
New Sources of Growth

Knowledge-Based Capital Driving Investment and Productivity in the 21st Century

INTERIM PROJECT FINDINGS

At the start of 2011, the OECD began a two-year horizontal project titled **New Sources of Growth: Intangible Assets**. For OECD member countries and key non-members, this project aims to provide evidence of the economic value of knowledge-based capital as a new source of growth and improve understanding of current and emerging challenges for policy.

This report outlines the scope of the work, its policy relevance and interim findings (at the half-way point of project implementation). The project will be launched at events in early 2013, combined with a set of publications that will include a synthesis report for the 2013 OECD Ministerial Council Meeting.

May 2012



Introduction

Investment and growth in OECD economies is increasingly driven by knowledge-based capital (KBC). In some OECD countries, firms now invest as much or more in KBC as they do in physical capital such as machinery, equipment and buildings. This shift reflects a variety of long-term economic and institutional transformations in OECD economies. The rise of KBC creates new challenges for policymakers, for business and for the ways in which economic activity is measured. Many policy frameworks and institutions are still best suited to a world in which physical capital drove growth. But today, the value of some leading global companies resides almost entirely in their KBC. At the start of 2009, for example, physical assets accounted for only about 5% of Google's worth. With many OECD member and partner countries facing sluggish economic growth and high unemployment, new thinking is needed to update a range of framework conditions – from tax and competition policies to corporate reporting and intellectual property rights. Updated policies could help yield significant economic value from forms of KBC that have thus far received scant attention, such as design and data. For instance, research suggests that the use of geo-location data, such as GPS, and location-based services could generate almost USD 500 billion in consumer value by 2020.

Three types of KBC can be distinguished: computerised information (software and databases); innovative property (patents, copyrights, designs, trademarks); and economic competencies (including brand equity, firm-specific human capital, networks joining people and institutions, and organisational know-how that increases enterprise efficiency). Research on KBC is showing that growth can arise from previously under-appreciated sources. For instance, studies suggest that firms' organisational know-how can increase the value of computer assets by a factor of ten.

Across Europe, investment in KBC accounts for 20 to 25% of average labour productivity growth. In the United States, between 1995 and 2007, some 27% of growth in labour productivity resulted from business investment in KBC. Unlike physical capital, investments in many forms of KBC – such as R&D, design and new business models – create knowledge that spills over into other parts of the economy, spurring growth. KBC can also foster growth because the initial cost incurred in developing knowledge – typically through R&D – is not re-incurred when that knowledge is used again. This can lead to economies of scale in production.

The environment for investment in KBC is likely to determine which countries retain or move into the highly value-adding segments of different industries. For example, in 2006, the iPod accounted for 41 000 jobs, with 27 000 outside the United States and 14 000 inside. But US workers – where investments were occurring in forms of KBC such as design, R&D, software and marketing – earned a total of USD 753 million, while those abroad earned USD 318 million. And KBC is transforming the determinants of competitive success. In the automotive sector, the cost of developing new vehicles is increasingly dominated by software, while high-end vehicles rely on millions of lines of computer code and advanced on-board processors.

Jobs producing or manipulating knowledge tend to be highly-skilled – scientists, engineers, programmers, IPR lawyers, and others. Growth driven by KBC may be one factor fueling growing income inequality across OECD countries. However, some mature industries facing low-wage competition in sectors like autos, apparel or footwear have been able to re-invent themselves and maintain lower-skilled jobs through the exploitation of clever branding, software-enabled features and new business models. Additional work is needed to fully understand the effects of KBC on demand for skills and the distribution of returns from this form of capital.

To address the rise of KBC the OECD has embarked on a two-year horizontal project, **New Sources of Growth: Intangible Assets**. For OECD member countries and key non-members this work aims to:

- Provide evidence of the economic value of KBC as a new source of growth; and
- Improve understanding of current and emerging challenges for policy, in such areas as taxation, competition, intellectual property rights, personal data, and corporate reporting.

The **New Sources of Growth** project draws on expertise from across the OECD Secretariat. Led by the Directorate for Science, Technology and Industry (DSTI), key substantive inputs are provided by the Centre for Tax Policy and Administration (CTPA), the Directorate for Financial and Enterprise Affairs (DAF), the Economics Department (ECO) and the Statistics Directorate (STD). This paper outlines the scope of the work, its policy relevance and interim findings (the project findings will be launched at events in early 2013).

What is knowledge-based capital?

Knowledge-based capital (KBC) is made up of a number of asset types and is increasingly the foundation of modern economies.

Knowledge-based capital (KBC) comprises a range of assets. These create future benefits but, unlike machines, equipment, vehicles and structures, they do not have a physical or financial embodiment. This non-tangible form of capital is, increasingly, the largest form of business investment and a key contributor to growth in advanced economies. One widely accepted classification groups KBC into three types: computerised information (software and databases); innovative property (patents, copyrights, designs, trademarks); and economic competencies (including brand equity, firm-specific human capital, networks joining people and institutions, organisational know-how that increases enterprise efficiency, and aspects of advertising and marketing).

Knowledge-based capital is critical to investment and growth

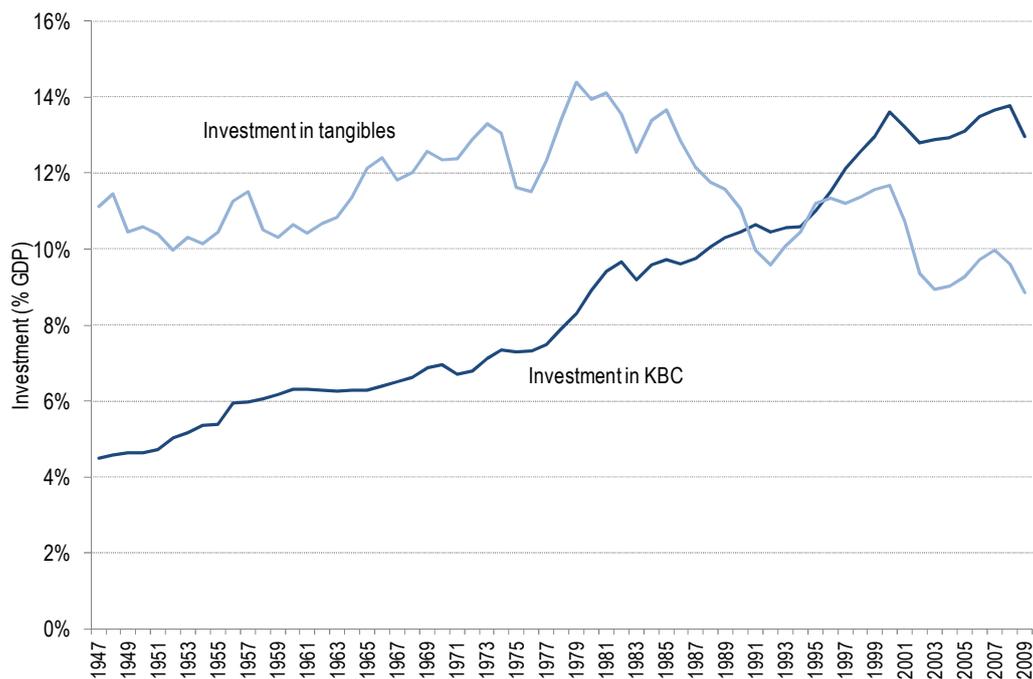
Research has started to measure aggregate business investment in KBC.

Historically, business investment in KBC has not been accurately measured in national income or corporate accounts (Box 1). However, a relatively recent body of research has started to measure overall business investment in KBC. Beginning in the early 2000s, and focusing initially on the United States, researchers have applied direct expenditure methods to assess business investment in KBC, and then used these measures in growth accounting studies (growth accounting ascribes the rate of growth of an economy's output to increases in the amount of factors used – usually capital and labour – and technical change). A significant research effort has expanded the number of countries covered by growth accounting analyses. The important findings of this research are summarised below.

Business investment in the different forms of KBC is increasing in many OECD economies.

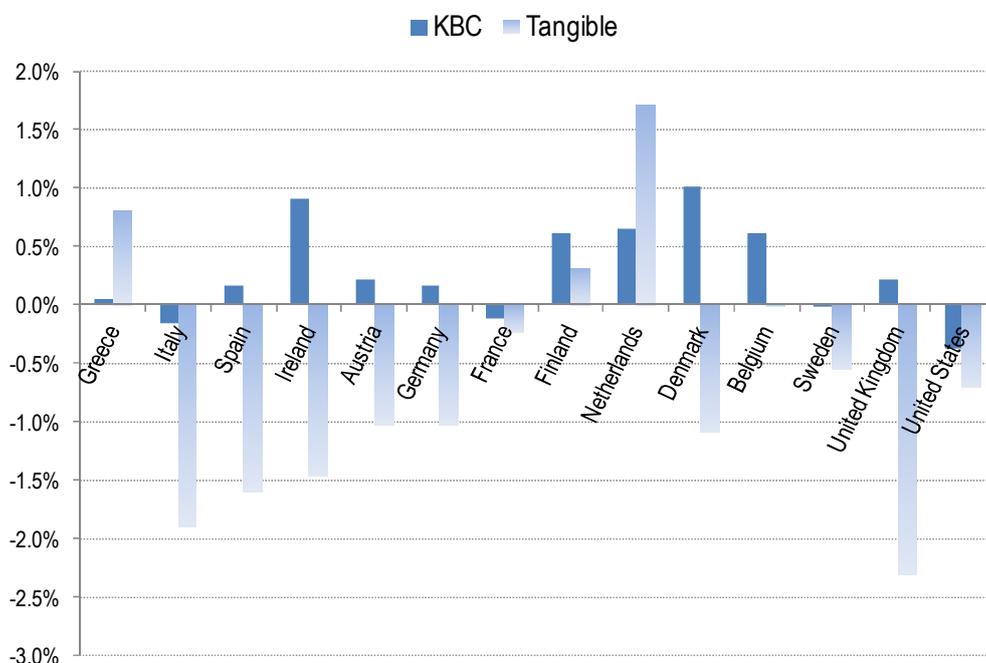
Most advanced economies have become progressively intensive in the use of KBC. In the United Kingdom, business investment in KBC is estimated to have more than doubled as a share of market sector gross value added between 1970 and 2004. In Australia, since 1974-75, average annual growth of investment in KBC has been around 1.3 times that of investments in physical assets such as machinery, equipment and buildings. In Japan, the ratio of investment in KBC to GDP has risen throughout the past 20 years. In Canada, between 1976 and 2008, real investment in KBC increased at 6.4% a year, as compared to 4.1% a year for investment in tangible assets. In the United States, research shows almost continuously rising business investment in KBC for at least 60 years (Figure 1). And recently gathered data suggest that at least in the early phase of the global economic crisis, investment in KBC has not declined to the same extent as investment in physical capital (Figure 2).

Figure 1. Business investment in KBC and tangible capital, United States, % GDP (1947-2009)



Source: C. Corrado, J. Haskel, C. Jona-Lasinio and M. Iommi (2012, forthcoming), Joint database on intangibles for European policymaking – data from INNODRIVE, COINVEST and the Conference Board.

Figure 2. Change by type of business investment, 2006-2009 (percentage points of GDP)



Note: between 2006 and 2009, in most of the countries shown in Figure 2, business investment in KBC rose further as a share of GDP, or declined less, than investment in physical capital. For instance, in Denmark, investment in KBC rose from 7.3% of GDP to 8.3%, an increase of 1 percentage point. Investment in tangible capital in Denmark fell from 11.4% to 10.3% of GDP over the same period.

Source: C. Corrado, J. Haskel, C. Jona-Lasinio and M. Iommi (2012, forthcoming), Joint database on intangibles for European policymaking – data from INNODRIVE, COINVEST and the Conference Board.

Box 1. Treating spending on knowledge-based capital as investment

When businesses invest to integrate databases and organisational processes, spending on hardware typically only represents some 20% of total costs. The remaining costs are for organisational changes such as new skills and incentive systems. But most of these costs are not counted as investment, even if they are as essential as the hardware. Treating spending on different forms of KBC as investment accords with the views of many in the business community who attribute fundamental aspects of corporate success to investments in such things as marketing, data, design and business processes reorganisation.

Both firm-level and national income accounting have historically treated outlays on KBC as an intermediate expenditure and not as investment. By accounting convention, if an acquired intermediate good contributes to production longer than the taxable year, the cost of the good is treated as investment. Evidence suggests that the different forms of KBC should be treated as investment. Research from the United Kingdom has estimated the productive lives of specific types of KBC as follows: firm-specific training (2.7 years); software (3.2); branding (2.8); R&D (4.6); design (4) and business process improvement (4.2).

Spending on software and mineral exploration are currently treated as investment in the national accounts, and a number of countries have created satellite accounts in which R&D is capitalised. But the growing literature on intangibles suggests that, conceptually, more than just software and R&D could be treated as investment.

Studies suggest that business investment in KBC is large.

Research also indicates that overall business investment in KBC is large:

In some countries – such as Sweden, the United Kingdom, and the United States – investment in KBC matches or exceeds investment in physical capital (Figure 3). Business investment in KBC in Canada in 2008 was about 66% of investment in tangible capital.

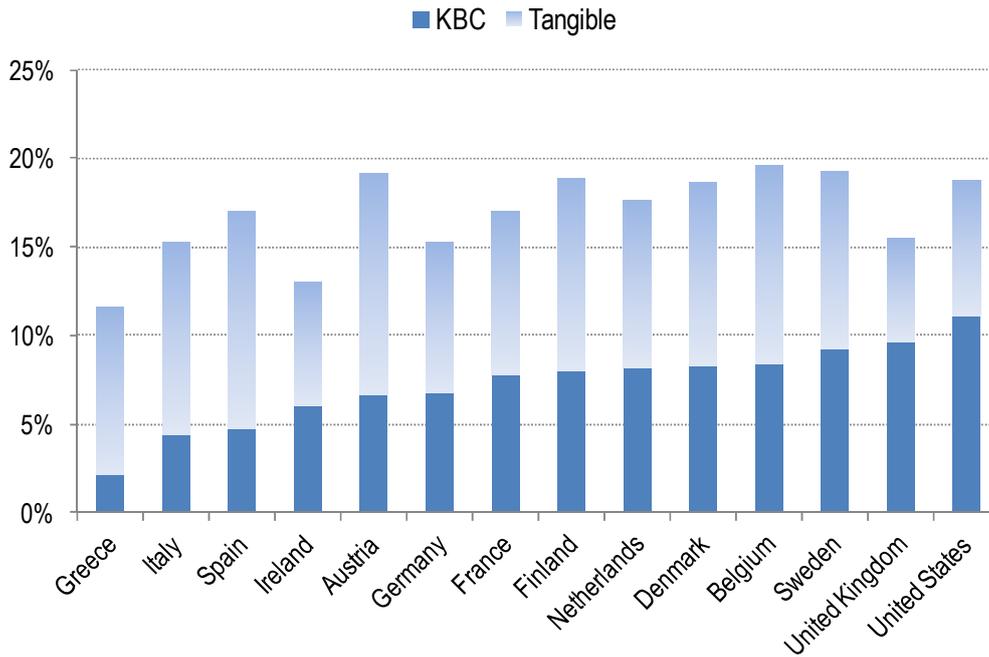
In the United States, total investment in KBC in 2009 is estimated at USD 1.17 trillion, some 11.4% of GDP. By omitting accumulated investments in KBC, around USD 4.1 trillion was calculated to have been excluded from published national accounts data in the United States in 2007.

For the period 2005-2009, business investment in KBC represented an (unweighted) average of 6.6% of GDP across 17 countries belonging to the European Union, including Germany, France, the United Kingdom and Italy (compared with investment in tangible capital averaging 11.5% of GDP). Business investment in KBC in Japan was equivalent to 9.3% of Gross Value Added over the period 2001-2008.

Differences across countries in the share of business investment in KBC correlate positively with income per capita.

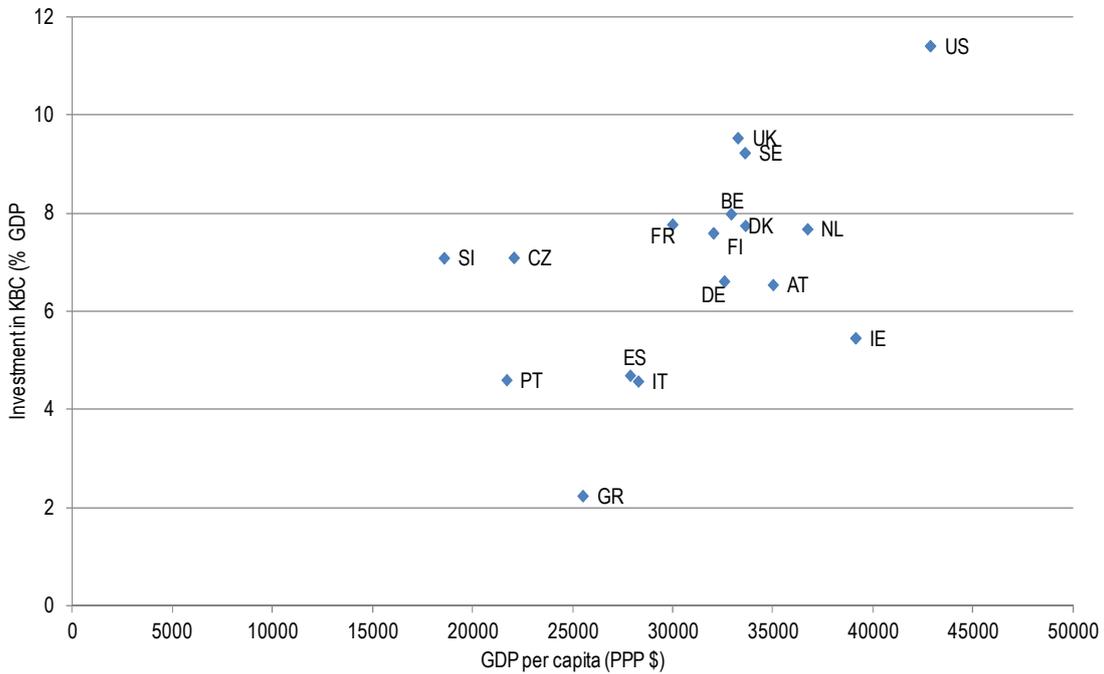
As a share of GDP, the business sector in richer economies invests proportionally more in KBC (Figure 4). Taking only one form of KBC – R&D – significant concentration is also seen: in 2008 just five countries – France, Germany, Japan, Korea and the United States – accounted for 74% of R&D spending in the OECD area.

Figure 3. Business investment in KBC and tangible capital, 2009 (% GDP)



Source: C. Corrado, J. Haskel, C. Jona-Lasinio and M. Iommi (2012, forthcoming), Joint database on intangibles for European policymaking – data from INNODRIVE, COINVEST and the Conference Board.

Figure 4. Business investment in KBC and GDP per capita, (2005-09)



Source: C. Corrado, J. Haskel, C. Jona-Lasinio and M. Iommi (2012, forthcoming), Joint database on intangibles for European policymaking – data from INNODRIVE, COINVEST and the Conference Board.

Business investment in KBC is important for growth and productivity

Growth accounting shows an important role for KBC.

Covering various time periods, growth accounting studies show a positive relationship between business investment in KBC and macro-economic growth and productivity change. It is estimated that between 1995 and 2007 27% of labour productivity growth in the United States was explained by investments in KBC. Across Europe, investment in KBC accounts for 20 to 25% of average labour productivity growth. And research indicates that Canada's GDP and labour productivity growth would have been 0.2 percentage points higher between 1976 and 2000 if previously excluded KBC were included in the national accounts as investments.

If business investment in KBC were fully reflected in national accounts then the observed sources of growth would change.

Estimates for the 27 EU countries show that once business' spending on KBC is treated as investment, measured labour productivity growth increases in all countries. In national accounts, treating KBC as investment, rather than intermediate expenditure, generally increases the contribution to overall growth coming from capital deepening (*i.e.* from a greater use in production of the capital represented by KBC).

Econometric research has also examined the causal impacts of R&D and human capital on macro-economic productivity...

Growth accounting, however, does not explain the causal determinants of growth. Nor does it explain the complementarities between those determinants. Econometric methods are needed to tackle this challenge. Considering human capital and R&D – two forms of KBC – research has established their positive and significant impacts on macro-level productivity and growth. For instance, raising average educational attainment by one year has been estimated to increase aggregate productivity by at least 5%. R&D not only enlarges the technological frontier, it also enhances firms' technological absorptive capacity. Micro-econometric studies often find private rates of return to R&D in the range of 20-30%. This is generally higher than the returns to physical capital, which is consistent with the higher risk associated with KBC. And the spill-over effects of R&D, while hard to measure precisely, are usually found to be large.

...and key firm-level outcomes are also linked to investments in different forms of KBC.

Positive linkages exist between firms' investments in different forms of KBC and important business outcomes. For instance, at the micro level, in the United Kingdom in 2004, around half of export sales from winners of the Queens Award for Exports were attributed to investments in design. In the United States, firms that base significant decisions on investments in data exhibit levels of output and productivity 5-6% higher than would be expected given their other investments and usage of information technology. And corporate management and marketing practices – particularly organisational capital complementary to information technology – have been found to correlate with firm-level productivity.

Box 2. Design – a form of KBC driving innovation and growth

Beyond the physical appearance of products, design is often integral to all stages of the business process, from basic research to manufacture, marketing and after-sales services. One study in the United Kingdom suggests that design spending might be more than twice as large as business spending on R&D. And design plays important roles in innovation and firm performance. For instance:

- A number of world-beating products owe at least part of their success to different facets of design. Research published in 2010 indicated that the iPhone had then added around USD30bn to the value of the Apple Corporation, with only 25% of this attributable to patentable technology stemming from R&D. Much of the rest arose because of Apple's innovations in design, marketing and management. Companies in traditional industries such as textiles, apparel and furniture are also able to succeed based on design competencies. For instance, Italy has long had a successful furniture industry based largely on small and medium-sized firms with competitive advantages in design.
- 67% of exporters in New Zealand have identified design as central to their commercial success.
- In 2007, almost half of businesses in the United Kingdom believe design contributes to increased market share and turnover. And in 2004, among firms in the United Kingdom that saw design as integral to their business, nearly 70% had introduced a new product or service in the previous three years (compared to just 3% of companies in which design played no role).

The 'Europe 2020 Flagship Initiative – Innovation Union' includes design among its ten identified priorities. And further afield, China, India, Korea and Singapore have all enacted design policies and consider design to have strategic economic importance.

Inherent features of KBC can be growth-promoting.

Two properties of KBC have particularly positive implications for growth. First, unlike physical capital, investments in many forms of KBC – such as R&D, design and new business models – create knowledge that can spill over into other parts of the economy. That is, others can only be partially excluded from the benefits generated through the investment in KBC. KBC can also spur growth because the initial cost incurred in developing knowledge – typically through R&D – is not re-incurred as knowledge is used again in production. For instance, software or new product designs can be used simultaneously by multiple users without diminishing their basic usefulness (in other words, some forms of KBC exhibit 'non-rivalry'). This can lead to increasing returns to scale in production. Scale economies of this sort can be reinforced by network externalities, which occur when the benefit from the network rises with the number of users. Such externalities are particularly prevalent in industries – such as ICT – intensive in KBC.

However, while R&D exhibits properties of partial excludability and non-rivalry, other forms of KBC may not have as large an impact on growth (and their growth impacts have also been less studied). In particular, firm-specific human capital and brand equity are highly excludable and rivalrous. Policy must also account for potentially unwelcome consequences of partial excludability and non-rivalry. These mainly relate to the need to provide adequate incentives for investment in knowledge, if the creators of knowledge cannot reap all the benefits this yields, and the maintenance of competition in contexts of increasing returns to scale.

Box 3. Why is business investing more in knowledge-based capital?

There are a number of possible explanations why the intensity of business investment in KBC is growing:

- With rising educational attainment, OECD economies have accumulated a growing stock of human capital. Human capital subsumes KBC. For instance, patents are a legal device for securing the intellectual property associated with innovations emanating from human thought. A growing stock of human capital permits and complements the production and use of KBC.
- Many products are themselves becoming more knowledge intensive. For instance, in the automotive sector, valuable trade secrets now lie in the electronic controls that regulate the operation of motors, generators and batteries. Huge volumes of computer code are required, especially by hybrid and electric vehicles: the Chevrolet Volt plug-in hybrid uses about 10 million lines of computer code.
- In a context of global integration of markets and deregulation, sustained competitive advantage is increasingly based on innovation, which in turn is driven, in large part, by investments in KBC. For instance, research shows that absolute levels of patenting, R&D, IT and management quality have risen in firms more exposed to increases in Chinese imports. And in sectors particularly exposed to Chinese imports, jobs and survival rates have fallen in firms with lower patenting intensity, but have been relatively protected in high-tech firms.
- The fragmentation and geographic dispersion of value chains – as well as the increased sophistication of production processes in many industries – have accentuated the importance of KBC, in particular organisational capital (for instance, Wal-Mart's computerised supply chains, or Merck's multiple R&D alliances).
- Businesses have made major investments in new information and communication technologies. These have required complementary investments in forms of KBC such as new business process skills.
- New information and communication technologies may themselves make some types of KBC more valuable to firms. For example, when consumers can buy on-line, rather than face-to-face, a brand and a reputation for reliable service gain additional importance. For instance, 99% of the time, at least one Internet bookseller offers a price lower than Amazon, but Amazon retains its large market share on account of a reputation for customer service.
- The growth of the services sector has amplified the importance of KBC, given that many service-sector firms are highly reliant on the use of intangible assets.

Knowledge-based capital enables the capturing of value in global value chains

Command of KBC is a driver of success in global value chains.

Increasingly, the value in global production systems is concentrated in forms of KBC such as complex systems integration, marketing, access to basic R&D, design and the integration of software with hardware. KBC can effectively root value in a particular location, even if temporarily. A stellar illustration of this is the case of the iPod. While China successfully produces and exports the iPod, especially to the United States, its competitive advantage is concentrated in downstream production and assembly. Micro-economic analysis shows that the largest part of the value created from the iPod accrues to providers of distribution and retail services in the United States and to Apple, principally reflecting that company's innovations in design, marketing and supply-chain management. For each iPhone 4, sold with a retail price of USD 600, Apple earns USD 270 of margin, while Korean firms supplying core components earn USD 80, and enterprises in China providing assembly services earn USD 6.5, a mere 1% of the total value. The Secretary General of the China Industrial Overseas Development and Planning Association recently stated "Our clothes are Italian, French, German, so the profits are all leaving China... We need to create brands, and fast."

Many emerging economies are seeking to increase investments in KBC

Many emerging economies are seeking to augment investment in KBC to compete in higher-value activities.

Emerging economies account for an increasing share of global investment in innovation. Enabling business investment in KBC has become a priority in many emerging economies. Policies focus on education and R&D, complemented with efforts to develop linkages between MNEs and local firms and in some cases measures to strengthen the intellectual property regime. Examples include Thailand's establishment of an IP capitalisation project, Brazilian assets in aerospace, and Indian information technology.

China is taking major steps to facilitate investment in KBC.

Policymakers have set the goal of making China an "innovation-oriented" society by 2020, which requires sustained investment in KBC (Box 4). China is investing in IP, acquiring/developing global brands, promoting design and investing in human capital. Various Chinese enterprises have introduced global brands. Examples include Lenovo, TCL and Huawei Technologies. Once considered a low-cost vendor, Huawei's innovative products are now used by telecoms operators around the world. In 2008, Huawei topped the list of PCT applicants reported by the World Intellectual Property Organisation, the first time for a Chinese company. Huawei and other Chinese firms have expanded their operations abroad, in some cases establishing overseas R&D capacities. The Chinese government is actively promoting the use of intellectual property to protect intangible economic value. Counterfeiting and piracy for long represented a threat to the intellectual property of firms investing in China. China's adherence to relevant international conventions (including accession to the World Trade Organisation), and the introduction of intellectual property legislation, have brought some improvements. However, a significant breakthrough has come with a change in perspective of Chinese firms, which increasingly seek protection for their own intellectual property.

Box 4. Estimating business investment in knowledge-based capital in China

Research by Hulten and Hao (2011) has aimed to measure investment in KBC in China.* Recent economic reforms in China aim to raise incomes by capturing more value added via technology. Doing so will require large-scale investment in KBC. Moreover, particular features of economic transition in China require the creation of particular forms of KBC. For instance, the privatisation of many state-owned enterprises requires investments in organisational capital and new business models.

Severe data constraints hamper measurement of KBC in China. Nevertheless, the authors estimate that investments in KBC were equivalent to 7.5% of GDP for the total economy in 2006. Such investment has increased over time, from 3.8% in 1990. Spending on R&D accounts for only 18% of total investment in KBC, which suggests that narrowly focused innovation indicators will ignore much of total spending on innovation.

China's rate of investment in KBC is comparable to estimates for Germany and France, but behind Japan, the United Kingdom and the United States. However, it is uncertain whether the significant investment in KBC will translate into technological leadership. Half of KBC investment in China is due to two categories: software and architectural and engineering design. These two items are tied to investments in tangible capital (ITC and residential structures). A more focused measure of organisational and product/process innovation might exclude them, in which case, the adjusted KBC investment rate for China would only be 3.6% of GDP (2006). This is well below the corresponding adjusted rate of 8.6% for the United States, or 6.8% and 6.6% for Japan and the United Kingdom respectively. Furthermore, in China, the ratio of investment in KBC to investment in tangible capital is around 0.3. By contrast, in Finland, France, the United States and the United Kingdom this ratio is near to, or above, 1. Despite substantial investments in KBC, China still appears strongly oriented to its manufacturing base.

* C.R. Hulten and J.X. Hao (2011), "The Role of Intangible Capital in the Transformation and Growth of the Chinese Economy", unpublished working paper, The Conference Board, 16 December.

Preliminary policy insights

This section reviews preliminary policy insights from the **New Sources of Growth** project while describing work in progress and future analytic challenges. The policy insights described are broadly applicable to OECD countries at lower and higher income levels, as well as many emerging economies.

Investment in KBC underpins modern economies and is affected by a wide range of policies.

Business investment in KBC underpins the entire knowledge economy. Accordingly, these investments are affected by many areas of policy. Framework conditions are key, as these provide the fundamental economic context for investment in KBC. Well-designed framework policies can facilitate the reallocation of resources to new sources of growth, including those based on KBC. Critical framework policies include tax, competition, education and training, intellectual property rights, corporate reporting and an array of policy settings that affect access to finance for KBC-intensive firms. Attention must also be given to complex regulatory issues, for instance in connection with data privacy and security. Indeed, as new technologies develop, based on KBC, new regulatory challenges are likely to emerge (see Box 5). And recognising that business' spending on KBC is a form of investment may also have implications for the conduct of macro-economic policy.

Box 5. Transmitting data – a regulatory barrier to the Internet of things

In the near future, the Internet will connect things as well as people. Companies will change how they design machines and devices. They will first define the data needed and then build the machine around this. Tens of billions of devices are likely to be connected by 2025. A new type of user of mobile networks will emerge – the million-device user (such as car, consumer electronics and energy companies, and health providers, whose vehicles and devices connect to the Internet). Machine to Machine (M2M) communication will become standard.

Mobile networks are best geared to support geographically mobile and dispersed users who want to be connected everywhere all the time. However, a major barrier for the million-device user is a lack of competition once a mobile network provider has been chosen. The problem lies in the SIM-card, which links the device to a mobile operator. By design, only the mobile network that owns the SIM-card can designate which networks the device can roam on. In mobile phones the SIM-card can be removed by hand and changed for that of another network. But when used in cars or other machines it is often soldered, to prevent fraud and damage from vibrations. Even if it were not soldered, changing the SIM by hand at a garage, a customer's home, or on-site, costs USD 100-USD 1 000 per device.

Consequently, once a device has a SIM-card from a mobile network, the company that developed the device cannot leave the mobile network for the lifetime of the device. Effectively, therefore, the million-device user can be locked into 10-30 year contracts. It also means that when a car or e-health device crosses a border, the large-scale user is charged the operator's costly roaming rates. The million-device user cannot negotiate these contracts itself. It also cannot distinguish itself from other customers of the network (normal consumers) and is lumped into the same roaming contracts.

There are many technological and business model innovations that a large-scale M2M user might want to introduce. However, at present, it cannot, because approval would be needed from its mobile network operator. Many innovations would allow the bypassing of the mobile operator and as such are resisted. The solution lies in governments allowing large-scale M2M users to take control of their own devices by owning their own SIM-cards, something implicitly forbidden in many countries. This would make a car manufacturer equal to a mobile operator from the perspective of the network.

Removing regulatory barriers to entry in this mobile market would allow the million-device customer to become independent of the mobile network and create competition. This would yield billions in savings on mobile connectivity and revenue from new services.

Targeted public support for investment in KBC requires evidence of private under-investment.

Beyond the essential attention to framework conditions, public policies to increase business investment in KBC must be based on evidence that businesses would otherwise under-invest in KBC. KBC comprises a diverse set of assets – from databases and patents, to brand equity and business process know-how. For firms, the ability to fully internalise the returns from investments in KBC varies across these different asset types. The strongest evidence for private under-investment exists for R&D-related spending. For most other forms of KBC, more evidence is needed on associated externalities. For example, work to date on the *New Sources of Growth* project has found no systematic research on design-related externalities that might provide a basis for public support of this form of business expenditure. However, survey evidence indicates that many businesses do experience copying of their designs, indicating that some spill-over of value is occurring.

Skills shortfalls represent a bottleneck

Research on KBC underscores the importance of some traditional areas of policy, in particular relating to skills.

The research on KBC highlights that a central element of economic policy must be the design and effective operation of institutions and incentives that permit the supply and demand for skills to balance quickly. Human capital subsumes KBC. For example, over half of all R&D is spent on wages for researchers. Patents are a legal device for securing the intellectual property associated with innovations emanating from human thought. And software, which represents a large portion of R&D spending, is itself a form of codification of human expertise and know-how. Despite the preeminent role of human capital, skills shortages in many OECD economies appear significant. As the recovery gains momentum, skills shortages can be expected to increase. The production and use of some forms of KBC require skills which are new, especially in connection with emerging technologies. For instance analysis in the United States suggests a shortfall of some 1.5 million managers with adequate understanding of the business benefits of data. Insights are here being drawn from the OECD Skills Strategy.

The tax treatment of KBC – stimulating investment and growth in cost-effective ways

Tax policy affects investments in KBC through numerous channels...

Tax policy affects business investment in KBC through many routes. Most countries, for instance, operate some form of R&D tax credit or special allowance to reduce the cost of investing in R&D. Some countries offer significantly reduced tax rates on income from KBC (e.g. on royalty income from patents). And it is generally agreed that the rate of tax on capital gains can have an impact on risk-taking and venture capital investment.

...while taxation of KBC involves particular, important and under-examined challenges in a globalised economy.

Multi-national enterprises (MNEs) increasingly operate as integrated global businesses. Conventional methods to assess the effective tax rate (ETR) on many forms of KBC are incomplete as they largely ignore the international dimension of tax policy and the tax planning behaviour of MNEs. For instance, in many OECD countries, MNEs performing tax-assisted R&D are largely able to avoid domestic corporate income tax on returns to R&D. Through cost-sharing agreements between parent companies and offshore intellectual property holding companies, and/or by using non-arm's length transfer prices on inter-affiliate transactions, profits on the exploitation of R&D

Cross-border tax strategies, and poorly informed policy, may undermine efforts to foster innovation...

...while also weakening the management of public finances.

The New Sources of Growth project is developing evidence to inform a wide range of tax policies.

may largely be shielded from home-country tax. The issue of MNE tax planning is acute with respect to KBC, as intellectual property is generally easily transferred from one location to another.

Cross-border tax planning by MNEs may result in ETRs on the return on R&D well below levels intended by tax authorities. Moreover, domestic tax systems may be encouraging the migration of KBC to offshore holding companies, and the use of KBC in foreign rather than domestic production. Both of these outcomes may weaken the rationale for tax incentives for R&D, which is to counter domestic private underinvestment in R&D and promote the adoption of new technologies in domestic production.

Currently, no systematic approach is being taken globally to measure the total income being shifted internationally through MNE tax planning involving KBC, but the magnitudes involved are significant. For example, research suggests that the potential annual revenue cost from income shifting by US-based MNEs may be as high as USD 60 billion, with possibly half of this due to aggressive transfer pricing of KBC-related transactions.

As part of the New Source of Growth project the OECD is developing new ETR measures that include tax-planning effects, to help provide guidance on a range of tax policy choices, as outlined here:

Spillover benefits from R&D may increasingly extend beyond national borders. This suggests the need to assess domestic versus cross-border spillovers generated by R&D and the use of KBC in production, and to measure and possibly adjust rates of domestic tax relief for R&D.

Cross-border tax planning strategies largely enable MNEs to avoid domestic tax on income earned on the exploitation of knowledge resulting from domestic R&D (e.g. royalties). This suggests the need to address and possibly adjust rates of domestic tax relief for R&D costs, if the setting of current rates did not factor-in cross-border tax relief on the income side.

Unlike MNEs, small R&D performers – especially start-ups that have not yet made sales and are thus in a loss position – cannot make immediate use of non-refundable R&D tax credits. Furthermore, tax relief for MNEs from cross-border tax planning creates competitive disadvantage for small domestic R&D performers with no foreign investments or affiliates. This calls for an assessment of possible domestic policy adjustments that could provide a more level playing field (e.g. introduction of (limited) refunds for unused R&D tax credits, increased targeting of R&D tax credits to SMEs, and possible tightening of tax relief for MNEs).

The use of IP holding and finance companies may in some cases be combined with investment in production abroad, where the corporate income tax burden is below that of the home country. Work under the New Sources of Growth project is pointing to the need for measures of ETRs on foreign production that factor in tax relief from cross-border tax planning strategies. Developing such measures would help assess the effects of current domestic tax policies on domestic investment and employment.

Competition policy faces new challenges from industries founded on knowledge-based capital

Competition in the digital economy is dynamic and complex. Competition authorities are now key players in the digital economy.

Research concurs that competition is central to innovation, even if discussion continues on the precise circumstances under which competition has the greatest effect. Problems addressed by antitrust authorities have sector-specific features. For instance, competitive strategies, sources of scale economies and the barriers to entry in the digital economy are often distinct from those in other sectors.

The digital economy has brought the rapid creation of new industries and business models. New businesses have challenged incumbents in novel ways. New claims of restrictive practices are frequent and a number of major legal disputes are ongoing. In these processes, intellectual property rights are critical and directly shape firms' competitive strategies and conditions of market entry. Simply understanding how competition operates in such new sectors can be difficult. Features of the digital economy that can bring about new forms of restriction to competition, and new challenges for antitrust analysis, relate to:

- The **enhanced role of IP in business strategies**. Issues arising for competition authorities relate to mutually blocking patents – which require a need for patent pools or cross-licenses – and the protection of trade secrets.
- **Economies of scale for information products**. Many information products involve large scale economies, opening opportunities for abuses of market power. Producers are also under pressure to engage in price discrimination, producing multiple versions of a related product – such as software – for slightly different market segments. This can pose practical challenges when trying to identify anti-competitive behaviour.
- The increased incidence of **complements and interfaces**. Many high-tech products are constituted from complex systems of components that need to interface with each other and, in some cases, with external networks. Consequently, firms must work together to set standards and ensure interoperability. But working together might invite collusive practices.
- The **importance of networks** and the effects of network economies. Networks generally become more valuable as they increase in size (in terms of nodes or users). Networks thus exhibit scale economies, from the side of demand. This accentuates the importance for competition of the terms on which access to a dominant network can occur. Virtual networks – such as the network of users of Microsoft Word – are also important in the information economy. As virtual networks grow, the control of interfaces and compatibility standards, among other issues, increase in importance.

In connection with the **New Sources of Growth** project, the OECD's Competition Committee has begun exploring how competition in the digital economy works and which specific policy issues might be focused on in future assessments. A number of preliminary conclusions are set out below:

A focus on competition among platforms best suits the features of the digital economy.

When companies in the digital economy become very successful, many, even thousands, of other businesses might depend on their products or platforms. Examples include Apple's iPhone, and the thousands of software companies that have developed iPhone applications, and Facebook and the many software developers that enhance the Facebook product for users. As companies like Facebook and Apple reach huge market valuations, competition authorities may be tempted to focus on competition issues specific to individual platforms. But unlike other sectors of the economy, the most meaningful competition in the digital economy takes place between companies using very different business models. For example, Apple, Google, and Microsoft all compete in the market for mobile phone operating systems. But Apple does not license its Operating System (OS), reserving it for its own brand of phones. Google offers handset manufacturers free licenses to the Android system. And Microsoft licenses its mobile OS but charges a fee. Competition *among* platforms is far more important to innovation than competition *within* platforms, so competition authorities should give priority to the former type of competition issues.

Eliminating anti-competitive product market regulation is key...

Beyond just the digital economy – prior to completion, the project will examine a wider set of KBC-related competition issues – one way to boost innovation is to eliminate unnecessarily anticompetitive product market regulation (PMR). OECD research suggests that the effect on business R&D of reducing anti-competitive PMR could be stronger than that achieved by reinforcing intellectual property rights or granting subsidies for private R&D. The Competition Committee has developed a Competition Assessment Toolkit to help governments eliminate anticompetitive PMR.

...as is enforcement of competition law.

The relationship between competition and innovation is complex and differs from industry to industry. But the relationship between investment in R&D and market concentration tends to take an inverted "U" shape. So R&D investment peaks in situations of modest market concentration. Almost all enforcement of competition law occurs in relatively concentrated markets that have low levels of competition, *i.e.* to the lower left of the inverted U. Effective competition law enforcement thus stimulates innovation by protecting and encouraging competition in those markets where there is the greatest potential for innovation to increase.

In a world of knowledge-based capital, intellectual property rights (IPRs) are a key framework condition

The New Sources of Growth project is highlighting the importance of intellectual property rights to growth.

Intellectual property rights (IPR) afford legal protection for rights on intellectual property embedded in different types of KBC. These rights include patents (mainly new products and new processes), copyrights (mostly software, databases and artistic creation), trademarks (brand or logo) and design rights. For each, the primary aim is to preserve incentives to innovate by granting time- and scope-limited exclusive rights over the use of a new product, process or artistic creation. By pushing firms to introduce new or improved products or services, competition is also central to fostering innovation. The overarching policy issue is to find the proper balance between exclusive rights and competition so that the application of one does not undermine the effectiveness of the other. An important question is whether the growing importance of information technology and other KBC-intensive industries has altered the nature of the trade-off and, more broadly, the costs and benefits associated with IPRs. A number of factors suggest that this may be the case, at least for patents and copyrights.

IPRs, and patents in particular, are increasingly prominent in economic debate, but concerns are growing about their efficiency.

In addition to increasing incentives for investment in knowledge, patents can, in principle, promote knowledge diffusion and, through patent sales and licensing, provide a market-based mechanism for the direct transfer of ideas. For firms, the ownership of patents can also give important signals to external investors about their KBC.

A number of OECD countries have begun comprehensive reviews of their IPR frameworks, and debates on IPR have assumed new prominence in the economics press. This prominence has been heightened by recent major corporate acquisitions of intellectual property. These include Google's purchase of Motorola Mobility and Nortel Networks Corp's auctioning of its intellectual patent portfolio. While IPR frameworks differ significantly, concerns exist as to the efficiency of IPR systems (see Box 6).

Design rights are an important, but under-investigated, part of the IPR framework.

The work on KBC also goes beyond patents, drawing attention to the importance of copyright and design. Design rights protect aspects of a product's appearance (rather than its function). Differences across countries in the propensity to register design rights may reflect different legal traditions, culture and design rights systems. For instance, France and Germany have historically had higher registration of designs than the United Kingdom. In Germany, relative to the United Kingdom, there appears to be greater awareness of design-related intellectual property. The cost of enforcement appears to be lower, and there is a generalised perception that courts will be active in protecting design rights. Infringement of design rights in the United Kingdom is dealt with under civil law and, unlike Germany, does not include criminal sanctions. With strong and relatively inexpensive legal enforcement, Germany also has multiple private initiatives to protect design. And France operates a simplified registration process for products with short product cycles. Internationally, relatively little is known about frameworks to protect design rights and their effects on design investment, much of which is undertaken by small firms with limited capacities to negotiate design rights systems and enforce their design rights. And more analysis is needed to understand how differences among firms in design registration actually affect differences in economic outcomes.

Box 6. Intellectual Property Rights – current policy concerns

Significant differences exist in IPR frameworks across countries. Nevertheless, a number of themes recur in current policy debates, including:

- Fears, particularly in the United States, over the possible erosion of patent quality (*i.e.* the accuracy of the patent claim and whether the patent is genuinely novel or non-obvious). Indeed, OECD data suggest that patent quality across the OECD area has eroded steadily over the last decade. Deterioration in quality could result from patent application backlogs. Technological advances in areas such as computer programs and telecommunications have driven strong growth in patenting activity, while times required for individual patent examinations have also risen.
- The creation of incentives for litigation. One study has shown that the cost of litigation exceeded the profit from patents in the late 1990s in US industries outside pharmaceuticals and chemicals. In such a context, many firms spend large sums to build patent portfolios to strengthen positions in prospective negotiations. In turn, this demand for patents can give rise to so-called ‘patent thickets’, obstructing entry in some markets.
- The growing problem of so-called ‘patent trolls’. As part of the dynamic described in the preceding bullet point, patent trolls are firms that do not make, own or provide their own products or services. Instead, they purchase patents and file resource-consuming lawsuits against companies alleged to have infringed those patents. Recent examination of the results from litigations prompted by patent trolls – which tend to be concentrated in IT industries – finds no evidence of a transfer of wealth from defendants to inventors.
- The extension of the patentable domain into areas such as business methods and software. Overly broad patents, it is feared, could retard follow-on innovation, limit competition and raise prices through unnecessary licensing and litigation.
- Concerns over the effects on innovation and competition of specific operational features of patent systems such as patent notice (how well a patent informs the public of what technology is protected) and patent remedies (judicially awarded damages that should replicate the market reward that the patent holder loses because of patent infringement).
- In an ever more integrated global economy, the need to harmonize intellectual property systems internationally (for instance to permit cross border copyright licensing).
- While the appropriate protection of copyright is crucial, there also exist concerns regarding some measures of copyright enforcement in the digital age and concerns that copyright law should be updated and carefully enforced lest it hinder emerging internet-based firms and impede research based on new text and data mining techniques.
- A broader concern that SMEs are relatively disadvantaged in their ability to negotiate intellectual property systems. SMEs may also be put at a particular disadvantage by cross-country differences in regimes and dispute resolution mechanisms.

Facilitating entrepreneurial activity is essential

A dynamic process of firm creation and exit will facilitate resource reallocation to new sources of growth based on KBC.

Realising growth potential depends on the ability to reallocate labour and all forms of capital to their most productive uses. The pace of reallocation is generally high in OECD countries: on average, about 15-20% of all firms and more than 20% of jobs are created or destroyed each year. The key mechanisms through which reallocation occurs are firm turnover (*i.e.* entry and exit), shifts in resources across incumbent firms and resource reallocation within firms. But the efficiency of resource allocation varies across countries. For example, the size of entering and exiting firms tends to be smaller in the United States than Europe. Successful young firms also tend to expand more quickly in the United States than elsewhere. And firm productivity within industries tends to be more dispersed in the United States than Europe (with more productive firms likely to account for a larger share of employment in the United States than in some European countries). One interpretation of these findings is that there is a greater degree of experimentation and ‘learning by doing’ among entrants in the United States. Such cross-country differences tend to be largest in new and high-technology sectors, where the intensity of KBC use is likely to be greatest.

Improved corporate reporting of KBC could help

Corporate reporting of investments in KBC is widely considered deficient...

...and improvements could yield a range of significant benefits.

Corporate reporting has grown in length and complexity without necessarily addressing the issue of KBC.

In a world of integrated financial markets, international policy coordination could be valuable...

...along with assisting young firms and developing frameworks for auditors.

Wealth creation depends on achieving an efficient allocation of capital on a risk adjusted basis. At present, corporate reports provide only limited information on companies' investments in KBC. A lack of reliable and relevant information on KBC may result in companies having to bear a higher cost of capital than necessary and, in the case of listed companies, being subject to high stock price volatility. Research suggests that industrial sectors more dependent on external finance grow faster in countries with higher quality corporate disclosure regimes. And in sectors more reliant on external finance, growth in R&D expenditure as a share of value-added is higher in countries with higher quality corporate disclosure. In addition, enhanced disclosure of KBC could have a positive impact on corporate governance, by improving internal controls and risk management, on oversight of senior management and strategy by the board, as well as on transparency and accountability to shareholders and other stakeholders.

Better assessment of KBC by non-financial metrics, primarily through narrative reporting, is considered a priority. Various narrative disclosure frameworks have been developed through private-sector led initiatives (Intangible Assets Monitor, WICI Framework, etc.). However, implementation is voluntary (having been developed by the private sector) and has not been widespread. Furthermore, measurement of implementation is complicated by the fact that companies might report their KBC to private investors but not externally. In addition, individual standard setters do not track the adoption of their standards. The fact that company practices in this area have not evolved significantly in recent years is due in part to the emergence of other reporting concepts, such as environmental, social and governance (ESG) and sustainability reporting. As a result, corporate reporting has grown in complexity and length. Furthermore, few OECD governments have introduced guidelines on how KBC should be reported. This leaves disclosure subject to market demand and the perceived need and ability of companies to provide it. The result is that reporting by companies follows different reporting frameworks, limiting its comparability and consistency.

Although complete harmonisation in reporting standards is neither feasible nor necessarily beneficial (because of sectoral idiosyncrasies), policymakers could help by promoting comparability and consistency of reporting. Considering the challenge of incorporating KBC in financial reporting, extra-financial reporting on intangibles based on a few sector-specific key performance indicators (KPIs) could help companies better communicate their value to investors and analysts. Additional measures could include support to young companies for the implementation of data management and reporting frameworks. Another example of a policy that could potentially stimulate reporting on KBC is the introduction of frameworks for auditors to provide more assurance around extra-financial disclosure. Further deliberations in the Corporate Governance Committee are pending.

The calibration of macro-economic policy may need to be revised

Large and growing business investment in KBC could have implications for the conduct of macro-economic policy...

...but these implications have not yet been properly assessed.

By definition, treating spending on KBC as investment rather than intermediate consumption raises the level of recorded investment and GDP, as well as the saving rate. Research suggests that capitalising R&D would have raised the national savings rate in the United States by 2% in the early 2000s. Non-trivial increases in reported national savings could call into question the appropriateness of policies aimed at boosting private savings.

Furthermore, assuming that the cyclical sensitivity of firms' spending on KBC is comparable to that of physical assets, treating KBC as investment in national accounts is bound to raise the variance of measured GDP over time. More investment will be recorded during upturns in the business cycle. And measured investment contraction will be greater during downturns. In such circumstances, it is possible that by not treating spending on KBC as investment, macro-policy could be insufficiently counter-cyclical.

The implications for macro-policy of capitalising spending on KBC in national accounts requires further investigation, and has barely figured in policy analysis to date.

Better policy can help create economic value from personal data

The use of personal data represents a new frontier in productivity and competitiveness.

The growing pervasiveness of the Internet means that, increasingly, personal and professional activities are being conducted online, while new capabilities simultaneously emerge to capture, analyse and store data about online activity. The explosive growth of digital technologies such as mobile networks, remote sensors and cloud computing create vast fields of information, loosely referred to as 'big data', a large part of which is personal data pertaining to specific individuals. Personal data are now processed, shared and transferred around the clock and across the globe. Global data creation is projected to grow at 40% per annum, compared with 5% yearly growth in worldwide IT expenditure. The world's data storage capacity was estimated to have exceeded 1 000 exabytes in 2010 (an exabyte is a billion gigabytes) and is expanding exponentially (Figure 5). Combined with powerful data analytics, personal data offer the prospect of significant value creation, social benefits and productivity enhancement. Recent research estimates that some EUR 600 billion in consumer value is potentially available annually from business utilisation of personal location data. Search engine data are fuelling automated translation services and uncovering flu trends. Location data from mobile phones are revealing transportation flows. Personal data are used by financial services firms to assess credit requests and to address fraud and security concerns. And loyalty programmes extract information on customer preferences. Such programmes are estimated to increase operating margins in the retail sector by more than 60%, which could boost annual retail productivity by 0.5% through to 2020. The value of data is also evident in crime statistics: reported theft of electronic data now surpasses physical property losses as the major crime problem for many global companies.

Measuring the value of personal data is important for the development of policy.

Measuring the value of personal data and its impacts is complex. The value of personal data is poorly captured in economic statistics, and often under-appreciated by organisations and individuals. The direct collection of data from individuals often takes the form of a non-explicit exchange for “free” services. Measurement challenges also reflect the complexity of data flows and uses, including across borders. However, improved measurement could facilitate the development of policies better tailored to the scale, benefits, and risks posed by the expanding uses of personal data.

Innovation will also be supported when privacy concerns are addressed.

New uses for personal data are arising continuously. But using personal data in ways in which it was not originally intended raises core privacy concerns and undermines user trust. Improving the ability to address the privacy risks of unanticipated uses of personal data can help enable continued innovation in data-driven services.

Governments can also help by raising awareness as to how personal data are used.

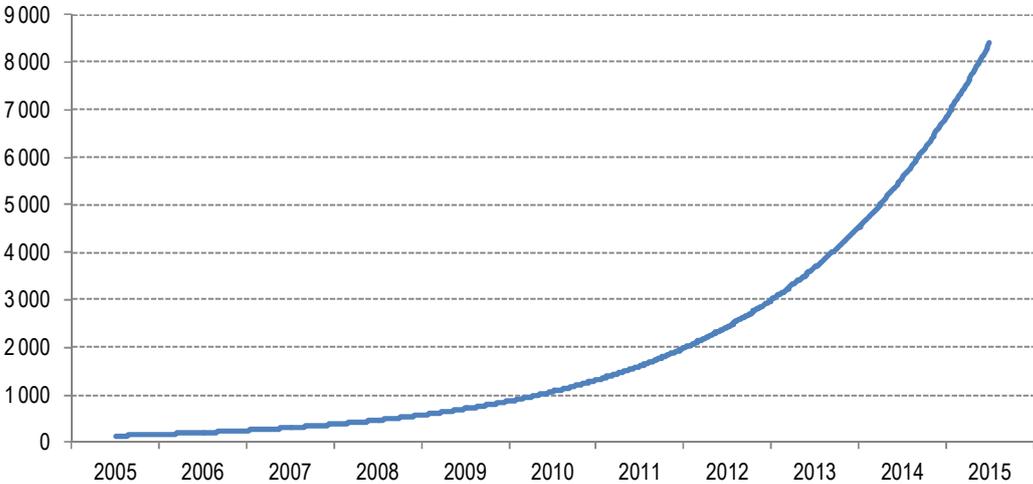
Individuals typically do not have a clear idea of what data about them is available, how it is used and by whom. The ubiquity of data collection and frequent lack of transparency make it difficult for individuals to understand and make choices related to the uses of their personal data. For example, many are unaware that they may be revealing their location merely by carrying a mobile phone, much less the extent of information that is often shared with the applications on their mobile devices. Improving awareness about the usage of personal data is key to building trust that individuals can also receive benefits from those uses. More broadly, the ability to extract value from data requires an expertise that may accentuate the “digital divide”.

Better use of data can also create benefits for the public sector...

Investment in public data in the United States has been estimated at tens of billions of dollars. It is estimated that improved use of data could have an annual value of USD 300 billion, just in US healthcare. The sharing of health data facilitates access to medical care and affords insights useful for product and services innovation. Beyond health, improved use of data has been calculated to have a potential annual value of EUR 250 billion to Europe’s public sector administrations. But not enough is known about the scale of investments in public data and the possible returns to its different uses. The vice-president of the European Commission responsible for the Digital Agenda, Neelie Kroes, has recently called for public data to be opened up for all to use.

...although research is required on how these benefits can best be achieved.

Figure 5. World data storage in exabytes (billions of gigabytes)



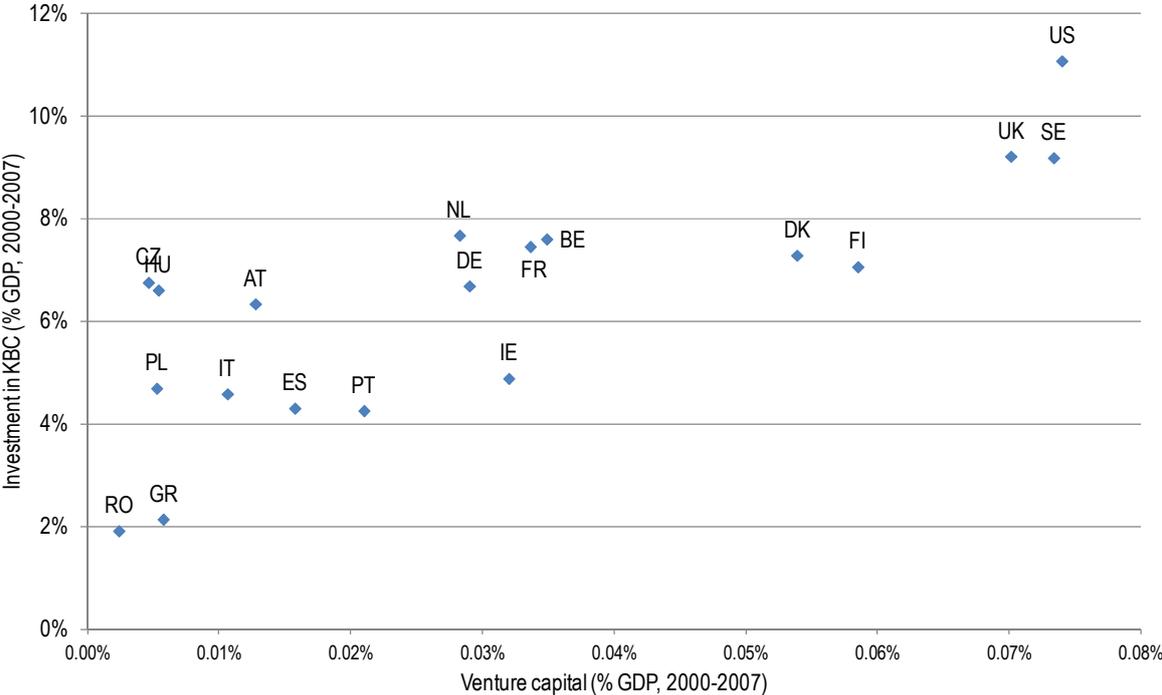
Source: OECD, based on IDC Digital Universe research project.

Governments will need to ensure good conditions for the financing of KBC-intensive firms

An efficient system of early-stage risk finance is important.

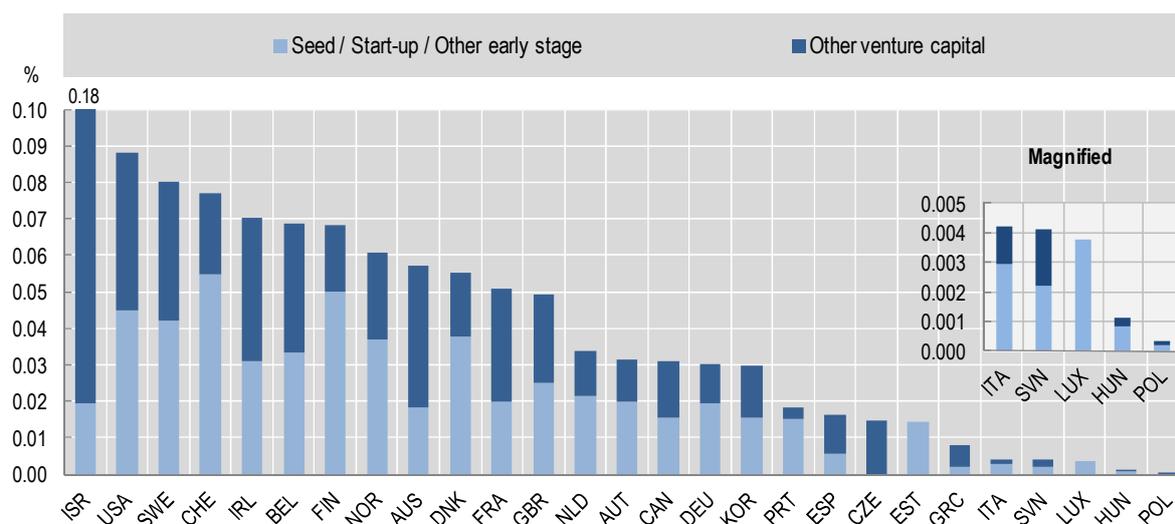
The venture capital industry specialises in early-stage investments in firms that often rely on KBC. Indeed, for a sample of 18 European countries, plus the United States, analysis shows a positive correlation between aggregate business investment in KBC and the size of the venture capital sector (Figure 6). Nevertheless, significant cross-country differences exist in the supply of seed, early stage and venture capital investments (Figure 7). This raises the question of whether cross-country differences in public policy settings exacerbate rigidities in the financing of investments in KBC. A number of policy areas matter here, including: *tax arrangements* (tax deductions on investments, tax relief on capital gains and special provisions concerning the roll over or carry forward of capital gains and losses); *the operation of public investment and co-investment funds* (in Europe, it is estimated that over half of all early-stage venture capital finance is provided by hybrid funds supported with public money); *regulations governing the types of institutions that can invest in venture capital, such as pension funds*; the viability of *exit strategies available to venture capitalists* (e.g. initial public offerings); and *bankruptcy arrangements*. Examination may also be needed of the effects of recent regulatory changes in financial markets on the supply of risk capital.

Figure 6. Business investment in KBC and the size of the venture capital industry (2000-07)



Source: C. Corrado, J. Haskel, C. Jona-Lasinio and M. Iommi (2012, forthcoming), Joint database on intangibles for European policymaking – data from INNODRIVE, COINVEST and the Conference Board.

Figure 7. Venture capital investment as a percentage of GDP, 2009



Source: OECD (2011), *OECD Science, Technology and Industry Scoreboard 2011: Innovation and Growth in Knowledge Economies*, OECD Publishing, Paris, www.oecd.org/sti/scoreboard.

Governments could also look to fostering the innovative use of KBC as security

While far from a mature phenomenon, innovations have occurred in recent years in KBC-based lending and equity investment. For instance: royalty financing arrangements, particularly in the pharmaceuticals and biotechnology sectors, have been used as sources of securitization. Some transactions have been based on prospective revenues from products still at a pre-commercial stage of development. In the United States, royalty-based financing is estimated to have been worth some USD 3.3 billion in 2007-2008. While still rare, KBC is also used as loan collateral. For instance, one major publishing company funded an expansion of its business through a deal secured by its existing rights to the works of composers. Investment banks and boutique private equity (PE) firms have also raised and invested funds targeted on KBC and intellectual property.

Governments can facilitate these developments in a variety of ways, from monitoring the broader array of securities laws and regulations and how they affect KBC-based financing, to ensuring a robust market for IP and institutional arrangements that minimise uncertainty as to ownership claims for KBC. Better measurement of business investment in KBC will also help to assess the efficiency of financing arrangements.

Bridging between businesses and information sources – benefits could be had from including all forms of KBC

Most governments try to create linkages between business and sources of research and technical information. Benefits could be had by including all forms of KBC.

Most OECD governments operate programmes that facilitate business' access to research or technology-related advice and information, often from universities and public research organisations. These schemes – such as innovation vouchers, know-how funds and technical extension services – tend to focus on technological information (typically creating links to academics in science, technology, engineering and mathematics (STEM) disciplines). However, businesses interact with academics for a variety of reasons not restricted to technological development. In the United Kingdom, for instance, nearly a third of all academics from the arts and humanities are engaged with business in some way, as are nearly a half of academics from the creative arts and media. As well as knowledge related to STEM disciplines, businesses also search for assistance with marketing, sales and support services, as well as human resource management, logistics and procurement. Businesses require information and advice relating to many forms of KBC, some of which could be omitted from bridging programmes exclusively focused on STEM disciplines.

A fuller understanding of innovation, investment and growth requires better measurement

Measurement frameworks do not fully reflect the reality of the knowledge economy. Advancing the measurement agenda is critical.

Despite the centrality of KBC to growth in OECD economies, the development of international comparative data is in its infancy. Some progress is occurring. For instance, in the United States in 2013 R&D will appear as an investment, for the first time, in the measure of GDP. Nevertheless, measures of investment in KBC are fraught with assumptions that require greater testing and empirical refinement. At the micro-level, key investments in such areas as design and training are poorly captured in surveys. As part of the *New Sources of Growth* project, the OECD is working with national statistical authorities and international experts to increase the rigor and comparability of measurement. This ongoing work will provide an essential foundation for fuller exploration of the relationships between KBC, productivity and growth.

Opportunities exist for international collaboration

The impacts of some policy reforms could be magnified if governments work together.

As indicated in the preceding text, the outcomes of a number of policies on KBC may be greater if governments took action together. Cases in point include:

- Coordination of regulations so as to permit cross-border transmission of data;
- Cross-country promotion of increased comparability and consistency in corporate reporting of investments in KBC.
- Cross-border spillover benefits from R&D suggest that tax relief for R&D expenditure may be inefficient from a national perspective. But national and global efficiencies may be realized where many countries provide support for R&D. Possible roles for policy competition or co-ordination shall be examined.

A potential role for policy collaboration will be examined in the remainder of the project.

Project milestones and outputs

A policy-oriented conference will be held in early 2013, with publications being launched, in a variety of formats, on the following subjects: **measurement of KBC and its effects on economic growth; improving tax policy for KBC; the creation of economic value from personal data; corporate reporting of business investment in KBC; knowledge networks and markets; and the role of KBC in global value chains**. There will also be an overall **project synthesis report** and a **report to the 2013 OECD Ministerial Council Meeting**.

This project is also pointing to policy-relevant themes that will need further investigation in the medium-term, owing to their complexity and/or evolution. Among these are: understanding how the impacts of investments in KBC translate into labour market outcomes, both in terms of aggregate demand for labour and in terms of the demand for skills (in this connection, links can also be drawn to recently published OECD work – as well as the broader literature – on the causes of income inequality in OECD member countries); assessment of the adequacy of IPR frameworks in the knowledge economy, including the economic importance of design rights; creating economic value from personal and public data; innovations in the financing of KBC-intensive firms, tax policies, and improving internationally comparable measurement of investment in KBC and the associated macro- and micro-economic outcomes. This work will inform OECD's broader work on 'new approaches to economic challenges'.

<http://oe.cd/kbc>