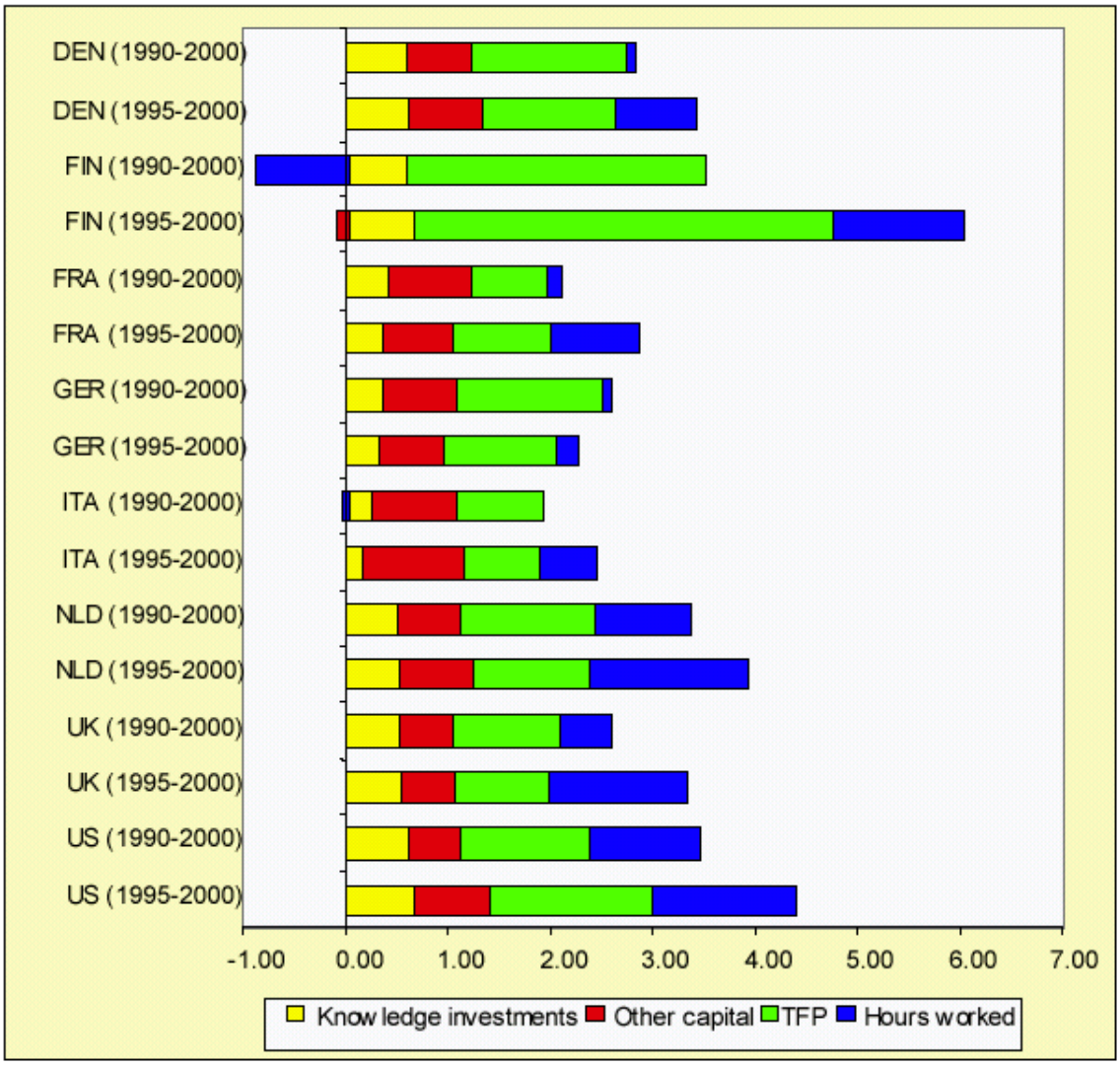
Figure 1 – Growth contributions, 1990-2000



4. Production revisited

A soft revolution, in the words of Paul Romer, may have taken place. That is to say, the assets which we have inadequately and inaccurately described as soft, immaterial or intangible for centuries may in fact have become key economic goods. A fundamental difference between the 20th and 21st century economies might simply be that we can no longer rely on tangible assets to provide a reliable guide to the rate and direction of economic change. Investment in intangibles has been growing faster than investment into physical assets in the 1980's and 1990's (Meijers & Hollanders, 2002). The figures run into the billions for an economic area the size of Europe.[4]

In the light of the evidence, we see a need to re-visit our macro-economic conceptualisation of economic production and the role of so-called intangibles within them. In classical economic

[4] For more detail, see "Charting the development of the 21st century economy"

theory, final products are created from the inputs of labour, raw materials (intermediate expenditures in national accounting parlance, current expenses in business accounting speak) and fixed assets. All measurement and accounting frameworks are created with that as their theoretical underpinning.

However, we reason that the basic element that determines the productivity of the production process has changed. Factors once considered as the mainstay of (industrial) productive processes – namely, raw materials, material inputs, product and mechanical technology - are losing their significance. According to Peter Drucker, the relative share of raw materials in the manufacturing output has been decreasing at an annual rate of about 1% a year since the end of World War II. Since 1950, the relative share of energy input has been declining at the same rate. Conversely, since the 1880's, the relative contribution of information and knowledge to manufacturing output has been growing at the same rate (Drucker, 1992).

As physical inputs decline, so the role and importance of immaterial or intangible inputs rises. The very existence of intangibles is nothing new in of itself. Every asset (be it a heavy industrial product or a service) could be considered as having been produced from *inputs*, which are part tangible and part intangible. No output is entirely tangible or intangible: it is a meaningless divide. The intangible part is the original concept (the idea). The tangible part is the access or carrier device that allows this concept to be used.

Different outputs will consist of different proportions of the two. In so far as the access device is of material cost and lasts a long time, is only gradually consumed in the process of production and yields a flow of capital services during that time, then the access device is what is traditionally recognised as a tangible asset. So-called intangible assets do not really exist on their own but always require some form of embodiment (some access/storage/carrier device, be that a CD, a human, a pill, a hard drive, etc.) to make them useful and useable – and therefore, of any worth.

For that reason, it is not considered meaningful to de-compose a balance sheet into tangible assets and intangible assets. They are not additive. In the industrial era, the intangible element was fairly negligible in cost terms and so was ignored. In the 21st century's knowledge-based economy, however, the intangible element is of increasing importance in the production mix – to the point it can no longer be sub-optimally treated by accounting and measurement systems.

Outputs are conceptually quite distinct from the inputs used to produce them. Every process of production and output requires some prior intangibles, even if they were produced long ago. However, they have very different production cost structures:

- Traditional fixed assets' production expenses are mainly found in fixed capital and manual labour.
- Digital assets, such as software, are produced through heavy use of human/intellectual assets in the development stage. The actual production (or replication) costs, once the original design/recipe/formula has been developed, are minimal.

This is most easily demonstrated by looking at the profit and loss accounts of some well-known companies. Microsoft and Pfizer (the drug company) have been chosen to illustrate one end of the spectrum, Boeing at the other.

$m's	**Pfizer (2001)**	% of sales	**Microsoft (2002)**	% of sales	**Boeing (2001)**	% of sales
Revenue	**32259**		**28365**		**58198**	
Cost of Goods Sold	**5034**	15.6	**5191**	18.3	**48778**	83.8
R&D	**4847**	15.0	**4307**	15.2	**1936**	3.3
General admin, Marketing & Sales	**11299**	35.0	**6957**	24.5	**2389**	4.1

Source: Respective companies' annual reports

4.1 Economic Production and National Accounting

With these thoughts in mind, we have re-visited the conceptualisation of the economic production process.

Most current thinking starts from the output side on the basis that "if an expenditure flow is not a current expenditure, where is the corresponding fixed asset?" Such a view wishes to capitalise investment expenditures as some kind of Gross Capital Stock. If it cannot do so, the expenditures by default are charged as current period expenditures

We have started from the input side and have considered each flow in accordance with its economic role, approaching the production process with no pre-conceived ideas as to what the outputs of production might be and how they might be classified.

At any one time, there are limited amounts of resources available to an economy in the form of stocks of various kinds of human, fixed and natural assets. There is also a set of known production techniques (the "technology" meaning the art/craft of being able to do something). Resources can be shifted around between different processes of production using the production techniques available so that it is possible to trace out a 'production possibility frontier' for the economy as a whole. This frontier shows the maximum amounts of various different combinations of outputs that can be produced from the total resources available.

The production possibility frontier at any point of time is conditional on both the technology available and on the amounts of resources available: that is, on the stocks of the various different kinds of assets. However, the production frontier is not fixed over time. There are two quite different ways of enlarging the set of production possibilities.

- One is to increase the stocks of assets by increasing the rate of gross capital formation. With more fixed or human assets, more output can be increased with a given technology.

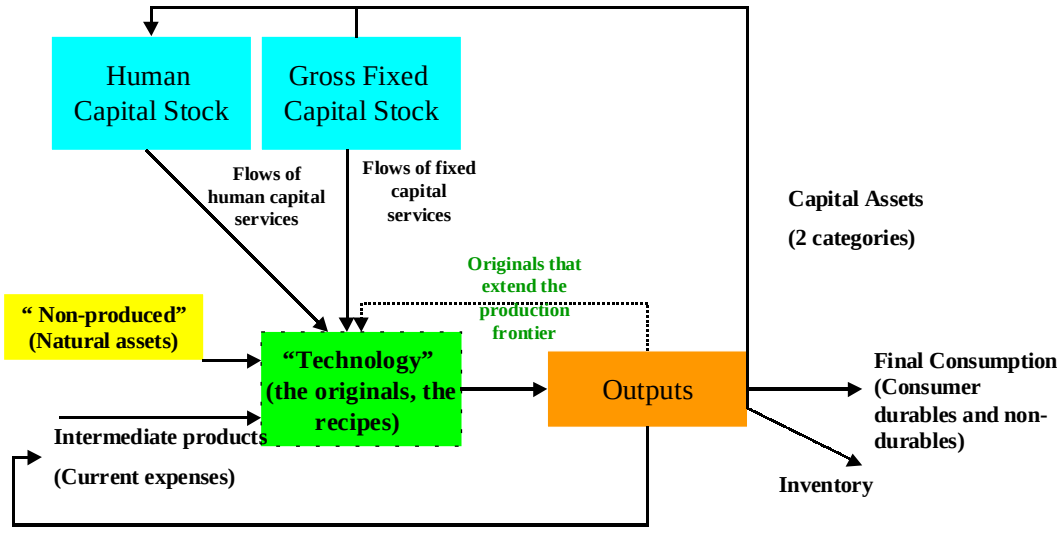
- The other is to improve or augment technology. By enlarging the set of production techniques available, more can be produced with a given set of resources.

Increasing the stock of assets requires more gross capital formation, either human or fixed capital formation. Similarly, improving technology requires more resources to be devoted to innovative and creative processes of production.

Innovative processes (supported by expenditure flows such as R&D expenditure) produce originals that extend production possibilities by creating new technology. Originals provide the new information, plans or designs that make it possible to carry out processes of production that were not possible up to that point of time. The new technology may make it possible to produce new products that could not have been produced before, or to produce existing products more efficiently.

Originals, therefore, extend the production frontier by *changing* technology. They do not change the stocks of assets available. The only way in which to increase the stock of assets is to engage in additional gross capital formation, leading either to human capital formation or fixed capital formation. If, however, technology were to be ignored or overlooked, the only way in which to increase production possibilities would be to increase the stock of assets. It seems to be this line of thinking that has led to the focus on how originals could be treated as some form of fixed asset.

We think that this line of thinking holds too narrow a view of assets. Not everything has to be a fixed asset. Explicit recognition that other stores of value can and do exist could allow the System of National Accounts of the future to be set up to explicitly align its production account with what we reason in this diagram to be the economic realities of production.[5]



There are four main kinds of inputs into a process of production:

- intermediate inputs of good and services;
- labour services: *i.e.* the capital services provided by human assets
- the capital services provided by fixed assets.
- the capital services provided by land and other natural assets

The outputs of the production process are either:

[5] This diagram depicts a "closed" economy in as much as its flows ignore the obvious realities of foreign trade. In practice, imports would add to total domestic output while some of the resultant outputs would "disappear" as exports. This is a deliberate oversimplification to illustrate a point.

- Intermediate products which are then “re-circulated” for use in the production of final products; or
- Final products which:
  - Either contribute to the gross capital stock (in one of its 2 sub-categories, fixed capital and human capital)
  - Or are consumer products (classified either as consumer durables or non-durables)
  - Or are stocked as inventory (pending sale)
  - Or are originals which add to the notional stock of Information/Technology/Know-How

The technology, which is itself produced in the above sense, determines the assets which are used in production. Originals shape the technology, the production possibilities; however, they are not inputs into the production itself.

It is immaterial whether the assets are owned by the producer or are rented or leased. In the context of a production account, it is preferable to view workers as human assets because the quality of the services the workers are capable of providing can vary greatly depending on the amount of human capital formation they have undertaken in the past. Employers can be viewed as renting the human assets of their employees in return for salaries and benefits.

A production account records the values of all the inputs into, and outputs from, some process of production. The values of the outputs obtained from given flows of inputs are determined by the production function at the time the production takes place. The inputs in the production account measure the values of the flows of services from the three kinds of assets -- fixed, natural and human – used in the production process. These are equal to the rentals payable for using the assets, salaries and benefits being the rentals on human assets.

An economic production account as just described can easily be compiled within the general accounting framework of the international System of National Accounts, or SNA, without changing any of the basic concepts or fundamentals of that system. However, the so-called ‘production account’ actually found in the SNA’s sequence of accounts is not a production account, but a simple ‘value added account’.

No attempt is made in the SNA to measure the values of the inputs into production provided by fixed and natural assets. This is a serious limitation of the SNA for purposes of production and productivity analysis. Depreciation, or ‘consumption of fixed capital’ is measured but this does not measure the inputs of capital services into production provided by fixed assets. For this purpose, rentals are needed, which may be approximated by depreciation plus the cost of capital, or interest. In the case of natural assets, not even depreciation, or depletion, is measured.

4.2 Production Examples

It might be useful to think through the production of some different outputs to add colour to this line of thinking:

- **Human capital formation**

  - The inputs are reasoned to be principally the output of the educational services industry and the time/effort exerted by the students.

- We reason that this is a productive activity along the lines of Machlup's thinking – that dissemination and circulation of knowledge is as necessary to the production process as the original discovery of new information:

"…disclosure, dissemination, transmission, and communication become parts of a wider concept of "production of knowledge…In other words, "producing" knowledge will mean … not only discovering, inventing, designing, and planning but also disseminating and communicating. (Machlup, 1962: 7).

- This stock of human capital is then used – to varying degrees – in the production of all goods and services. Companies effectively lease these capital services from their employees in return for wages (and other forms of compensation).
- The stock is reasoned to be continually in flux to the extent that knowledge becomes obsolescent and requires replenishment through ongoing training.

- **Production of a drug**

  - An original will be created through research and development expenditures in combination with the human capital services "leased" from the expert scientists. A limited amount of fixed capital (the laboratory) and raw material will be required.
  - Once the original – the formula, if you like – has been created, tested and approved, the technology has been determined and mass production can begin.
  - The original will determine the mix of fixed assets (e.g. factories, plant and machinery), human assets and intermediate inputs (e.g. the chemicals) that will be required to produce the drug itself.
  - This drug is not a capital item, nor is it an intangible item. It is very much tangible and very much a consumable.

5. Closing Thoughts

This paper has argued that no New Economy as such has emerged in the last few years. Rather, a "new-look" economy has gradually developed over the last few decades, propelled by a combination of factors such as knowledge, innovation and creativity, new forms of technology-rich capital assets (ICT capital), and a growing ability, in some cases, to effectively combine labour and capital.

The end result has attracted a number of labels – post-capitalist, digital, service, knowledge, intangible, etc. Call it what you will – what concerns us is our ability to understand it, which in turn is strongly linked to our ability to measure it.

We believe that a soft revolution has gradually taken place, in which those assets, which hitherto we have inadequately and inaccurately described as soft, immaterial or intangible and treated as residuals in economic measurement parlance, are in fact the key economic goods. The end result is that we need to re-align our conceptual frameworks, models and toolkits – including, for example, the System of National Accounts (the SNA) – to incorporate their role in the production processes of today's economy.

Only then can we take a better, longer and deeper look at this new-look economy and decide what different decision-making it demands of us – whether we are concerned with policy, organizational or individual decisions.

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