SYNTHESIS REPORT ON ANALYZING SUCCESSFUL PRACTICES AND POLICY FRAMEWORKS ON ACCELERATING VALUE CREATION THROUGH IA BASED MANAGEMENT

This document was prepared and submitted as the Project Report based on the Agreement of Entrustment of Funds in Support of Analyzing successful practices and policy frameworks on accelerating value creation through IA based management between the Ministry of Economy, Trade and Industry of Japan (METI) and the Organisation for Economic Co-operation and Development (OECD).

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Executive Summary

At the 2006 Meeting of the OECD Council at Ministerial Level, Ministers noted the growing importance of intellectual assets for sustained economic growth and the need for improved measurement of these assets as an input to the process of policy formation. Building on the OECD report *Creating Value from Intellectual Assets* (2006), Ministers endorsed a follow-up study in order to deepen understanding of intellectual assets in relation to innovation and value creation. This work is being conducted under the auspices of the Committee on Industry, Innovation and Entrepreneurship. The Directorate for Science, Technology and Industry has the lead responsibility for the project, which is being implemented in co-operation with the Directorate for Financial and Enterprise Affairs, the Centre for Entrepreneurship and external experts.

The report presents a synthesis of the key findings to-date from work in three broad areas. This summary briefly reviews selected highlights in each area:

- Macro-level: national accounts and estimations of investment in intellectual assets

The System of National Accounts provides a key instrument for monitoring of the economy. The information is of crucial importance for assessments from the perspectives of both domestic economic development and international comparisons. Decision makers across society depend on this information. Yet, the current approaches to this accounting provide an incomplete accounting of intangible assets. While there has been some progress in recent decades in enhancing the System of National Accounts to better reflect these assets, gaps remain. A substantial share of intellectual assets is still not reflected in the reporting. For example, the latest revisions have resulted in inclusion of certain types of software and R&D investment, but firm-specific intangibles – such as network capital or organisational capital – are still not captured directly. As a result, it remains difficult to assess with precision the economic contribution and evolution of intellectual assets, leaving decision makers with incomplete information about an asset category that – for OECD economies – appears to be roughly comparable in size to that of tangible assets.

A number of statistical assessments are underway that aim to improve estimates of the scale of investment in intangible assets at the national level for selected OECD countries. The present report considers estimates of total annual investment in intellectual assets for five OECD Member countries (Finland, Japan, Netherlands, United Kingdom and United States). These estimates were developed using similar methodological approaches, but they are not strictly comparable in terms of the variables covered. The estimates underscore the large scale of this investment and amount to between 7.5 and 11.7% of gross domestic product, depending on the country. The underlying assessments demonstrate possibilities for compilation of macro-level estimates of investment in intellectual assets and the importance of pursuing this line of research. Not taking investment in intellectual assets into account may lead to underestimation of GDP and biased estimates of the contribution of the various components of GDP. Overall, the factors typically associated with the growth of the "knowledge economy" become even more important once intangibles are included.

- Regional level: the regional dimension of innovation, firm location and linkages

The present report presents new work on the importance of intellectual assets for clusters and the geography of firms, as well as regional linkages. The analysis shows that there are important differences in the inventive performance of regions in OECD economies, as measured by indicators for one of the key types of intellectual assets (*i.e.* patents). Inventive performance is shown to be particularly concentrated in certain regions of continental Europe, North America and Japan. The development of inventive activities in countries usually takes place in a small number of regions. Highly inventive regions tend to cluster together. This spatial dependence is found to have increased over time. Moreover, the inventive performance of regions is found to be directly influenced by the availability of human capital and R&D expenditure. Cross-country differences point to the importance of national innovation systems. The results also indicate the importance for innovation of linkages within firms across regions. At the same time, the most inventive regions tend to have relatively more multi-regional firms among their innovative firms. It is important to arrive at a better understanding of these processes, especially with a view to maximising the returns to innovation and optimising the effects and efficiency of innovation policy.

- Firm-level: corporate reporting, value creation, SMEs

The present report highlights developments in guidelines and frameworks for reporting by enterprises concerning intellectual assets. While there are a variety of such reporting initiatives, the main disclosure standards and practices can be categorised broadly in two categories: *i)* narrative statements and non-financial reporting intended to cover all types of value drivers related to organisational performance and *ii)* specific reporting about the intellectual assets. In many cases, current management and corporate reporting practices are focused on backward-looking information and provide little systematic information about the capacity of the company to generate future revenues with respect to intellectual assets. Under the various reporting initiatives, governments and industry bodies have moved to enhance narrative reporting and promote the disclosure by companies of, *inter alia*, material, qualitative and forward-looking information about value drivers, trends, risks and uncertainties.

Despite the diffusion of these initiatives, specific reporting on intangibles remains relatively limited in practise, albeit with some variation by region and sector. Still, there are indications that successful implementation of enhanced reporting on intellectual assets can yield a number of benefits in terms of efficiency and value creation. The provision of sufficient and appropriate information about intellectual assets can improve decision-making by investors and help discipline management and boards with positive economic consequences. By ensuring that the non-financial information is consistent and comparable over time and across companies, these initiatives may allow investors to better assess future earnings and the risks associated with different investment opportunities. This should contribute to making financial markets more efficient by reducing information asymmetry, biased or unfounded earnings estimates, unrealistic valuations and unjustified share price volatility. Improved information about intellectual assets and company strategy also improves the ability of firms to secure funding at a lower cost of capital – notably for small listed companies that suffer from a lack of coverage by analysts – and to better allocate resources.

One important policy implication is the potential for government to assist in the efforts to promote identification and dissemination of best practices in reporting. (In this regard, it should be noted that the types and importance of intellectual assets vary across industries and some specificity is needed.) Dissemination of knowledge about the potential benefits could also encourage more companies to improve their disclosure practices as well as their internal management systems. Better information on intellectual assets in the national accounts and corporate reporting would also facilitate the design, monitoring and implementation of more efficient public policies, for example with respect to investment in intellectual assets to generate economic value.

At the firm level, the ability to create value from intellectual assets is highly contingent on the management capabilities in individual firms and the implementation of appropriate business strategies. Work on the impact of R&D, patents, human capital and software shows that the average return on investment in intellectual assets can be large. Leading firms have increased the efficiency of their R&D processes by linking internal R&D activities more closely to their business strategy and relying on external sources to gain access to complementary knowledge and round out technology portfolios. Such techniques are particularly important in competitive industries where innovative products rapidly become commodities through follow-on innovation and imitation. The ability of companies to manage risks is also important, requiring systems of internal control and good information including with respect to intellectual assets.

The situation of small and medium size enterprises merits special attention with respect to reporting and management of intellectual assets. To the extent that intellectual assets reporting guidelines cover all organisations, they can have beneficial effects for small innovative companies. Enhanced approaches to reporting can raise awareness – among businesses and policymakers – of the potential for small firms to develop and exploit intellectual assets. For example, young and innovative firms can usefully employ their intellectual property as collateral in obtaining finance in cases when they cannot rely only on their tangible assets and do not yet have reputation or brands or other intellectual assets for use in raising capital. Moreover, there is room for enhancement of polices in support for small and medium size enterprises with respect to intellectual assets and value creation. Small firms often rely on informal approaches to management of intellectual property, a point that policy does not always take into account. There is scope for improved awareness of this among policy makers and in the larger business community. Such awareness may lead to enhancement of communication and support strategies for small firms, for example in the targeting of government or business association efforts to provide access to intellectual property, to simplify administrative procedures and to deliver training and capacity building.

Further work

The analyses conducted in the context of the present phase of OECD work on intellectual assets and value creation underscore the economic importance of intellectual assets and the central role that they play in the modern knowledge economy. Effective development and deployment of intellectual assets can fuel value creation both in terms of expansion of the stock of wealth and in the generation of current value through new or improved products and processes. Failure to correctly assess intellectual assets can lead to misallocation of resources and other inappropriate decisions by managers, policymakers and others.

With respect to the follow up to the present project, the analyses clearly highlight gaps in our understanding of intellectual assets and value creation. There is room for increased standardisation in the terminology, development of statistical indicators and expanded analytical work across the three tiers of current OECD studies on this issue area (national, regional and firm-level).

Particularly promising areas for follow on work might include such topics as the following:

- Intellectual assets and new business models -- Intellectual assets are increasingly important for innovation, and in particular non-technological innovation and other new forms of innovation. An extension of the current analysis could examine the impact of intellectual assets on the emergence of new business models.

- Value creation and globalisation -- Intellectual assets play a pivotal role in the increasing fragmentation of global value chains and in the globalisation of business services. An extension of the current analysis could explore the relationship between intellectual assets and organisational change, with particular regard to value creation in the globalising world economy.

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Introduction

1. At the 2006 Meeting of the OECD Council at Ministerial Level, Ministers noted the growing importance of intellectual assets for sustained economic growth and the need for improved measurement of these assets as an input to the process of policy formation. Building on the OECD report *Creating Value from Intellectual Assets* (2006), Ministers endorsed a follow-up study in order to deepen understanding of intellectual assets in relation to innovation and value creation.

2. The Committee on Industry and Business Environment (predecessor to the Committee on Industry, Innovation and Entrepreneurship – CIIE) moved to implement this request in October 2006 when it endorsed next steps [DSTI/IND(2006)14]. The work is proceeding under a three-tier approach. At the macro-level, the focus is on national accounts estimations of accumulated intellectual assets and comparable growth accounting. At the regional level, the project is assessing the importance of intellectual assets for clusters and the geography of firms, as well as regional linkages. The third tier of work considers intellectual assets and their efficient management at firm level.

3. The Directorate for Science, Technology and Industry (STI) has the lead responsibility for the project, which is being implemented in co-operation with the Directorate for Financial and Enterprise Affairs (DAF), the Centre for Entrepreneurship (CFE) and external experts. The Structural Policy Division in STI is handling coordination of the work.

4. This report presents a synthesis of the key findings to-date from each tier of the project, drawing on the underlying project documents. The report aims to provide an integrated perspective on the topic, highlighting common themes, gaps and areas where further analysis is required.

Motivation

5. The expansion of the services sector, globalisation, deregulation and the emergence of new information technologies have brought to the fore the issue of how knowledge is created, disseminated, retained and used to obtain economic returns. This has led to a structural change, from traditional scale-based manufacturing, which relies heavily on tangible assets, to new innovation-oriented activities which rely largely on research and development (R&D), patents, software, human resources and new organisational structures which represent key forms of intellectual assets.

6. Intellectual assets have become strategic factors for value creation by firms. They are increasingly important in enabling productivity and efficiency gains, and are a crucial part of innovation processes in relation to business processes and products. As such, intellectual assets are central to economies' growth and competitiveness.

7. These developments have transformed the value creation process, and have contributed to increasing fragmentation and globalisation of value chains. Intellectual assets are crucial for reaping the benefits offered by new technologies, for example in the implementation of organisational change and new

business models. Because of the potential transformative effects of intellectual assets, and the large contribution they make to the economy and the way economic processes are organised, measurement methods and conceptual models of investment, capital, and its return, need to be updated. This is true at both the economy-wide level and at the firm level; intellectual assets are rarely reflected in official measures of economic performance, and most of them are not accounted for as investments in financial statements.[1]

8. Today, firms often spend as much on intellectual assets as on tangible assets, so there is an increasing need to measure their contribution to OECD economies. The current bias towards tangible assets in measuring investment may lead to inefficient policymaking, misallocation of resources by managers and increased cost of capital for investors. However, any shift toward consideration of intellectual assets as investments rather than as expenses must overcome a range of measurement and valuation problems.

9. Although creating innovations and value through the efficient use of intellectual assets is primarily the role of company management and their boards, public policy is also important. Government has a key role to play in establishing appropriate macroeconomic and framework conditions conducive to development of intellectual assets and the creation of value.

10. The OECD's 2006 report to ministers on *Creating Value from Intellectual Assets* identified 5 major policy challenges in this regard: *i)* promotion of competition to support value creation and innovation, *ii)* gauging the impact of intellectual assets as sources of economic growth, *iii)* investment in human capital, *iv)* ensuring the diffusion of knowledge while retaining intellectual assets, and *v)* improved disclosure by listed companies. The present report builds on these findings, taking stock of recent developments and pushing the analysis forward across a range of policy dimensions.

Key dimensions

Overview - intellectual assets and value creation

11. This overview highlights the economic importance of intellectual assets, their links with new technologies, productivity, innovation and competitiveness. The subsequent sections highlight findings from each of the component areas examined in the context of the present phase of the OECD project on intellectual assets and value creation.

12. There is no commonly accepted definition of the term *intellectual assets* (Box 1), a situation that reflects the diversity of actors involved (*e.g.* academics, accounting bodies, investors, managers, management consultants and policy makers) and their different interests in addressing the issue of measurement and management of intellectual assets. Furthermore, there appears to be a mismatch between "theoretical" definitions and taxonomies, and the practical realities faced by businesses.

[1] For example, buying a piece of equipment is counted as investment, but money spent on learning how to use it or to pay the patent license that enables its use is not.

Box 1. Definitional issues

The term "Intellectual assets" is used across different disciplines, such as economics, business administration, management theory and national accounts, but there is no single or agreed definition. Other similar terms such as "intellectual capital", "intangibles" and "knowledge capital" are sometimes used interchangeably with "intellectual assets". Moreover, there have been a number of attempts to identify the various constituents of intellectual assets and develop a taxonomy. The resulting proliferation of definitions, classifications and measurement techniques is indicative of the methodological and practical difficulties.

While there is no globally accepted definition and classification of intellectual assets, most definitions seem to agree that they are non-physical assets with three core characteristics: i) they are viewed as sources of probable future economic profits; ii) lack physical substance; and iii) to some extent, they can be, retained and traded by a firm. They are generally seen to include R&D, patents, and trademarks. More recently, the scope has evolved to a broader conceptualisation that includes human resources and capabilities, organisational competencies (*e.g.* databases, technology, routines and culture) and "relational" capital (*e.g.* organisational designs and processes, and customer and supplier networks).

Definitions now tend to include more dynamic business attributes such as knowledge-creating capability, rights of access to technology, the ability to use information, operating procedures and processes, management capability to execute strategy and innovativeness. The expansion in the conceptual scope of intellectual assets is pushing the definition beyond the traditionally accepted intellectual assets such as patents, software and trademarks, to include the associated value drivers such as management capacity to execute strategies that generate value from the retention and use of the assets.

This blurring of definition is in part due to the fact that intellectual assets by themselves neither create value nor generate growth. They need to be combined with other factors of production. Moreover, the components themselves are often deeply intertwined. For example, patents frequently are the result of R&D and are a legal device for securing the ideas emanating from human capital; the development of software represents a large portion of R&D spending, especially in services; software and organisational structure are frequently the codification of human expertise and know-how; investment in training only generates value when combined with other factors such as improved business processes and the availability of the right information system (Lev and Daum, 2004).

Sources: Bismuth (2006), Bismuth and Tojo (2006).

National accounts

13. The increasing importance of intellectual assets for value creation is reflected in corporate expenditure, whereby investment in intangible assets appears to be approaching levels comparable to investment in tangibles. While the System of National Accounts (SNA) is changing to adapt to the new reality of the knowledge economy, not all intellectual assets are fully reflected in its coverage. For example, SNA revisions have resulted in inclusion of certain types of software and R&D investment, but firm-specific intangibles, such as network capital or organisational capital, are still not captured. As a result, it remains difficult to assess with precision the economic contribution of intellectual assets, in particular with respect to productivity growth. This section examines the coverage of intellectual assets in the SNA and related issues.

Background

14. The acceleration in the pace of technological change in recent decades has been accompanied by an expansion in the role of intellectual assets. The dynamic and increasingly interdependent nature of global economy is reflected in the use of terms such as "post-industrial economy", "information economy", or "network society"; the creation, dissemination, and use of tacit and explicit knowledge is crucial. With the role of intangible assets growing as a source of comparative advantage, they are increasingly also attracting attention from policy makers.

15. The economic literature has long recognised that the accumulation of physical capital is not the only factor influencing economic growth and development.[2] Intellectual assets need to be taken into account both at the microeconomic level, as companies increasingly derive economic returns from developing and using intellectual assets, and the macroeconomic level where the diffusion of knowledge and innovation are increasingly important as drivers of economic growth.

16. National accounting systems measure economic activity and these data are used for evaluation, analysis and ultimately policy formulation. A portion of key intellectual assets remains beyond the scope of the current system and is not directly captured in the national accounts. Reforms are now under way to adapt the accounting systems to better reflect the new economic realities. In addition to the shortfall in coverage in the SNA, other national statistics and traditional corporate reporting standards do not adequately reflect the role of intellectual assets as a productive force and tend to rely on methods that favour financial or physical capital. The result is inadequate availability of reliable statistical information on intellectual assets, which may have negative consequences for economic decision making.

17. The issue of the classification of certain dimensions of intellectual assets has been around for a long time. The OECD released the first edition of the Frascati Manual on the valuation of R&D activities in 1963. In late 1970's, some economists began to focus on a critical reassessment of the notion of capital particularly in relation to intangible assets. Development of human capital theory and theories of innovation and technical change followed.[3] Explicit theory on intellectual investment emerged in the 1980s (notably in France). More recently, work on the "knowledge-based" economy has further enriched the conceptual framework for measuring intangible investment.

18. There are a number of drivers behind the increased efforts to better assess the measurement and policy dimensions of intellectual assets at the national level. Governments and business leaders have come to recognise the potential economic importance of such efforts. Consideration of intellectual assets is a part of the path to a more complete understanding of economic developments, the appropriate policy responses and lessons for the future, including with respect to such issues as growth, adjustment and competitiveness. Nevertheless, the methodological challenges remain; efforts to date have not been able to overcome them. The complexities stemming from the nature of intellectual assets, an increasingly dynamic environment and the absence of a coherent and agreed conceptual framework make the research in this area extremely challenging and difficult to reconcile for practitioners and policy makers.

19. This section of the synthesis report is organised around the following three basic aspects of intellectual assets: *i)* definition of different types of intellectual assets, *ii)* the proposals for a general framework for integrating intellectual assets into System of National Accounts based on an incremental approach, and *iii)* the treatment of intellectual assets in macroeconomic statistics.

Different categories of intellectual assets

20. There are a variety of classifications of intellectual assets. One common approach is to classify the components in three broad categories: human capital, relational capital and structural capital.[4]

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2 *E.g.* Frederick List criticised Adam Smith's classical notion of capital back in the 1800s (List, 1856).

3 See Clement, Hammarer and Schwarz (1998) and Ducharme (1998) for a description of the theoretical origins of intellectual capital coverage.

4 One categorization proposed by the European Commission through the MERITUM and the PRISM projects is often employed in intellectual capital guidelines and in academic papers. See Holtham and Youngman (2002) for more details on the PRISM and MERITUM projects.

- **Human capital** relates to the knowledge, skills and know-how that employees "take with them when they leave at night". Examples are, innovation capacity, creativity, know-how, previous experience, teamwork capacity, employee flexibility, tolerance for ambiguity, motivation, satisfaction, learning capacity, loyalty, formal training, and education.

- **Relational capital** concerns the resources arising from the external relationships of the firm with customers, suppliers and R&D partners. It comprises that part of human capital and structural capital involved with the company's relations with such stakeholders. Examples are image, customer loyalty, customer satisfaction, links with suppliers, commercial power and negotiating capacity with financial entities.

- **Structural capital** refers to the knowledge that stays with the firm "after the staff leaves at night". It comprises organisational routines, procedures, systems, cultures and databases. Examples are organisational flexibility, a documentation service, the existence of a knowledge centre, the general use of information technologies and organisational learning capacities.

21. Unfortunately, such a classification of intellectual assets is more easily described than conceptually framed and implemented for SNA purposes. Whereas such a descriptive framework may be useful from a point of view of a firm manager, it is inadequate for a national accountant.[5] As a result, the distinction between different types of intellectual capital forms is a topic of ongoing debate extending from a mere classification issue to much deeper understanding of economic systems, how they work and the way that economic activities are meaningfully presented in the accounting statements.

22. SNA reform requires a more exact, measureable and operational understanding of the issue. As Hill (2003a) put it when pleading for a rethinking of SNA conventions, "Economics literature is full of statements to the effect that goods are material, or tangible, whereas services are immaterial, or intangible. Such statements are casual and conventional rather than scientific, as the nature of an immaterial product is not explained and is by no means intuitively obvious."

The current System of National Accounts and knowledge assets

23. It has been long argued that distinguishing and recording intellectual assets within the SNA would necessitate some major changes to the System. Although there are numerous theoretical complexities and institutional rigidities that make major changes to the system extremely difficult to introduce, some observers have commented that the SNA must avoid becoming locked into its own conventions and increasingly disconnected from economic theory and reality (Hill, 2003b).

24. An asset is defined in the SNA as "an entity over which ownership rights can be established and from which economic benefits may be derived by holding them, or using them, over a period of time" (SNA, 10.2). One of the key criteria for recording an asset into the balance sheet of the SNA is the concept of ownership which envisages the rights from such ownership are actually enforced. The main sequence of accounts is the production account recording the productive activities. Thus, it is of central importance for the SNA system to label an asset as productive or not. Due to the incomplete tracking of intellectual assets, the SNA has omitted some important productive assets from its coverage.

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5 *E.g.* Young (2003) puts the current problem of the academic research literature about the intellectual assets as "The final limitation is that little effort has been made to develop a set of principles. Instead, the literature on intangibles to date tends to focus on one of two matters: a description of the problem, frequently illustrated with examples or anecdotes, but without much in the way of a conceptual framework to structure it, or a handbook for executives who wish to manage their intangible assets more effectively."

25. Though the 1993 revision of the SNA introduced an important change by recognizing certain categories of intellectual assets into the System such as software, literary and musical compositions, entertainment originals or recordings and mineral exploration, the scope of intellectual assets covered by that revision under the definition of intangibles remains relatively narrow (Schreyer, 2007). For example, a sizable share of R&D remains outside the scope of the current definition of assets and therefore expenditures on them are treated as intermediate consumption or final consumption depending on the sector.

26. Part of the rationale behind the 1993 SNA revision focused on clarity of identification of the assets concerned.[6] Software, literary and musical compositions and recordings were easy to identify as assets, unlike some forms of R&D. The treatment of R&D as an asset was limited in order to avoid opening a door to capitalization of almost any corporate expenditure. The 1993 revision resulted in the integration of certain intellectual assets into the System in light of the clear evidence that they are produced assets, placing them in the category of intangible fixed assets. The traditional produced fixed assets in the form of buildings, machinery and equipment were then described as tangible fixed assets.

The integration of intellectual assets into SNA and future work

27. A further revision (1993 SNA Rev. 1) to the SNA is pending, set to be released in 2008. Under this revision, R&D capitalization will be integrated into the revised SNA.[7] The 1993 SNA Rev. 1 recommends that expenditure on R&D be recorded as Gross Fixed Capital Formation (GFCF) if it meets the general characteristics of a fixed asset. However, the 1993 SNA Rev. 1 will note that there are substantial difficulties in implementing this recommendation and cautions against implementation in the core accounts until these difficulties have been overcome. Thus, it is likely that the integration of technological assets will start by way of satellite accounts prior to a full consolidation into the SNA. A taskforce has been set up by the OECD to work on bridging the gap between available R&D data and the requirements of the SNA. The OECD is also preparing a handbook on deriving capital measures of intellectual property products. Eurostat has also indicated that it too intends to form a task force to develop guidelines for the construction R&D satellite accounts.

28. Several countries (Australia, US and Canada) have indicated their intention to include R&D GFCF in their core accounts. The EU has decided that member countries should compile R&D satellite accounts until they feel the estimates are good enough to go in the core. Several OECD countries are also in the process of enhancing their statistical systems to include coverage of different forms of intellectual assets including human capital. Nevertheless, for now, and for some time to come, coverage of intellectual assets in SNA will remain incomplete, facing a number of challenges out of both institutional and conceptual concerns.

29. As for next steps, it would appear that a combined approach of encouraging new front line research and guidelines on the one hand, while consolidating the already existing efforts and stock of

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6 The 1993 revision has aroused some controversy. *E.g.* Hill and Youngman (2002) also argue that the economic differences between the intellectual assets (some of them being treated as intangible fixed assets) and tangible fixed assets are so fundamental that they should constitute different categories of assets. They describe technological assets as originals and state that "They do not provide flows of capital services as inputs into production. They are technology assets whose role is quite different from that of a fixed asset. They expand the set of production possibilities that are attainable with a given stock of (tangible) fixed assets."

7 The 1993 SNA Rev. 1 chapters 6 (production account) and 10 (capital account) are near finalisation, and are of particular interest for capturing intellectual assets as they include such issues as R&D, patented entities, originals and copies, and databases.

knowledge on the other may contribute to the progressive revision of SNA. The continuation of the incremental approach employed to date has the advantage of balancing between taking realistic steps today while preparing the ground for more complete treatment of the issue tomorrow. International co-ordination in this context is vital and will maximize the efficiency of the revision process.

30. Summing up, there has been some progress to date in enhancing the SNA to better capture intellectual assets. There is also progress in analysis of the broader role of intellectual assets in the economy (next section). Nevertheless, gaps remain and a substantial share of intellectual assets is not reflected in the current approaches. Research and incremental steps promise progress without undermining the soundness of the current SNA approaches.

Intellectual assets in macroeconomic statistics

31. Economists have engaged in a number of analytical initiatives beyond the SNA efforts, in an attempt to fill the gap in official statistics measuring investment and intellectual assets at the macro level. Corrado *et al* (2005, 2006) estimated the annual investment in intellectual assets by US businesses in the late 1990s. Their methodology groups intellectual asset investments into three major categories: *i)* computerised information (software, computerised databases), *ii)* innovative property (scientific R&D, non-scientific R&D, design); and *iii)* economic competencies (brand equity, firm-specific human capital and organisational capital).

32. In the study by Corrado *et al, b*usiness spending on such assets is estimated based on data from National Accounts, official surveys, and other sources. This spending is then converted into investment expenditure by deducting expenses that yield only short period returns (*e.g.* less than one year). The study estimates total annual investment in intellectual assets by US businesses in the late 1990s to have amounted to some USD 1.1 trillion, or 12% of GDP. This is roughly the same as tangible investments indicating the huge implications of not taking intellectual assets into account in measuring and analysing economic activity. The importance of intellectual assets in the US (according to this method) is illustrated in Figure 1 and Table 1.

Figure 1. Business investment in the US, tangible and intangible investment

(ratio to business output)

Source: Corrado *et a*l (2005, 2006)

33. The study by Corrado *et al* for the US was replicated by Marrano and Haskel (2006) for the UK. They used data for 2004 from National Accounts, Annual Business Inquiry (ABI), and other sources to estimate UK expenditures and investment in intellectual assets. Their estimate of UK intangible investment in 2004 came to some GBP 116 billion, or 10% or UK GDP, which is about equal to UK investment in

tangible assets. The magnitude and composition of UK intellectual asset investments are comparable to CHS estimates for the US, though this can probably also be partially explained by their use of the same methodology and assumptions. However, the US and UK results differ significantly on innovative property, especially scientific R&D, reflecting lower business R&D intensity in the UK.[8]

34. Fukao *et al* (2007) also follow the approach from Corrado *et al* (2005, 2006) to estimate investment in intellectual assets in Japan using the Japan Industry Productivity Database and various surveys. Using a somewhat narrower dataset than those used in the US and UK analysis discussed above, Fukao *et al* find that intellectual asset investment in Japan has risen over the past 20 years, reaching 8.3% of GDP by 2000-2002. This may underestimate the actual situation due to the lack of reliable data in three asset classes: "Other product development, design and research", "Firm-specific human capital" and "Organisational structure".[9] Thus, the numbers are not strictly comparable with those for the US and UK.

Table 1. Intellectual Asset Investment in 5 OECD Countries, by asset category

(Percentage of GDP)

	CHS (2005, 06) US 1998-2000	GH (2006) UK 2004	FHMS (2007) Japan 2000-2002	RBT (2007) Netherland 2004	JAA (2007) Finland 2005
Computerized Information	1.7	1.7	2.0	1.2	1.0
Innovative Property	4.6	3.4	3.7	2.4	4.0
Scientific R&D	2.0	1.1	2.1	1.5	2.7
Mineral exploration	0.2	0.0	0.0	0.0	0.0
Copyright and license costs	0.8	0.2	0.9	0.1	0.1
Other product development, design and research	1.6	2.0	0.7[1]	0.7	1.1
Economic Competencies	5.4	5.0	2.5	3.6	4.1
Brand equity	1.5	0.9	1.0	1.6	1.7
Firm-specific human capital	1.3	2.5	0.3[2]	0.8	1.2
Organizational structure	2.7	1.6	1.2[3]	1.2	1.1
Total Intangible Assets Investment	11.7	10.1	8.3[4]	7.5	9.1

Notes: 1. Product development in financial services only.

2. Direct firm expenses only.

3. Purchased organisational structure is not included.

4. Not strictly comparable with the figures for the other countries due to incomplete coverage of some asset classes.

Sources: Corrado et al (2005, 2006), Marrano and Haskel (2006), Fukao et al (2007), van Rooijen *et al* (2008), and Jalva *et al* (2007).

8 Business Enterprise Expenditure on R&D (BERD) as a percentage of GDP is 1.09% for the UK in 2004, while comparable figure for the United States is 1.88% (MSTI, volume 2006/2).

9 Due to the data constraints, Fukao et al (2007) do not include following expenses in their estimation; 1) new architectural /engineering designs and R&D in social science and humanities, 2) wage and salary costs of employee time in training, and 3) purchased consulting services for organisational change. These omitted components add up to 2.5% of US GDP in Corrado *et al* (2005, 2006) and 3.0% of UK GDP in Marrano *et al* (2006).

Preliminary cross-country comparison of intellectual asset dynamics

35. Based on the estimated of investment in intellectual assets, Corrado *et al* (2005, 2006) construct an intellectual asset stock time series, using a set of deflators and depreciation ratios by asset class, and examine the contribution of intellectual assets to US economic growth. They estimate that nominal US GDP would have been about 10% higher than the published figures in the late 1990s if such investments had been taken into account. They also find that the contribution to labour productivity growth over the period 1995-2003 was equal to that of investment in tangible assets (see also Box 2 below).

36. Marrano *et al* (2007) conducted a similar exercise for the UK, using assumptions from Corrado *et al* (2005, 2006) where necessary. The results are similar to those for the US, bearing in mind differences in industrial structure. The new analysis is particularly useful in the context of the so-called 'UK productivity puzzle' as it suggests that at least part of the apparent UK productivity slowdown since the early 1990s can be explained by measurement issues connected to investment in intangibles.

37. Fukao *et al* (2007) find that the growth rate in intellectual asset investments in Japan declined from 1980s to the 1990s in stark contrast with the high growth rate in those in the United States in the late 1990s. The ratio of intangible to tangible investment is much smaller in Japan than in the US and the UK.[10] As a result, the contribution of intellectual asset investment to total labour productivity growth in Japan is substantially smaller than in the US.

Box 2. Intangible assets, ICTs, and productivity

Basu *et al* (2003) argue that the US – UK total factor productivity (TFP) differentials from 1995 onwards can be explained by a combination of unmeasured investments in intangible organisation capital and ICTs as a general purpose technologies (GPT), *i.e.* information and communication technologies (ICTs) and the complementary investments and innovations they induce. The existence and importance of intangible capital contributes to the explanation of the Solow productivity Paradox of why productivity remained slow in the 1980s and early 1990s when ICT investment was strong, and can also explain why productivity growth remained strong after 2000 when ICT spending fell dramatically (Baily, 2003). The idea is that it takes time and resources to learn how to use ICT properly. Initially there may even be a fall in productivity as resources are allocated to learning ICT. ICTs alone are not sufficient, but when ICTs act to make other innovations effective they will provide gains. If ICTs are used to do the same things in the same way as before the ICT spending occurred or if the real purpose of the investment in ICT has not been identified before the investment is made, its impact will be limited.

Improvements in workplace organisation, enabled by ICT, have also improved productivity. The main driver of productivity improvements has not necessarily been the spending on ICT, but rather the changes and innovations that this ICT has enabled, such as the re-organisation and streamlining of existing business processes, for example order tracking, inventory control, accounting services, and the tracking of product delivery (Atrostic and Nguyen, 2006). When considering ICTs as a GPT with the power to transform most economic sectors, the expected economic impact will be far greater than what is predicted by just examining the capital investment associated with ICTs because this does not take into account the widespread complementary innovations enabled by ICTs (Brynjolfsson and Hitt, 2000).

Black and Lynch (2001) find evidence that organisational changes affect productivity. The way in which new work practices are implemented within establishments is found to be associated with higher productivity, and strong complementarities are found among work practices, workforce skills, and the share of the workforce using computers. Plant-level productivity is found to be higher in plants with relatively more-educated workers or greater use of computers by non-managerial employees.

[10] The ratio of tangible to intangible investment is 0.3 in Japan (1995-2002), 1.2 in the US (1998-2000), and 1.1 in the UK (2004).

The effects of organisational changes may rival the effects of changes in the production process in terms of their impact on productivity at the firm-level. The ability to create economic value from intellectual assets is highly contingent on the management capabilities of individual firms and the implementation of appropriate business strategies (OECD, 2006), and the ability of ICTs to enable complementary organisational investments such as business process and work practices constitutes a significant component of the value of ICTs. These investments, in turn, lead to productivity gains by allowing firms to reduce costs and increase output quality, for example in the form of new products or through improvements in intangible aspects of existing products, such as convenience, customisation, timeliness, quality and variety (Brynjolfsson and Hitt, 2000). However, the productivity effects of these complementary factors may take some time to appear. The longer term productivity and output contributions of computerisation at the firm-level have been found to be up to 5 times greater than those in the short run (Brynjolfsson and Hitt, 2003). The relatively better productivity performance of the affiliates of US multinationals compared to non-US owned establishments in the UK has also, at least in part, been attributed to a better use of ICTs in US firms. Establishments that were taken over by US multinationals also subsequently increased the productivity of their ICTs, whereas observationally identical establishments taken over by non-US multinationals did not. It is thought that the internal organisation of US firms allows them to exploit ICTs more efficiently, highlighting the impact of ICTs through the managerial and other organisational changes they allow to be implemented (Bloom *et al*, 2007).

Quantitative study of the effects of intangible investments, such as organisational changes and management practices, on growth is relatively recent and requires new frameworks and measurement practices. Given the quantitative importance of intellectual assets, their inclusion in measures of economic activity (such as GDP) is important for obtaining an accurate picture of economic growth, productivity and cyclical developments (OECD, 2006). Corrado *et al* (2006) argue that the conventionally measured capital stock is underestimated by some 1 USD trillion and the business capital stock by up to 3.6 USD trillion.[11] Adding this capital to the standard growth accounting framework changes the observed patterns and sources of US economic growth significantly. In particular, the rate of change of output per worker increases more rapidly in the presence of intangible capital, and capital deepening becomes the dominant source of labour productivity growth. Oliner *et al* (2007) also provide preliminary estimates of the growth contributions of intangible capital using an augmented growth accounting system. Intangible investment is estimated to have surged during 1995-2000, boosting growth in aggregate output, but then retreated during 2000-2006. The growth contribution from intangible capital deepening follows the general pattern for IT capital, high during 1995-2000 and then falling back. This similarity reflects the strong association between intangible capital and IT capital in the methodology. Nevertheless, intangible capital increases less rapidly than IT capital in each period as a result of the quality-adjusted declines in computer prices that lower the user cost for IT capital. This user-cost effect became more pronounced during 1995-2000 when fall in the prices for IT capital goods was particularly marked.

Source: van Welsum (2008).

Lessons from these estimates of intangible capital

38. The studies based on the methodology used in Corrado *et al* (2005, 2006) show not only that it is possible to compile macro estimates of investment in intellectual assets, but also that doing so is crucial as it represents a significant part of total investment (*e.g.* for the US, investment on tangible and intangible capital amount to the same proportion of GDP). Not taking investment in intellectual assets into account leads to underestimation of GDP and biased estimates of any analysis of the contribution of the various components of GDP for example to productivity. The estimates for the US, UK, and Finland are of the same order of magnitude. Estimates for Japan and the Netherlands are somewhat smaller, but still similar, especially considering the analysis for those two countries suffered from some omitted variables.

39. These estimates of investment in intellectual assets provide a new perspective on productivity dynamics and source of growth derived from growth accounting. The inclusion of intangibles makes a significant difference in the measured pattern of economic growth. The growth rates of output and of output-per worker are found to increase at a noticeably more rapid rate when intangibles are included,[12]

[11] An amount equivalent to around 29% of US GDP in 2005, or around 12% of US business capital stock.

[12] While expenditures by household and government on intangibles (*e.g.* education) are already recognised as final expenditures in the SNA, expenditures by enterprises on intangibles other than software (*e.g.* training or brand building) are recorded as intermediate consumption. Recognition of such business expenditures as investment would increase level of output and output-per worker. If those unrecognized investments

and capital deepening[13] (when expanded to include both tangibles and intangibles) becomes the dominant source of growth in labour productivity. Overall, the factors typically associated with the growth of the "knowledge economy" become even more important once intangibles are included.

40. The compilation of data series for these assets reveals a number of common problems, as do efforts to identify returns to investments in various capital items, lags and depreciation rates. If comparability is to be achieved, conventions will need to be agreed on the asset boundaries. There could also be issues of location: intellectual assets could be as mobile as the platforms on which knowledge is stored or the individuals who have the capabilities to render it productive within the firm or elsewhere. The framework would also need to be tested to avoid double counting outside and within the class of intangible investments.

41. This section has discussed the methodological and measurement challenges of intellectual assets, as well as some of the consequences for economic analyses when these are not fully taken into account. The next section looks at the linkages between geographical areas and between firms resulting from the flow and transfer of intellectual assets and knowledge spill-overs.

The regional dimension of innovation

42. This section investigates the regional distribution of innovation, and factors that determine regional linkages. It is based on work by Usai *et al* (2008), who exploit a new OECD database in which inventors and owners of patents are coded to regions. Preliminary results indicate that the regional distribution of innovation is skewed, especially in Europe. Both the most and the least innovative regions are located geographically close together, respectively, so the closeness of regions appears to matter.

Background

43. Innovative activities are not distributed evenly within countries, pointing to the relevance of regional factors, such as regional and local governance, infrastructure and factor endowments (e.g. skilled labour), alongside national factors such as macroeconomic conditions and policy frameworks, specifically on competition, R&D, and intellectual property right (IPR) protection. There are various types of "economies of agglomeration", related notably to the use of common resources by innovative actors. For instance, agglomerations benefit from positive "local externalities" such as lower communication, transportation costs and knowledge spillovers. The local availability of skilled labour, of competitive firms and the presence of high quality publicly funded research (universities, public laboratories) have also been found to matter. There can, however, also be certain costs associated with geographical agglomeration of activities such as congestion.

44. This raises a number of questions, which are addressed in this section: What is the regional profile of inventive activities? How skewed is the cross-regional distribution of inventive activities? What influence (positive, negative) do inventive regions exercise on neighbouring regions? What are the factors that make regions inventive or not – R&D, human capital, influence of neighbouring regions, country level factors?

45. This section presents preliminary results from work that will contribute to answering some of these questions (Usai *et al,* 2008).

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grow faster than the economy as it was likely the case in the second half of 1990s, then the growth rate of output and of output-per worker would also increase.

13 Capital deepening is an increase in the capital to labour ratio. Other things being equal, this should raise labour productivity.

Introduction

46. Economic activities, and innovative activities, are not randomly distributed across space but tend to concentrate geographically. Knowledge spill-overs add to other agglomeration forces and locational determinants (local infrastructure, a pool of skilled workers, the presence of other firms, and a relatively larger market). Geography matters for the spatial distribution of intellectual assets and innovation activities in particular, as knowledge flows and specific skills often require proximity to be fully exploited. Indeed, knowledge is often tacit and requires direct interaction, on-the-job training, and the mobility of workers to circulate. The degree of uncertainty surrounding innovation projects can also be reduced by the exchange of information among firms, and the complexity of innovation processes often requires accessing complementary inputs and co-ordinating different aspects of the innovative activity. The presence of upstream and downstream activities further promotes the agglomeration of activities, and in particular of innovation activities that require horizontal and vertical linkages.

47. Given the importance of knowledge spill-overs for innovation and the diffusion and transmission of intellectual assets in theory, it is important to attempt to measure the extent of knowledge spill-overs, as well as their rate of decay with distance, in practice. This is a difficult task, especially in light of numerous measurement challenges, not only for capturing information on intellectual assets, but also innovative activity itself. The approach taken in Usai *et al* (2008) uses patents as an indicator of innovative output.[14] Highlights of the relevant background literature are given in Box 3. There are some advantages in such an approach: for instance, as an invention is needed to apply for a patent, patent statistics do not include the unsuccessful R&D (contrary to R&D statistics). However, it should be stated at the outset that there are some limitations in using patent indicators for such a purpose. This is because the relationship of patents to the overall volume of innovation is not necessarily linear. Some innovators may opt not to employ intellectual property (IP) protection or may choose to rely on other forms of IP protection instead of patents (*e.g.* copyrights or trade secrecy).

[14] Patent measures are often used as an indicator of inventive performance. Patents are filed when firms have inventions, hence between the R&D stage (upstream) and the marketing stage (downstream). Patents are indicators of the output of R&D. All studies find a positive link between patents and other indicators of inventionve activity (R&D, innovation counts etc.) at the firm level, industry level or country level. Patents are the only indicators of inventions that can be regionalised in all countries and over long periods of time. However patents have drawbacks as indicators of invention. Looking at the number of patents granted does not provide an estimation of the quality or impact of the underlying innovation, nor does it necessary reflect the impacts of patenting on the diffusion of knowledge. Moreover, the increasing importance of open innovation may affect the usefulness of patents as an indicator of innovative activity. Also, not all inventions will get patented, and not all patents will result in commercial innovations.

Box 3. Examining knowledge spill-overs empirically using patents

There are broadly two strands in the literature on using patents to examine the regional dimension of innovation. One tries to measure the extent of knowledge flows directly on the basis of patent citations. The results indicate that knowledge is largely localized as inventors located closely together have a higher propensity to cite each other's patents than those located further away.

A second strand of the literature uses the Knowledge Production Function (KPF) to measure the intensity and spatial extent of Knowledge Spill-overs (KS) by examining the functional relationship between knowledge inputs and outputs. This can be done at the firm-, area and sectoral level. The production of innovation (measured by patents or innovation counts) is linked to variables such as R&D (per employee or expenditure), university and/or private research, transport costs, economies of scale, and spatial indicators such as urban density.[15] Overall, results seem to suggest that geographical concentration is higher in industries where new economic knowledge (R&D, university research and skilled labour) is most important. This makes sense as many types of knowledge and intellectual assets require geographical or physical proximity to flow. Studies also tend to find that technological and knowledge spill-overs can exist within and between regions, and generally within a country rather than across borders. Therefore, national innovation systems, their institutions and policies, are important determinants of regional innovation performance. Technological "closeness" also contributes. Spill-overs tend to decrease sharply with distance, highlighting the importance of proximity.

At present, there is no consensus on the relative importance of the effects of concentration versus diversity on innovation. Specialisation economies occur when innovators in the same field locate together, and urbanisation economies can be achieved in the presence of diversification of fields of activity located together. Studies do appear to consistently find differences between Europe and the US, suggesting the importance of local innovation systems. Within countries there can also be regional and sectoral differences. Competitive market structures are also found to be important.

Source: Usai *et al* (2008), and the references therein.

48. The number of Patent Cooperation Treaty (PCT) applications is used as the main indicator of inventive performance.[16] Using patents rather than R&D data has three major advantages: *i)* patents include information about the residence of the inventor and can therefore be grouped regionally; R&D statistics are usually only available for certain regions, or at the national level; *ii)* patents include technological content and can therefore be grouped into industrial sectors; R&D data tend to be aggregated, especially at the regional level; and *iii)* patents are available over long time periods whereas regional R&D data have become available only relatively recently, and not on a continuous basis. The data used come from the OECD Regional Database of statistics on socio-economic indicators (*e.g.* demographics, economy and labour market, and social issues) in some 2 014 regions across the 30 OECD member economies. The level of detail chosen for the analysis is the so-called Territorial Level 2 (TL2), where possible, and

15 Innovation and R&D are closely related, but the concept of innovation is broader than that of R&D. Not all R&D will lead to innovation (and some may be used for imitation rather than innovation), and not all innovation requires R&D. Innovation is defined in the OECD Oslo Manual (2005) as "the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations". Innovation can be seen as the successful development and application of new knowledge, distinguishing innovation from the concept of invention. However, in practice it is more convenient to consider innovation as a process ranging from initial research (R&D) through to the development of prototypes and the registration of inventions (patents) and eventual commercial applications. This definition emphasises that innovation requires more than just greater R&D inputs into the research process (Jaumotte and Pain, 2005).

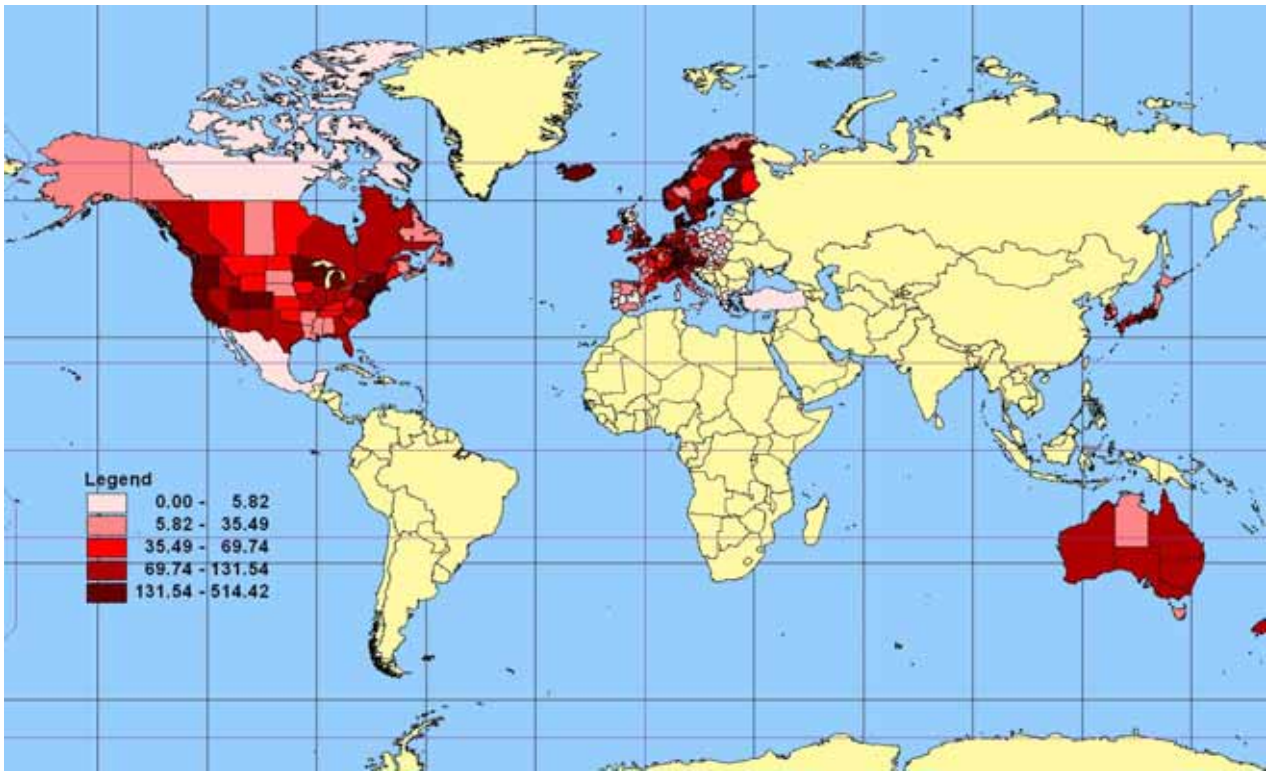
16 Use of the PCT applications database distinguishes this report from most of the literature on this topic, in that the other analyses tend to use the databases from the European Patent Office (EPO), US Patent Office (USPTO) and the Japan Patent Office (JPO). Those databases reflect a home bias effect; this is negligible in the PCT database, making it very suitable for cross-country analyses.

country level elsewhere.[17] The regional distribution of PCT applications in the 30 OECD economies is shown in Figure 2 (separate figures for the US, Europe and Asia Pacific are shown in Appendix Figures 1 to 3). The greatest regional coverage can be found in the US (each of the 51 states).

49. Usai *et al* (2008) examine two time periods, 1998-2000 and 2002-2004. Growth in PCT applications was greatest in Japan and Korea, which are still modest utilisers of this type of applications. Most countries that experienced low PCT values in the first period saw a significant increase in PCT values in the second period (Mexico, Poland, Turkey, and Slovak Republic). Countries with strong performances in the first period saw slower growth in the second period (Finland, Norway, Sweden, and Luxembourg). Most European regions showed significant PCT applications growth in both time periods. Figure 3 presents the top 30 regions ranked by the number of PCT applications in absolute terms and per million population. Most regions of innovation excellence can be found in Europe and the United States, but Japan also has some high performance regions.

Figure 2. PCT applications, OECD countries, 2002-2004

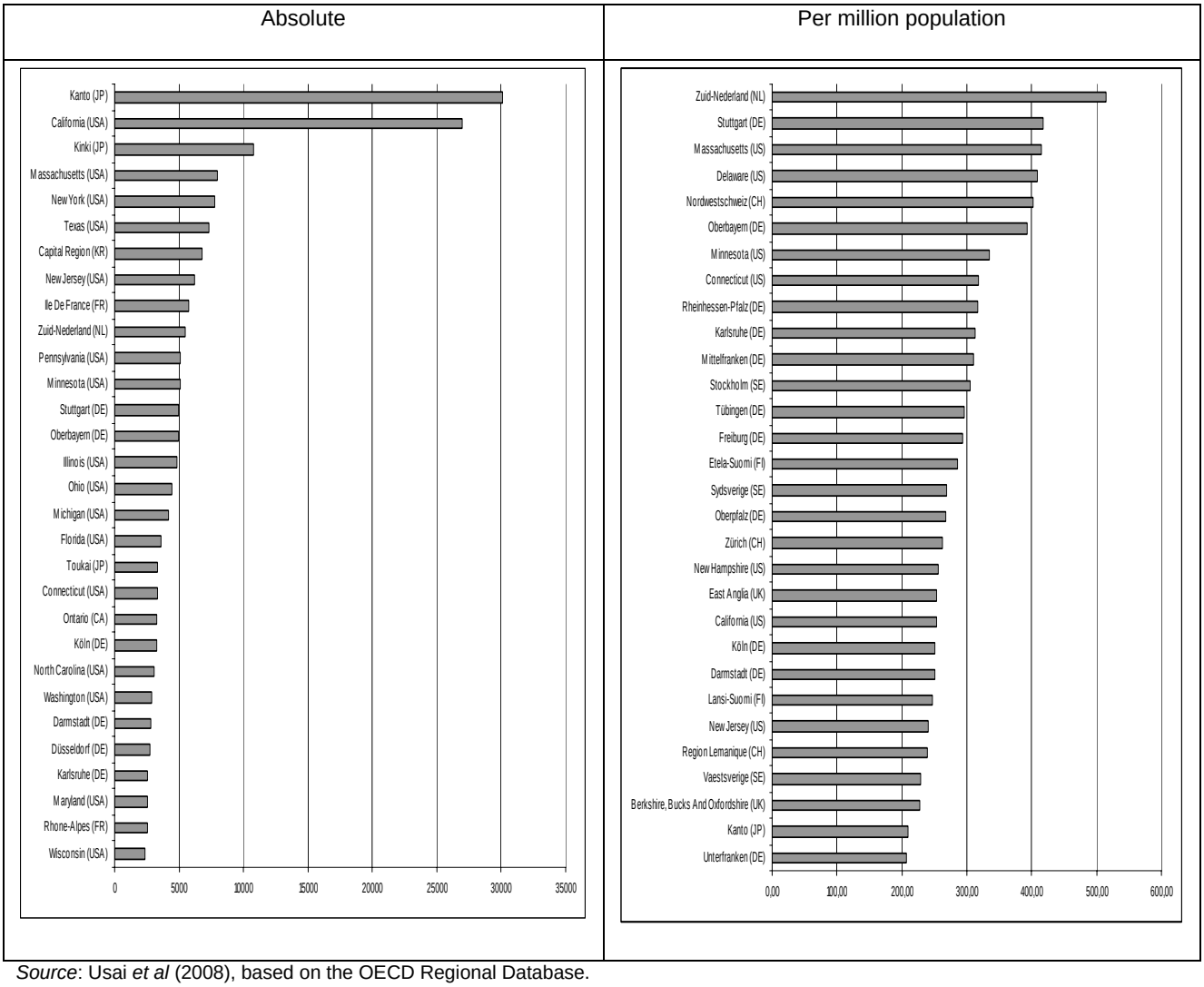
(per million population)



Source: Usai *et al* (2008), based on the OECD Regional Database.

17 TL2 data are available for 23 of the 30 OECD member economies. Country level analysis has to be used for the remaining countries: Denmark, Iceland, Ireland, Luxembourg, Mexico, New Zealand, and Turkey.

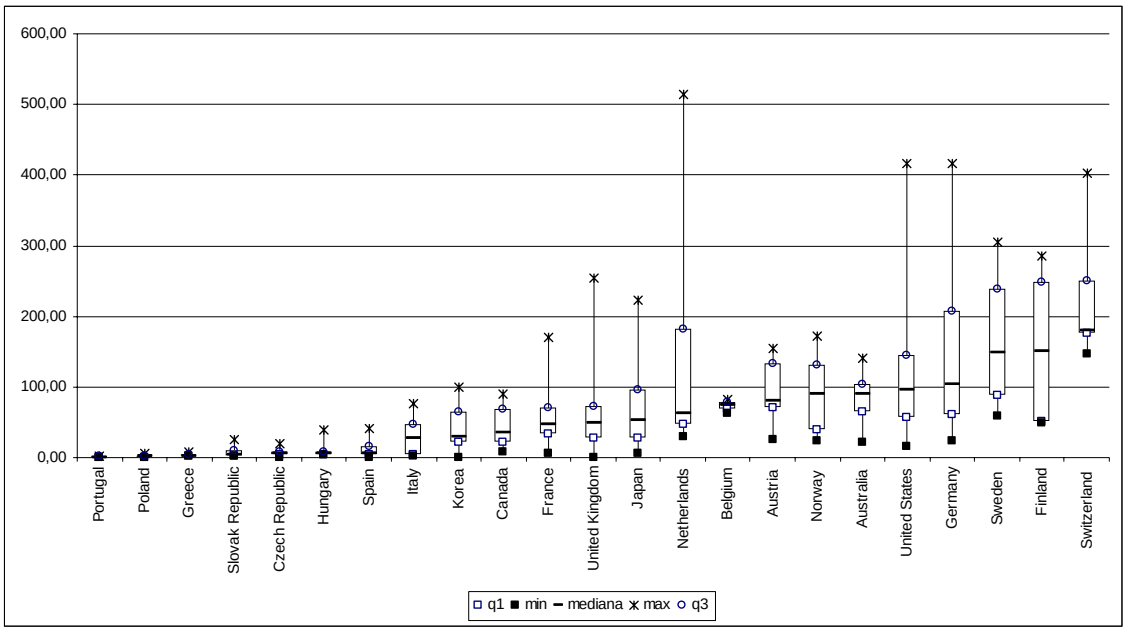
Figure 3. Top 30 regions in PCT applications, OECD countries, 2002-2004



Source: Usai *et al* (2008), based on the OECD Regional Database.

50. Countries exhibit very different dispersion patterns of PCT applications per million population (Figure 4). There is much dispersion across regions, with the number of patents in 2002-2004 ranging from 0 to 30 000, or from 0 to 500 on a per capita basis. Lower dispersion is found in the distributions of Czech Republic, Greece, Hungary, Poland, Portugal, and Slovak Republic (all relatively less inventive countries), whereas Finland, Germany, Netherlands and Sweden show higher dispersion. Hence it seems when inventive performance becomes significant in a country, that process takes place mainly in certain regions, not in the whole of the country. Cross-regional dispersion of inventive performance results in a skewed distribution of patent numbers, with a few regions having high numbers while many regions have low numbers (see Usai *et al*, 2008, Table 10).

Figure 4. PCT applications per million population, variability across OECD regions, 2002-2004



Note: This graph shows a five indicator summary of the regional distribution for each country: the box contains the middle 50% of the data; the upper side of this box indicates the 75th percentile of the data set, and the lower edge of the box the 25th percentile. The minimum and maximum values are also shown.

Source: Usai *et al* (2008), based on OECD Regional Database.

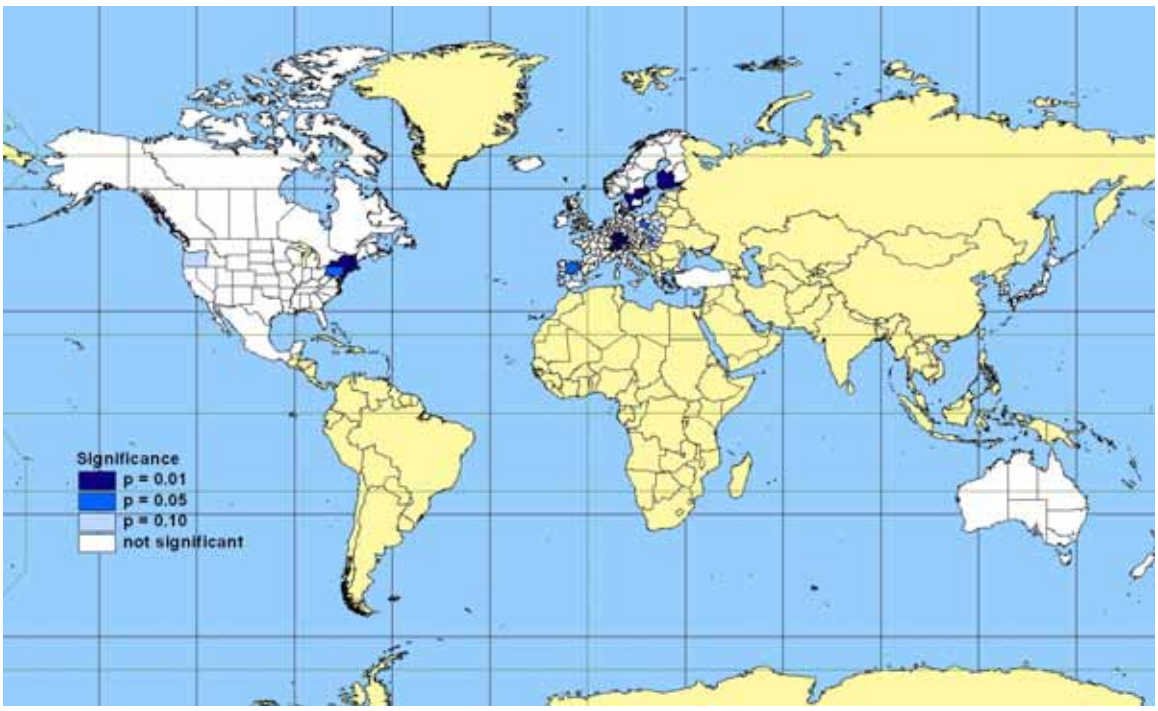
51. Geographical proximity of regions also matters, both for high and low performance innovators, especially in Europe and the United States. The results point to four main innovation clusters with strongly significant spatial interactions: the West and East US coastal belts, the "spine" of continental Europe (Switzerland, Southern Germany), and Scandinavia. Asia Pacific regions show a rather different pattern. Figure 5 presents an indicator of the strongest observed spatial interactions;[18] these are concentrated in the US North-Eastern coastal states, in Continental Europe (Austria, Switzerland and Southern Germany), and in the South-Baltic Scandinavian regions. The indicator measures spatial correlations across the range of innovative performance: highly innovative regions can be adjacent, but so can regions that show low inventive performance.

52. A "knowledge production function", relating inputs to inventive performance at the regional level has been estimated. Inputs include human capital, R&D, agglomeration effects, country level characteristics (institutional factors) and factors of spatial correlation. The percentage of the population having completed a tertiary education degree[19] is used as a proxy for human capital. The clustering patterns of the PCT applications indicators are reflected to some extent in the geographical distribution of the human capital indicator, but are not nearly as pronounced in the distribution of the latter as it tends to be relatively high for most of the territory. The same is true when looking at the patterns of the R&D indicator (the percentage of GDP spent on R&D). Thus, it appears that while human capital and R&D are very important determinants of innovative performance, other factors contribute to the spatial correlation of regions.

18 Figure 5 presents a so-called "Lisa map".

19 Based on the ISCED 5 and 6 classifications.

Figure 5. Regional interaction in PCT applications, OECD regions, 2002-2004



Note: This figure shows the significance of spatial interactions in clusters of regions, based on PCT applications per million population in the form of a so-called "Lisa map".

Source: Usai *et al* (2008), based on the OECD Regional Database.

53. The inventive performance of a region can be related to the share of skilled workers as the concentration of skilled workers in a region should enable externalities to materialise since direct communication enables flows of information and tacit knowledge. The density of economic exchanges and contacts is assumed to act as a catalyst for agglomeration effects.[20] Innovation systems have been found to matter for innovation performance at the aggregate level (*e.g.* Jaumotte and Pain, 2005) and regional innovation institutions and strategies are likely similarly important in stimulating and diffusing innovation. Finally, with knowledge spill-overs, innovation generated in one region may spill-over and help knowledge formation in other regions, especially nearby ones. Indeed, the production of knowledge in a region may depend not only on its own research efforts, but also on the knowledge stock available in the whole economy and on its ability to exploit it. Many factors, including those external to the region, can have an impact on technological activity, such as trade and investment flows and common markets for skilled labour and final goods.

54. Preliminary empirical evidence[21] on the regional dimension of innovation confirms the importance of R&D and human capital for innovation. However, it is difficult, at this stage, to find robust and widespread evidence of regional effects. Local agglomeration factors (proxied by the density of

20 *E.g.* Audretsch and Stephan (1996) argue that, all else being equal, the same R&D efforts may result in higher levels of innovative activity in urban areas than in rural areas because of agglomeration economies.

21 As a result of data restrictions the analysis in Usai *et al* (2008) focuses on Europe and the United States. It is important to bear in mind that the territorial dimension in the US is the state level, *i.e.* larger than the regions in Europe. As a result of a regional dimension that is too large, impacts may actually happen within the region without any inter-regional effects.

population) are not found to have a significant impact on the innovation indicator (PCT applications). There are some negative effects from being a rural region, but there is no effect from being an urban region. Institutional factors are found to have some impact, generally positive in regions with a lot of innovative activity, and small or negative in regions with low innovative activities. This is likely to reflect the general efficiency of research, influenced by economy-wide institutional settings as well as the productivity effects of the diffusion of knowledge throughout the economy. Relatively higher GDP also has a positive impact, although the capacity of R&D and human capital to drive further innovation appears to slow down with GDP. In Europe there is also some positive effect on a region's PCT applications from R&D undertaken in nearby regions which could point to some interregional knowledge spill-overs and a geographical proximity effect.[22]

55. Summing Up

56. The work discussed in this section reflects an initial analysis employing a pioneering new OECD database; it among the first systematic attempts to analyse comparatively the distribution of innovative activity across regions in OECD economies with a set of homogenous measures for both input and output in the process of knowledge production and dissemination. Over time, more data will become available and the quality will improve so the analysis can be refined in future.

57. The descriptive analysis shows that there are important differences in the inventive performance of regions in OECD economies, as measured by indicators for one of the key types of intellectual assets (*i.e.* patents). Inventive performance is concentrated in some areas in continental Europe, in North America and Japan. The development of inventive activities in countries takes place usually in a small number of regions. Highly inventive regions tend to cluster together. This spatial dependence is found to have increased over time. The inventive performance of regions is directly influenced by the availability of human capital and R&D expenditure. Cross-country differences point to the importance of national innovation systems.

58. While this section has focussed on the linkages between regions, the next section pursues the spatial analysis, but shifting the focus to linkages between firms, and between firms and universities.

Intellectual assets: firm location and linkages

Background

59. This section investigates the impact of business structures and strategies on the degree and patterns of innovation on regions and on the intensity and patterns of cross-regional technological links. It also examines the role of intra-firm and inter-firm relationships in inter-regional co-operation. It draws on new work by Thoma (2008). Preliminary results indicate that most of the linkages between regions are intra-firm and that the most innovative regions tend to have relatively more multi-regional firms among their innovative firms.

60. This section presents some important stylized facts of the dispersion and concentration of inventive production processes at the level of the organization that has generated them. There is large literature arguing the benefits of geographical proximity among different innovators, mainly based on the importance of local production means and localized technological spillovers for innovation and growth (Marshall, 1920; Porter, 1998, Jaffe, 1986; Jaffe et al., 1993). However, the mechanisms of generation, diffusion and absorption of these benefits are quite heterogeneous.

[22] That this result is not found for the US is not surprising given the unit of analysis in the US is state level.

61. The process also evolves over time, especially with technological developments, in particular in Information and Communications Technologies. These can enable a broader and faster exchange of codified knowledge and ideas. Tacit knowledge, however, tends to rely on proximity, practice and learning-by-doing. By locating close to each other, people can access information, monitor other people's behaviour, and foster communication among individuals, thereby reducing the complexity and uncertainty of the innovation process.

62. A second stream of literature describes the firm as the natural mechanism to foster, select and coordinate R&D projects and activities (Nelson and Winter, 1982; Dosi *et al*., 1988). Firms rely on specific competencies, learning processes, and communication systems that reduce the cost of coordinating different individuals and parts of the organization (Nelson, 1995). Firms' distinctive capabilities for spinoff companies are thought to lie in the parental origins of the firm, and require transferring the human capital employed by the companies (Klepper and Sleeper, 2002). The effectiveness of a firm's learning processes, the capabilities to coordinate and integrate internal activities, and the ability to modify strategies and competencies when the environment conditions are important factors in explaining firms' competitive advantage (Teece *et al.,* 1997). Thus, the geographical distribution of innovation activities at the regional level is intrinsically related to the geographical dispersion/concentration of inventive production process at the level of the organization that has generated it.

63. This section presents the findings from new analysis concerning the relative weight and the links between small and large firms and on the role of universities in the geographical distribution of innovation activities at the regional level. It addresses questions such as:

- How does the relative weight of small and large firms vary across regions, across countries, across industries, over time?

- Do large firms have a leading role locally vis-à-vis small firms in terms of innovation (*e.g.* initiating inventive activities in certain technical fields, and then followed by small firms)? Do small and large firms innovate in the same technical fields locally?

- Do multinational firms and large, national firms play different roles?

- Do small firms tend to co-operate with large ones or similar sized firms locally?

- Is it possible to identify distinct models of regional innovation on the basis of inter-firm relationships? If so, what are the effects on regional innovative performance, and do they differ across technical fields?

- Do universities an influence the degree and orientation of local innovation? Does the impact vary with firm size?

Methodology

64. In order to analyse these questions, the analysis classifies business organizations according to the geographical scope of their inventive activity or the number of distinct locations where the inventors are located. The following firm types are distinguished:

- Multiregional firms = firms that have located their invention activities in at least two regions

- Monoregional firms = firms that have localized their inventing activities only in one region

- Multinational firms = firms that have localized their inventing activities in more than one country.

65. The "size" of the innovator, defined by number of the inventions produced by a firm, is also important. The present study distinguishes between three types of innovators, based on the number of filings in the EPO during the period 1990-1995:

- Occasional inventors: firms that have applied for less than 5 inventions.
- Serial inventors: firms that have applied for at least 5 inventions but less than 100.
- Persistent inventors: firms that have applied for more than 100 inventions.

66. The geographical space unit used was Territory Level 3[23] (TL3, hereafter). This results in a database constituted of 422 893 patent applications, whose inventors are located in 2 060 distinct TL3 regions (Appendix Table 1). More than 65% of the regions are European, about 20% and 10% in the US and Canada, respectively. There are only 14 TL3 zones in Australia and 10 in Korea. The Japanese regions correspond to the 47 prefectures.

67. Regions differ substantially in terms of inventive performance as a high number and the most productive inventors are localised in only a small share of the regions (10% of the regions account for more than two-thirds of the patents). These top 10% regions are labelled "Top Knowledge Regions" and the analysis for the overall sample is compared to the performance of these regions. Indeed, the US accounts for some 25% of the Top Knowledge Regions, producing around 40% of the overall patents. The Top Knowledge Regions in Europe generated the same amount of patenting but with twice many regions as in the US.

The geographical scope of the inventive activities

68. The first question analysed is how firms vary according to the geographical scope of their inventive activities. Most applicants are mono-regional (64%) or bi-regional (29%), but most patents are from multi-regional firms (60% from applicants present in more than three regions; 17% in more than 20 regions). The largest applicants tend to be present in more regions than other applicants. Applicants with greater inventive geographical scope also tend to be more inventive. Relatively more multiregional applicants are found in Japan and the United States than in Australia, Canada, the EU, and Korea. There are also differences by technical fields; applicants in the chemicals and pharmaceutical technologies fields are active in relatively more regions and they are more inventive. This finding would be consistent with studies that have concluded that the inventive process in chemicals and pharmaceuticals is characterized by a more general and abstract knowledge (Arora and Gambardella, 1994). Such codifiable knowledge[24] enables the geographical separation and division of labour in the inventive process in these industries. Electrical-electronics and instruments technologies follow after chemical and pharmaceuticals. Top knowledge regions have a higher percentage of both multiregional applicants (47% versus 36% in total) and serial applicants.

What types of firms open new technical fields?

69. Certain inventions are more "radical" than others in the sense that they initiate new technical fields. It is interesting to examine what type of firms open new technical fields. The opening of new fields

[23] This level corresponds to NUTS3 for the European Regions, BEA zones for US and Canada, and prefectures.

[24] This is in contrast to so-called tacit knowledge, which tends to require physical proximity to be transmitted.

is detected with the first patent filed, world-wide, in a given technical class (technical classes are quite narrowly defined as there are more than 70000 classes overall in the international classification). Occasional inventors open 49% of new fields (whereas they represent 45% of all patents), monoregional firms (most of them occasional inventors) open 31% of new fields (19% of all patents). Hence, although larger, multiregional and multinational firms open the majority of new fields, smaller and monoregional firms contribute more than their overall weight in patenting, indicating their comparative advantage for such, more radical, inventions, which can be related to entrepreneurship.

The internationalisation of inventive activities

70. It is also interesting to see whether multinational firms are different from multiregional national firms in their patenting behaviour. There are relatively less multinationals than monoregional and multiregional national firms among patent applicants (10%, 63%, and 27%, respectively). However, relatively more of them are serial inventors – more than 30% - compared to only 1.5% for monoregional firms and 11.1% for multiregional national firms. Multinational firms are also characterized by a greater geographical scope of their inventive activities, and they tend to be located in the Top Knowledge Regions. This suggests that the innovative performance of a region both in terms of total inventions produced and innovativeness of its firms is strongly related to the region's degree of openness and collaboration with other regions, nationally and internationally.

71. Multinational firms, especially those with a broad geographical scope of their inventive activities (more than 20 regions) account for relatively more inventions than multiregional national firms. The relative importance of the inventive geographical scope is reversed for multiregional national firms: firms that employ inventors from less than 5 regions produce almost two-thirds of the total patenting by multiregional national firms. Analysis of the national origin of the applicant suggests that firms from Australia, Canada and Korea tend to obtain greater inventor heterogeneity by employing them from other countries to fuel the invention process. On the other hand, firms from Japan, US and EU appear to be less internationalized, possibly because they can achieve a higher level of inventor heterogeneity within their own countries.

Research co-operation within regions

72. It is important to look at research collaboration and invention in network-based organizations since small and medium size enterprises (SMEs), in particular, may strive to adopt that model of invention when they do not hold sufficient internal competences and resources to develop an invention autonomously. Thoma (2008) looks at copatenting to examine the extent of R&D collaboration among firms. In general, copatenting is not a common form of collaborative R&D collaboration. Only 0.2% of patents were found to have been filed by more than one applicant. When copatenting does occur it is done almost always in collaboration with multiregional firms (98.5%) and with multinational firms (87%). Monoregional firms, occasional innovators, and firms from smaller countries tend to use copatenting relatively more than multiregional firms and serial innovators. Copatenting tends to be done with regional partners, and monoregional firms are more likely to cooperate with partners of the same region than multiregional firms.

Research co-operation between regions

73. Cross regional coinventions are inventions with inventors located in at least two different regions. It represents two geographically distinct sources of knowledge being pooled together and resulting in a new invention. It is therefore an important type of crossregional linkages. Overall, about 56% of patents reflect crossregional coinventions. The practice of cross regional co inventions is more widespread among persistent and serial inventors than among occasional ones, and among EU and US firms. A very small share of crossregional coinventions are done as interfirm cooperation, about **0.2%** while the rest is

organised within firms. Hence, most of cross regional coinventions are in fact organised within firm, essentially large ones, multiregional and multinational.

Patenting by non-business organisations

74. Non-business organisations (NBOs) include notably universities and government research organisations. In the US, patenting by NBOs increased rapidly and substantially after the introduction of the Bayh-Dole Act in 1981 – followed by similar legislations in other countries. This Act made it possible to retain ownership rights over patentable inventions generated from publicly funded research projects. The increase has been more substantial in the US and Canada than in Europe, although some studies have pointed to systematic institutional differences in the patenting of inventions from public laboratories that favour the assignment of patents to a public organization in the US and to a business partner in collaboration with academic inventors in Europe (Lissoni *et al*, 2007). As a result, results making reference to cross-country comparisons need to be interpreted with care.

75. A large part of patenting by NBOs takes place in pharmaceuticals and biotechnology. Copatenting by NBOs with business partners also tends to concentrate in these fields. Copatenting is the main direct channel for universities and other non-business organizations to have an influence on the degree and orientations of local innovation (Cockburn and Henderson, 1997). A large share of copatenting by NBOs is done with occasional inventors and with multiregional firms. Most of the patenting by NBOs is in the same technical fields as the patents filed by inventors from the same region. This similar specialisation of business and NBOs at local level could be in indication of the importance of NBOs as a source of knowledge spillovers. The relationship is particularly evident in pharmaceuticals and biotechnology.

Summing Up

76. This section has examined the linkages that exist between firms in the form of the transfer and flow of intellectual assets, by looking at the impact of business structures and strategies on the degree and patterns of innovation on regions and on the intensity and patterns of cross-regional technological links. It also examined the role of intra-firm and inter-firm relationships in inter-regional co-operation. The results indicate the importance for innovation of linkages within firms across regions. At the same time, the most inventive regions tend to have relatively more multi-regional firms among their innovative firms.

77. It is important to arrive at a better understanding of these processes, especially with a view to maximising the returns to innovation and optimising the effects and efficiency of innovation policy. If larger, multi-regional firms demonstrate particular strengths in innovation as measured by patenting activity and presence in innovative regions, what are the implications for SMEs? The next section focuses on high growth SMEs and examines how they acquire intellectual assets and then use them to create value.

High-growth and innovative SME

78. This section draws on preliminary findings from an on-going OECD study on intellectual assets and innovation in high-growth SMEs[25] (carried out under the auspices of the Working Party on SMEs and Entrepreneurship, WPSMEE). It is important to look at high-growth firms as they account for a significant

[25] The OECD defines a highgrowth firm as being characterised by annualised growth in employment or turnover of more than 20% a year over three years for enterprises with a starting employment of 10 or more employees. Gazelles are a sub category added to capture growth within younger enterprises, *i.e.* those established for less than 5 years. One drawback of this definition is that it does not take sectoral differences into account.

share of jobs created and are key players in economic growth, and among such firms smaller firms tend to exhibit higher net job creation rates than larger ones. High-growth SMEs can be found throughout the economy, including older firms in traditional sectors as well as younger, technology-based ones in emerging and high-tech sectors.

79. There are at least two important aspects of the relationship between innovation and rates of SME growth. The first is the extent to which innovation promotes fast growth; the second is the relative importance of innovation versus other potential sources of high growth. The two aspects are related and are often driven by obtaining and exploiting intellectual assets. Having intellectual assets is important, but results also depend on the use that is made of them. It is not straightforward to establish the link between the use of intellectual assets, innovation and high-growth in SMEs empirically. While the importance of intellectual assets for productivity and firm performance in general was discussed in Box 2 (above), this section discusses more specific case studies with particular regard to SMEs.

Background

80. An OECD study of high-growth manufacturing SMEs (OECD, 2002b)[26] highlights five aspects of firm development with particular impact on growth: *i)* innovation, *ii)* market and technology links, *iii)* organisation and managerial structure, iv) teamwork, and v) networking. Overall, the findings point to the importance of the link between innovation and response to customer demands. High-growth SMEs tend to be very market-oriented and respond to market changes with product innovations, often also closely related to process innovations. They tend to aim for improved product quality and customer satisfaction rather than reduced costs. This is an example of how firms can create value from their intellectual assets.

81. Most high-growth firms relied on networking and public-private relationships to develop innovative products and processes, and only few had their own R&D department. The organisation and management of high-growth companies was found to generally take on a hybrid structure, as in partnerships, where decisions and strategy directions are arrived at by general agreement. The innovation process tended to be well organised and in line with the firm's overall strategy. Delegation of tasks, use of teamwork and knowledge are other key aspects of high-growth firms. Profit sharing was often used to motive staff. Training was important, especially when faced with difficulties in recruiting skilled staff. Networking with customers, other firms, suppliers, distributors and others such as competitors and public or private research institutions, was also found to be very important for high-growth firms.

82. The literature on the relationship between innovation and high enterprise growth can roughly be categorised into 3 groups, focussing on different types of intellectual assets: *i)* business practices, *ii)* knowledge acquisition and the increasing importance of obtaining and exploiting intangible assets, and *iii)* how the owners and managers of these enterprises handle transition points in their business life-cycle.

Business practices and the use of intangible assets

83. The importance of business practices is illustrated in several studies covering firms in New Zealand. Fabling and Grimes (2006) analysed the impact of business practices such as leadership, planning practices, customer and supplier focus on firm performance. Capital investment choices, R&D practices, market research and a range of employee practices were all found to be important factors. Innovation in capabilities and resources within the firm contributed to firm success. External characteristics such as industry structure were also important. Another study found that intangible resources inside firms and the use of existing knowledge adapted to changing circumstances were crucial in developing firms'

[26] The analysis employs case studies from the Canadian Province of Quebec, France, Germany, Greece, Italy, Netherlands, Spain and Sweden.

capabilities and competitive advantage (Campbell-Hunt *et al*, 2000). The importance of distribution networks has been highlighted in terms of the firm's ability to internationalise its operations (Chetty and Campbell-Hunt, 2003). Internationalisation can further contribute to a firm's performance through increased competitive pressures, access to new markets, and access to foreign knowledge and technologies, in turn an important driver of innovation.

The use and acquisition of knowledge

84. The nature of comparative advantage is increasingly shifting to the efficient and productive use of intangible assets such as knowledge, skills, and intellectual property. The impact of knowledge spill-overs, from sources both external and internal to the firm, on SME performance and firm growth have been examined empirically, though only on some small and selected samples. A study on a few selected firms in New Zealand (Davenport, 2005) found that geographical proximity was not necessarily a pre-requisite for innovation, especially when the firms internationalised (*e.g.* because they lacked domestic markets or networks). In innovative high-growth firms, "organisational proximity" was found to be more important than physical proximity. Other studies have found that the learning environment is important for small firms, especially when building on past experience (Dalley and Hamilton, 2005), and that learning often is a continuous process of adaptation to changing circumstances (Simpson, 2000). The ability to learn is fundamental to the ability to innovate, and the capacity to develop flexible and adaptable learning processes, especially in times of pressure, was found to have helped firms to grow and innovate even after the crisis period was over.

The business life cycle and key transitions

85. Managing transitions in a firm's life-cycle, for example in response to changes in regulation, is very important for innovative and high-growth SMEs. High growth often requires changes in entrepreneurial behaviour over the course of a firm's life cycle, for example with staff changes (number of employees, types of skills), or changing processes and procedures. Knowledge transfer is also especially important in times of change and transition. A firm's leadership role can play an important part in how it responds to high growth and whether it retains its competitive advantage, especially since staying competitive requires continuous efforts. From a strategic management perspective, innovation and high growth have been found to be closely related to the manner in which firms deploy innovation during key transitional phases in their growth patterns. For example, one way for a firm to manage sudden high-growth is to concentrate on a product niche to preserve the firm's competitive advantage (Corbett and Campbell-Hunt, 2002).

86. It has been argued that when firms reach specific transition points they are faced with two choices – to simply increase existing processes and routines, or to transform themselves by creating new ways of operating (Lowe and Henson, 2004). It has also been suggested that entrepreneurs in high growth firms who share the running of the business with a team, in so-called 'distributed entrepreneurship', are more likely to achieve significant growth. These findings highlight that the manner firms use intellectual assets is crucial to their potential to create value from them.

Other intangible factors affecting firm innovation and growth

87. The age and size of the firm as well as its management capabilities are among factors that influence whether a firm is innovative or high-growth. There are several theories explaining the role of firm age and size. The first is the "resource-based view",[27] the premise of which is that a firm builds competitive advantage through the portfolio of resources it assembles. In this view, a firm can be

[27] Penrose (1959), Barney (1991).

considered as a set of resources, and firm growth can be explained through the availability of under-utilised resources (Penrose, 1959). This theory emphasises the factors inside the firm as the antecedents of growth and value creation. Some resources (valuable, rare and costly to imitate or substitute) can provide a firm with a competitive advantage that enables above average growth relative to other firms in the industry (Pettus, 2001). This theory assumes that the indivisibility of resources is a particular phenomenon experienced by smaller enterprises and thus presents them with an unusual incentive to grow.

88. An alternative theory assumes that younger firms are under greater pressure to pursue growth. This can be explained by the 'theory of learning' interpretation, which emphasises organisational learning through the firm manager's understanding of the enterprise's growth opportunities. Younger firms may have relatively higher and/or more variable growth rates, as they have less understanding of the costs related to their activities and of how these costs vary over time. A new enterprise is, in a sense, characterised by a 'liability of newness' because the managers have had less opportunities to experiment with different resource combinations. However, an "entrepreneurial model of enterprise growth" would argue that young firms are more innovative, proactive and risk orientated than older firms partly as new firms emerge to take advantage of a new opportunity. This interpretation associates young enterprise with innovative risk taking. An empirical study on firms in Andalusia, Spain, points to the idle capacity interpretation of high rates of enterprises growth as smaller firms were found to acquire more assets in higher quantities than they actually need in the short term although it was not clear whether this reflects the indivisibility of assets or the preference of enterprises to invest for growth (Moreno and Casillas, 2007).

89. Management capability is another factor thought to influence firm innovation and growth. Hughes (2000) examines the link between entrepreneurship, innovation and business performance; he finds that innovation seems to be more prevalent in larger firms than in SMEs. Innovative SMEs in the UK may be more constrained by management skills than by financial concerns. This could point to an area for further assessment in terms of its policy implications; a lack of management skills is often named as a factor in cases where SMEs have failed either as a firm, or in bringing new ideas to the market. Many SMEs have a wealth of technological ideas but not the management skills to implement them and see the process through to successful innovation. This highlights the idea that the use that is made of a firm's intellectual assets is crucial to the firm's potential to create value from them, be it through new and/or improved products (with product and process innovations) or lower costs.

The management of intellectual property by SMEs

90. As intellectual assets and the ability to create value from them increases, so does the ability to reap the economic gains from the assets. In certain cases, this can be achieved through the use of intellectual property rights. Innovative and young SMEs can usefully employ IP as collateral in obtaining finance in cases when they cannot rely only on their tangible assets and do not yet have reputation or brands or other intellectual assets for use in raising capital, However, a study on SMEs in the UK and Finland found that many SMEs see IPRs as irrelevant and rely more on informal practices (Kuusito and Paallysaho, 2007). SMEs reported relying on a wide range of informal IP protection practices including secrecy, publishing, enhancing the commitment of the personnel, division of duties, circulation of duties, documentation, fast innovation cycle and technical protection. Informal ways of protecting IP are less costly, easier to control and use and they may be embedded in the routine working practices of the firm. However, for many SMEs improved informal IP management and protections skills can also be a 'first step' on the ladder towards an effective IP strategy that includes the utilisation of formal IPR protection.

91. These findings raise a number of policy issues. It would be useful to achieve a balanced policy approach that recognises the importance to SMEs of both informal and formal ways to manage and protect IP. This may result in more effective IP strategies among SMEs. This also requires improved awareness of informal IP protection and management strategies among policy makers and in business community.

Informal IP management and protection involve a wide variety of different types of business process activities carried out by SMEs. Such a wide interface creates opportunities to integrate IP strategy related issues more effectively into the SME policies. Linking IPrelated support services to the life-cycle of the innovation and business processes could be an effective way to communicate these issues to the SMEs, as would be providing access to IP knowledge, simplification of administrative procedures, adequate fees, training and capacity building. The suggestions are reflected in the responses from a policy questionnaire discussed in the next section.

SME policy questionnaire

92. The OECD WPSMEE is collecting comparative information on government programmes via a policy questionnaire covering WPSMEE members and observers[28] and targeting policies that aim to foster enterprise growth and innovation, in particular with respect to SMEs. The questionnaire addresses main policy objectives, including those that aim to: *i)* foster the growth or high-growth of SMEs, *ii)* promote skill development in enterprises, *iii)* develop intellectual assets (IAs) management capabilities in enterprises, including intellectual property rights (IPRs), *iv)* support business R&D in enterprises, *v)* stimulate enterprise in innovation, *vi)* facilitate enterprise collaboration with other partners and open innovation, and *vii)* improve access to financing for high growth SMEs and innovative enterprises (by debt financing, equity financing and financing for niche groups, *e.g.* creative industries).

93. The preliminary results presented in Figure 6 and Appendix Table 1 need to be interpreted with extreme care, particularly with respect to cross-country analysis. Indeed, the classification of the programmes into the seven main policy areas indicated in the questionnaire differs by country, the coverage of the reported programmes varies, and the scale of the programmes is not always indicated. Furthermore, some responses specify the budgets associated with the programmes while others report the number of firms supported.

94. The total number of reported programmes is shown by country in Figure 6, and the programmes in the area specifically designed to "Develop intellectual assets management capabilities in enterprises, including IPRs" in Appendix Table 2. Twenty-seven programmes in 12 countries (Australia, Austria, Belgium, Finland, Hungary, Italy, Japan, Korea, Mexico, New Zealand, Spain and Turkey) are reported for this policy area. More than a quarter of the programmes were introduced in 2007, sometimes modelled on previous similar programmes. Overall, the responses to the policy questionnaire show that this policy area receives much attention and substantial efforts from many governments. Many governments seem to react to a reported lack of awareness among SMEs of the importance of intellectual assets management and the resulting lack of resources allocated for this activity.

95. Preliminary analysis of the programmes related to intellectual assets reveals some common features. A substantial number of policy-oriented programmes are initiated by the national IP authorities (*e.g.* in Belgium, Finland, Italy and Korea). Most of the programmes deal with intellectual property rights rather than intellectual assets, and it appears they tend to emphasise patent and trademark issues. Many of the programmes aim to improve IP awareness and promote IP protection in business activities. While most of the programmes focus on the protection of firms' IP, Finland's "INTO road show" specifically focuses on trying to raise awareness among SMEs and entrepreneurs about the value and benefits of using the IP system as a reliable source of information in their businesses.

96. Some programmes specialise in IP protection in the international market such as the Australian Industry productivity Centres, the Austrian "Innovation Protection Programme", and New Zealand's "Identifying and Qualifying International Market Opportunities" programme. While all of these

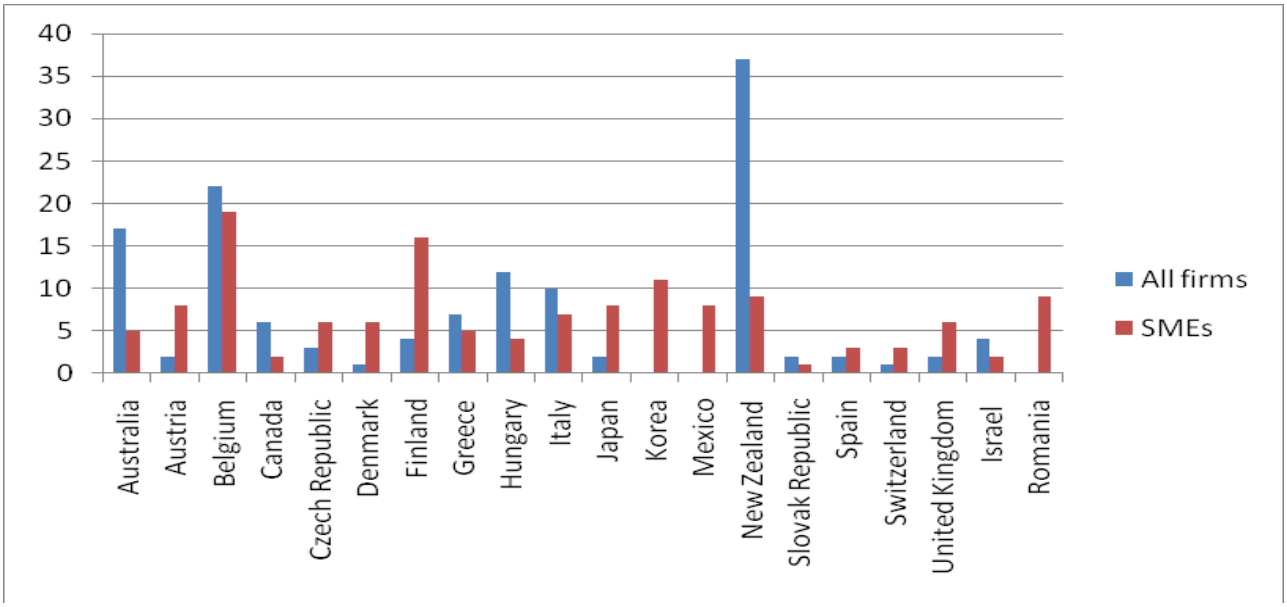
[28] The observers include Brazil, Israel, Romania and Thailand.

programmes emphasize the importance of IP protection in the export markets, Australia's programme also aims to ensure, via IP protection, fair international competition in the domestic market.

97. A number of programmes also provide training, seminars and events for enterprises (especially SMEs) while others directly provide subsidies and grants to the enterprise (especially SMEs). For example, there are a number of policy programmes in Finland aiming promote consultants or business advisors who can support SMEs in terms of IP management such as "training of trainers" (Finland's "BA-Training"), "InnoTraining" and "ip4inno." As SMEs have indicated finding it difficult to deal with intellectual asset management issues, this indirect approach might be effective.

98. The programmes in Japan and Korea explicitly refer to intellectual assets, with Japan's "Intellectual Asset-based Management" programme introduced in 2005, and Korea's "Consulting for Managing Intellectual Assets for SMEs" introduced in 2006. Neither of these programmes provides financial assistance, but Japan created the "Intellectual Asset-Based Management Manual for SMEs" in addition to the organisation of forums and seminars, and the Korean programme offers customised consulting services. So far, these policy initiatives seem successful in both countries although much more may still need to be accomplished.

Figure 6. Reported programmes by country, 2007



Source: WPSMEE.

99. While many programmes aimed at promoting skill development in enterprises tend to be implemented regionally and locally, the programmes to develop intellectual assets management capabilities in enterprises are overwhelmingly implemented nationally with two exceptions (Finland's "InnoTraining" and Korea's "Offering comprehensive consulting on patent information"). Finland's "InnoTraining" currently is a pilot programme, but is expected to lead to a national project. Korea's "Offering comprehensive consulting on patent information" is based on the function of regional IP centres in 9 metropolitan local areas.

100. This section has highlighted the importance of the management and use of intellectual assets for creating value in SMEs. One tool that firms and managers can use to optimise their intellectual assets is by taking stock of them through corporate reporting, which currently does not formally cover these assets. Such corporate reporting on intellectual assets can also facilitate access to finance for SMEs, and possibly at a lower cost. The next section looks in more depth at corporate reporting of intellectual assets.

Corporate reporting

Introduction

101. This section draws on two reports prepared by DAF entitled *Intellectual Assets and Value Creation: Implications for Corporate Reporting* (Bismuth, 2006) and *Intellectual Assets and Corporate Reporting: The Situation of Small Caps* (Bismuth, 2007). It investigates how companies use intellectual assets, in particular to innovate and to create value, and how intellectual assets fit into wider firm strategies and risks. Current accounting standards are not suitable for the reporting of intellectual assets, but additional non-financial disclosure has been found to enhance market efficiency. The issues at hand include questions such as what should be disclosed and how; what kind of information should be produced by the firm; and how this information can improve the management and operation of companies, including their risk management. Public policy and private initiatives can play a role by raising awareness about the concept of intellectual assets, its importance and existing best practices for intellectual assets reporting.

102. Competition is forcing many companies to accumulate intellectual assets and to seek to use them effectively to create value by introducing product and process innovations that improve product quality and sales or reduce production costs. This ongoing process has important implications for management, the design of information and control systems, oversight by the board and transparency with respect to shareholders and other stakeholders. However, many companies are finding it difficult to adjust to these changes. Board members and some executive managers express dissatisfaction with the information they are receiving about the effective use of intellectual assets (*i.e.* value creation) and many investors have expressed the same sentiment.

103. One way to disclose more information about a company's intellectual assets and strategies for value creation is through narrative reporting. Where firms disclose more about their assets and value drivers they are rewarded by improved market valuations, another form of value creation for the firm. This effect is especially pronounced for companies that have limited pools of available capital (referred to as "small-caps" hereafter) and that suffer from a lack of coverage by analysts[29] and sector or branch publications. The existence of special segments of stock markets might also improve the relationship between investors and the companies and thereby underpin valuations, innovation and growth.

Guidelines and frameworks for reporting intellectual assets

104. In spite of a great diversity in guidelines and frameworks, the main disclosure standards and practices enabling companies to provide non-financial information about their intellectual assets can broadly be categorised in two categories: narrative statements or non-financial reporting and specific reporting about the intellectual assets. Whereas the former is intended to report all value drivers of organisational performance, the latter focus on a more narrow definition of a company's intellectual assets. Narrative statements can, however, be a suitable framework for companies to present their intellectual assets and to discuss their value creation strategies and can complement more specific reports (Bismuth, 2006). Current management and corporate reporting practices are focused primarily on backward-looking

[29] The degree of analyst coverage is important as it not only has an impact on a company's valuation, liquidity and growth, but also affects the efficient operation of financial markets.

information and tend to provide little systematic information about the capacity of the company to generate future revenues. Or, investors need an overview of all value drivers of the company to better assess the potential of the company and its ability to achieve sustainable results. They can obtain this information through market sources and/or directly through corporate reporting. To assist investors in assessing the strategies adopted and the potential for those strategies to succeed, several guidelines to aid narrative reporting have been issued that promote the disclosure of, *inter alia*, material, qualitative and forward-looking information about the company's value drivers, trends, risks and uncertainties.

105. To date, three waves of proposed frameworks to encourage companies to report developments related to their intellectual assets can be distinguished. The first wave of reporting frameworks evolved around a scorecard format that provides a mechanism for companies to report a greater variety of information about the various components of their intellectual capital. Among them, the most famous are the Skandia Navigator[30], the Balanced Scorecard[31] and the Intangible Assets Monitor[32]. The second wave is characterised by the attempt to link intellectual capital more explicitly with innovation and the value creation process through frameworks such as the Value Chain Scoreboard[33]. The third wave relates to a more narrative-based format for intellectual capital statements and has emerged in Denmark. In 1997, a pilot group of Danish Companies issued Intellectual Capital Reports according to a guideline proposed by the Danish authorities. Taking the lead from the MERITUM and the PRISM projects at the European Union level, other firms have decided to make additional disclosures going beyond listing requirements, especially in Germany and in Spain.

106. A number of leading companies have also reported intellectual capital going beyond their reporting requirements (Ordonez de Pablos, 2005). European companies have pioneered the intellectual capital measurement and reporting field, but the trend has now extended to Japan where guidelines for disclosure of intellectual assets have been issued. In the United States, some leading firms have also moved to expand narrative reporting on these issues. In addition, there is interest in having standardised information directly linked to a revenue or income stream, as illustrated by practices in certain industries (*e.g.* pharmaceuticals) that use a number of intellectual-asset oriented indicators.

Aims and expected benefits from reporting intellectual assets

107. The main anticipated benefits from introducing non-financial reporting frameworks (see Appendix Table 3 for examples) include improved capital market efficiency, a lower cost of capital, a lower bid/ask spread and reduced stock price volatility. However, whereas the general non-financial reporting frameworks mainly concern listed companies and are usually mandatory and shareholder oriented, making them essentially a reporting tool for the company, the reporting guidelines on intellectual assets cover all organisations, with a special focus on small innovative companies (Box 4). They intend to promote a voluntary application of the guidelines, and are not necessarily shareholder focused so they tend to be considered as a management tool.

108. The main aims of the non-financial information assembled by the intellectual capital reports are to: *i)* make intellectual assets and their value drivers more visible; *ii)* ensure stakeholders that the specific

30 Skandia Annual Report (1994), *Visualising Intellectual Capital*

31 Kaplan, R.S. and D.P. Norton (1992), "The Balanced Scorecard- Measures that drive performance", *Harvard Business Review*, January- February 1992

32 Sveiby, K.E. (1997b), ""The intangible assets monitor", *Journal of Human Resource Costing and Accounting*, Vol. 2 No.1, pp.73-97. It has been used by the Swedish company Celemi in its Annual Report

33 Lev, B. (2001), *Intangibles: Management, Measurement and Reporting*, Brookings Institution Press, Washington, D.C.

risks arising from the intellectual assets are properly managed; and *iii)* report intellectual asset-specific key performance indicators that portray the performance of the company in terms of how it has managed its intellectual assets. Some companies use this narrative reporting to discuss their intellectual assets and corporate strategy with respect to innovation. In particular, the adoption of Intellectual Asset reporting should contribute to mitigating the difficulties encountered by research-intensive SMEs to find financing for their research and innovation projects.

Box 4. Examples of non-financial reporting frameworks and initiatives

The Enhanced Business Reporting Consortium (EBRC), launched in 2004, is a project of the American Institute of Certified Public Accountants' Special Committee on Enhanced Business Reporting. The EBRC released in October 2005 a disclosure framework draft that intends to promote greater transparency on corporate strategy and performance. In June 2007, the United States Securities and Exchange Commission set up an Advisory Committee on Improvements to Financial Reporting to examine the financial reporting system. The subcommittee on "Delivering Financial Information" is reviewing, among other initiatives, the EBRC.

The International Accounting Standards Board has also launched an initiative about whether it should promote a "Management Discussion and Analysis-type" reporting framework called Management Commentary (MC). The discussion paper on MC released in October 2005 with a consultation period ending in April 2006 proposes the development of a principle-based standard with non-mandatory guidance to provide forward-looking and contextual information for investors.

The International Corporate Governance Network (ICGN) set up a "non-financial business reporting committee" to review best practices and issue recommendations in 2004.

In the European Union, changes in EU company law require European countries to strengthen their management reporting requirements to comply with the 4th and 7th Company Law Directives from April 2005. EU companies (except small companies) have to expand their directors' reports to include a Business Review. Many major UK companies are already reporting beyond EU requirements by publishing an Operating and Financial Review (OFR) on a voluntary basis. Although the statutory requirement on quoted companies to publish OFRs has been removed, they are expected to keep on publishing them considering the benefits they have already experienced.

Other OECD countries have also expressed an interest in using EBRC and MC frameworks to update their management reports to encourage a discussion about the principal risks and uncertainties facing companies and to provide a balanced and comprehensive review of performance and development within the year, supported by financial and non-financial Key Performance Indicators (KPIs).

109. The main challenges for non-financial reporting frameworks in identifying and understanding competitiveness and value drivers are: *i)* to assist companies in the process of producing and disclosing timely, relevant and comparable reports that allow providers of capital to make more informed estimates of the future benefits and risks associated with their investment opportunities; *ii)* not to overlap with existing voluntary reporting and provide consistency with all existing reports; *iii)* not to overload information disclosure and to ensure the materiality of information released; and *iv)* not to increase preparation costs for companies listed in multiple jurisdictions.

110. Enhanced disclosure of non-financial and forward-looking information on the company's value drivers and main risks and uncertainties is expected to be taken forward in two directions. First, there is a move toward sectoral disclosure frameworks to address investors' concern for comparability within industries and to increase the interest in narrative statements. For example, the EBRC intends to supplement its current disclosure framework with industry frameworks. Five industries were selected for this modified framework (pharmaceutical, oil and gas, telecom, banking, information technology), with the pharmaceutical industry serving as a test through a collaboration with the Pharmafutures project. Further collaboration with the XBRL community [34] should lead to a specific XBRL taxonomy for the

[34] XBRL stands for eXtensible Business Reporting Language. XBRL is a language for the electronic communication of business and financial data. Rather than treating information as a block of text, each

pharmaceutical industry with a tagging of both narrative and KPIs. Industry frameworks will comprise a few metrics used across the entire industry. As value drivers differ according to the industry, the average number of KPI will also differ.

111. Second, there are initiatives to encourage smaller listed companies to improve their narrative statements in order to offset the disadvantage of reduced analyst coverage and the resulting higher cost of capital. In the US, the SEC Advisory Committee for Smaller Companies is concerned by the decline in analyst coverage in general and for the smaller companies in particular as economic and regulatory pressures have led to dramatically reduced research budgets. A lack of research coverage impacts company valuation, liquidity and ultimately the growth of the public company. Less than half of the small-caps receive coverage by even a single analyst and analyst coverage for the microcap universe is virtually non-existent. Small listed intellectual asset-intensive companies face a particular challenge arising from poor analyst coverage as a lack of research coverage has been found to impact company valuation, liquidity and ultimately the growth of the company. However, small-caps can mitigate these problems by taking a proactive stance in their corporate reporting and this can also encourage analysts to cover a company.[35] The existence of special segments of stock markets might also improve the relationship between investors and the companies and thereby underpin valuations, innovation and growth. Increased transparency has benefits for small companies with a low coverage by analysts in particular, as analysts with the more complete picture of corporate performance tend to be more confident in their forecasts and will be more likely to issue a "buy" recommendation. This may constitute an important dimension of value creation, especially for small firms.

112. Even though reporting guidelines on intellectual assets are potentially applicable to all companies, in practice most companies that have reported their intellectual assets in this form turn out to be non-listed SMEs. Major benefits reported by non-listed companies that have produced intellectual assets reports relate to internal management and communication with stakeholders. In Germany, Denmark and Japan, intellectual assets reports appear to have been used for strategic management purposes and to attract resources such as employees and customers. The experience of the Danish and German firms that have participated in the pilot projects shows that the main benefits of intellectual capital reports for them were improved customer acquisition and retention, enhanced employee motivation and an awareness of organisational strategy and the objectives of the company, improved employee recruitment and retention, and increased competitiveness of the company coming from a better identification of the value creation drivers, an enhanced efficiency of resource allocation and better project management. Intellectual assets reports may also serve to enhance the reputation of a company.

113. As intellectual assets reporting guidelines have been mainly adopted by non-listed SMEs, financial market considerations have not played a major role but financing conditions nevertheless have

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individual item of data is tagged. Once data is gathered under XBRL tags, information can be shared across geographical and legal jurisdictions and without technical or linguistic barriers. XBRL intends to become the standard way of recording, storing and transmitting business financial and non-financial information. The most important aspect of XBRL might, however, be the required emphasis on taxonomies (see Annex Table 2): the definitions and classifications that enable contextual tags to be applied to every item in a company's financial and non-financial statements. Although focused on the financials, taxonomies are being progressively extended to non-financial information and to KPIs organized by industry. Taxonomies covering financial, non-financial information and KPIs are currently being developed for six pilot industries: oil and gas, software, life insurance, pharmaceuticals, automobile and electronic parts. Private sector initiatives should follow in other sectors.

35 Financial analysts may still lack incentives to make additional efforts to cover small listed companies with a high level of intellectual assets. The investor community has some initiatives under way which may help to increase coverage. The development of a new technology, XBRL, expected to decrease the costs of information acquisition for financial analysts, may also contribute.

been important. Benefits have been reported by some companies in their relationships with creditors. In Germany, one company experienced a decrease in its interest rate which allowed the company to save several hundred thousand euros as well as an upgrade of its rating to "Investment Grade Rating".

114. Even though intellectual assets reporting guidelines have mainly been adopted by non-listed SMEs, there is some evidence that they can also benefit small listed companies, although investors report concerns about the materiality of information and KPI disclosed by current intellectual assets reports. The materiality of intellectual assets reports is affected by the relevance of KPI disclosed. Most of them are not informative about expected future revenue streams, strengths and weaknesses and the strategy adopted. Investors are looking for KPIs used by directors and executive management to measure the delivery of their strategies and to manage their business effectively. Usefulness would be enhanced by the release of a few KPIs that may vary by industry. The reliability of KPIs has to be ensured through suitable controls surrounding the collection of data used in KPIs, usually as part of the normal internal control procedures. Investors also report concerns about the comparability of the reports produced. First, there is not a critical mass of companies producing intellectual assets reports. Second, the preparation and the publication is not done on a regular basis as it is an expensive and time-consuming process and does not have to be updated regularly. Finally, comparability among organizations is reduced since companies tend to focus on individualized value drivers of intellectual assets.

The role of financial markets

115. Investors and financial markets have also taken a pro-active stance in improving the reporting of intellectual assets.

Investors

116. The pressure from investors for improved disclosure is at an early stage in many markets but could become a driving force in pushing companies to reconsider calls for an increased disclosure of forward-looking information about their intellectual assets and value creation strategies. The main objective for analysts and investors is to establish a link between key intellectual assets, company performance and share price. This type of information sought is characterised by *i)* forward-looking information (such as product pipeline); *ii)* information directly linked to a revenue stream; *iii)* standardised information; and *iv)* information that is hard to manipulate legally.

117. Initiatives from investor groups started in Europe with the establishment of the Enhanced Analytics Initiative (EAI) in 2004. With the EAI, major European institutional investors decided to commit 5% of their brokerage to stimulate innovative research on how to incorporate extra-financial and forward-looking information into their analysis for long-term investment decisions. North-American institutional investors joined the EAI in 2006. Its growing influence is also illustrated by the increasing number of analysts incorporating extra-financial issues into their research. Other initiatives from the financial analysts' community include guidelines for additional information on intellectual assets and on value creation issued by the European Federation of Financial Analysts Societies' (EFFAS) Commission on Intellectual Capital, the Italian Financial Analysts Society (AIAF) and the Norwegian Society of Financial Analysts (NFF).

118. The EAI conducts a six monthly evaluation of research that EAI members have found useful, using criteria established by EAI's members. There are generally 5 to 10 winners and the 5% commission fund is allocated to this group. A major result of this initiative is a more systematic integration of extra-financial issues in the mainstream research by analysts[36]. These extra-financial factors are defined as

[36] *E.g.*, UBS analysts are now considering a wider range of issues such as: competition issues; environmental issues; human rights; product responsibility; bribery and corruption; and respect for privacy.

factors which are likely to have at least a long-term effect on business results but which lie outside the customary span of variables that are considered in investment decisions. The list of extra-financial factors is constantly updated and some of them, such as some corporate governance factors (*e.g.* executive remuneration), are now mainstreamed into standard analysis. The main issues covered by analysts include intellectual capital management, executive remuneration, human rights, occupational health and safety and human capital practices, innovation, research and development, customer satisfaction, climate change, corporate governance, consumer and public health, reputation risk, and the environmental and social impacts of corporate activity. However, issues related to human and intellectual capital are poorly covered in comparison with environmental issues (with energy and utilities being the most closely covered sectors) and are under-represented relative to the importance of these issues to the buy-side. Considering the growing importance of social responsibility issues in EAI's research, some investors believe that the EAI contributes to increasing confusion about the current taxonomy of intellectual assets and that it could contribute to the lack of materiality of research focused on intellectual assets.

Markets

119. Even in the absence of formal disclosure of intellectual assets reporting, there is evidence that markets take into account company features such as the expected value of new innovations, R&D initiatives, technological breakthroughs and the quality of management. Capital markets use other channels of information, such as the information provided by analysts and specialised sector publications (Darby *et al*, 1999). For example, large investors discuss directly with management the innovation strategy and intellectual asset base of the company, although this way of obtaining information about intellectual assets and business strategies implies additional costs, which, in turn, delays the dissemination of their assessments in the financial markets as they will seek an economic return on their private knowledge (Holland, 2002).

120. Financial markets reward companies for increased disclosure, especially in the case of small listed companies. In particular, the negative association of increased corporate transparency and reduced stock price volatility is stronger for smaller companies (Barnett, 2003), and the importance of presenting good quality information increases significantly as the level of analyst coverage declines. Reduced stock price volatility, in turn, contributes to reducing the company's cost of capital. Company managers can encourage analyst coverage by explaining how business processes function and how value is created (Das et al., 2006). Market pressures also encourage more companies to improve their reporting practices but companies differ widely in this respect. Some companies are already coping with the non-financial reporting of intellectual assets, but not in any systematic way, and with great differences across companies, sectors and countries.

Intellectual assets, risk management and internal control

121. Although most existing guidelines focus on reporting issues, investors and managers are increasingly oriented to internal control and risk management issues. Intellectual assets reporting frameworks aim to report how an organisation is seeking to create value. As a result, the main benefits of intellectual assets reports have been found to be improved management of intellectual assets, enhanced resource allocation decisions at company level and better risk management. However, intellectual assets-intensive companies face heightened risks as innovation cycles are variable and entail substantial investments. The identification, assessment and management of such risks require a strong internal control system.

122. It is sometimes argued that intellectual assets reporting frameworks should evolve in this direction. Indeed, factors that contribute to investors' decisions include: *i)* the risk management capabilities which are assessed by scrutinising the contingency match of the managerial and board qualities to the

changes in forecast macroeconomic and competitive conditions; *ii)* reputation with key stakeholders and brand strength; and *iii)* business development strategy and innovation. Moreover, they expect externally reported information to be consistent with internal management reporting in order to improve their decision-making process. Even so, management is not always able to deliver the information on the company's value drivers needed by investors and boards, with information on key non-financial drivers of success either not available or of poor quality. Additional information is needed on intangibles such as how well the company is satisfying customers, delivering high quality products and services, operating with efficient processes, and developing new products and services.

123. In spite of the increasing demands for companies to monitor their internal control systems (*e.g.* United Kingdom, France), there appears to be a great difference between actual and good practice. Reporting frameworks will need to address the issues of internal control and risk management and encourage companies to set up internal information systems in order to provide managers and boards with the quantitative measures they need for efficient resource allocation. Increasing the efficiency of resource allocation is a major challenge as research has shown that, for example, an increase in R&D expenditures is not necessarily linked with more and successful innovation. Difficulties arise from the interrelated nature of intellectual assets: intellectual assets are not always separately identifiable but tend to be complementary and can overlap significantly. Knowing more precisely which combination of intellectual assets favours innovation and value creation contributes to improved allocation of scarce resource and strategy formulation, and hence increases a company's competitiveness and growth. By managing and reporting their intellectual assets, the experience seems to be that managers obtain new insights into the value and performance of the organisation's knowledge intensive resources. The increasing emphasis on risk management and internal control taken by current approaches to corporate governance is thus moving in the same direction as moves to improve the management and disclosure of intellectual assets.

124. Research (*e.g.* Bose and Oh, 2004) has also shown that intellectual assets-intensive companies have specific operating risks and that the management of intellectual assets relies on specific value-drivers. Specific operational risks include marketing risks, quality of R&D, manufacturing risk and competitive risk. Value-drivers that have been identified as having strategic management implications for intellectual assets-intensive sectors (such as biotechnology, information technology, and energy and environment) include the profitability of investment in intellectual assets, uniqueness of innovation, reputation of research team and firm, growth prospects, quality of management, and risk.

125. As the innovation cycle gets longer in some sectors such as in pharmaceuticals (and shorter in others), many diverse external risks may arise which, especially when occurring at the later stages of an innovation, have a major impact on value for the company concerned. Operational and competitive risks, usually seen as the most important ones, can take several forms: one competitor might launch the very innovation its competitor is holding back, or an unexpected competitor might enter a market.[37]

126. In some countries (Denmark, Germany and Japan) intellectual assets reporting guidelines have been mainly designed as a management tool for small innovative companies to enhance their decision-making process, to provide assistance in resource allocation decisions and to improve their risk management practices. Other countries (United States) believe there is no need to encourage small innovative companies to rethink their management of intellectual assets. One reason for this might be these

[37] Sometimes, the way an innovation is managed can become more important than the innovation itself as illustrated by the case of Sony and Toshiba each trying to impose their technology as *the* new DVD format. Both companies have developed innovative technologies (Blue-ray for Sony and HD-DVD for Toshiba) that are commercially viable but, ultimately, marketing aspects such as the capacity to build strategic alliances with electronic manufacturers are likely to be a determinant factor of success (among other factors, such as the price of the product and unforeseen manufacturing problems).

companies' reliance on an active and efficient venture capital and private equity industry to provide them with creative and diverse ways of financing in their early stages of development as well as with strong managerial inputs.

Venture capital

127. Start-ups and small innovative companies, both typically highly intellectual assets-intensive, need creative and diverse ways of financing, and this incurs reporting obligations. Firms with a high share of intangibles and in high-tech sectors are more likely to be financed through venture capital because they are more difficult for external investors to evaluate and they also look for extra-financial input. Venture capital reduces asymmetric information problems, which tend to be higher for small innovative firms and firms whose assets are difficult to evaluate (such as those whose main asset is a new product yet to be launched on the market or those with a large share of intangible assets in their "balance sheet").

128. Venture capital (VC) addresses the funding needs of entrepreneurial companies in a number of companies that generally do not have the size, assets, or operating histories necessary to obtain capital from more traditional sources, such as public markets and banks. VC can be defined as equity or equity-linked investments in young, privately-held companies, where the investor is a financial intermediary. Alongside the traditional cash-based VC, corporate venture capital (CVC) involves minority equity investments in small, young, independent entrepreneurial ventures by established firms. The typical distinction between corporate venturing and other types of venture investment vehicles is that it is usually performed with corporate strategic objectives in mind rather than only immediate financial objectives. CVC programs are instrumental in "harvesting" innovations from entrepreneurial ventures and thus are an important part of a firm's innovation strategy (Dushnitsky and Lenox, 2005). VC is distinct from other types of investors and forms of financial intermediation primarily through the governance and value added services that the investor provides to the company beyond their financial support, such as managerial inputs provided by venture capitalists to foster growth and innovation of the companies relying on VC.

129. Hands-on venture capitalists play roles over and above those of traditional financial intermediaries, which find it more difficult to value assets as collateral. The venture capitalist's contribution in financially-oriented areas (monitoring financial performance, regular budget reporting and giving financial advice) is obviously high, but their involvement also covers a wide range of non-financial areas. These include strategic advice, networking opportunities, providing focus and support and enhancing company credibility, their relative importance depending on the VC-backed company's development stage. VC is particularly suited to finance and nurture innovative companies at an early-stage of development (Hellman and Puri, 2002). For these companies, the expertise of the VC firm, its knowledge of markets and of the entrepreneurial process, and its network of contacts are most useful to help realise their growth potential.

130. As VCs are often industry specialized and entrepreneurs may lack management skills, VC strategic advice is a highly valuable input to many venture-backed companies, especially during developing stages. VC firms rely on their industry-specific human capital as their most valuable intellectual asset to identify good investment opportunities and to manage these investments (Gompers et al., 2005). However, access to information, including on firms' intellectual assets, is crucial for VCs ability to enhance the value creation process. For example, Board representation not only provides the VC with the rights to control corporate decisions, but it can also be used to ensure access to the company's trade secrets and therefore knowledge of its intellectual assets.

How do firms create value from intellectual assets?

131. This section draws on Bismuth and Tojo (2006) and unpublished OECD material. It highlights the critical role played by management capabilities of individual firms (and the corresponding implementation of appropriate business strategies) in the creation of economic value from intellectual assets. Work on the impact of R&D, patents, human capital and software shows not only that the average return on investment in intellectual assets can be large, but also that the value of many intellectual assets is highly skewed. Management practices are also important for improving returns on investments in knowledge. Managers now use new intellectual property management techniques to realise value from patented inventions.

132. Evidence from macroeconomic economic studies on the contribution of investments in intellectual assets to productivity and economic growth was reviewed above. This section looks at how firms use intellectual assets to create value.

Good management is key to creating value from intellectual assets

133. The ability to create value from intellectual assets is contingent on the management capabilities of individual firms and the implementation of appropriate business strategies. Leading firms have increased the efficiency of their R&D processes by linking internal R&D activities more closely to their business strategy and relying on external sources to gain access to complementary knowledge and round out technology portfolios (OECD, 2002a). The likelihood of success also appears to increase when management ensures that, before R&D projects are initiated, there is clear customer demand for the new products or services and a profitable way to bring them to market (Jaruzelski *et al.*, 2005). In the area of intellectual property, a number of firms have achieved considerable revenue growth through the adoption and active implementation of intellectual asset management procedures. These aim to realise value from patented inventions through licensing and sale, to transfer low-value patents to venture capital enterprises and to link patents better with innovation through incorporation into improved products and services (OECD, 2005). Such techniques are particularly important in competitive industries where innovative products rapidly become commodities through follow-on innovation and imitation.

134. At the microeconomic level, work on the impact of R&D, patents, human capital and software shows not only that the average returns to investments in intellectual assets can be large, but also that the value of many intellectual assets is highly skewed. For example, a small number of patents can account for the bulk of the value of firms' patent portfolios (Harhoff *et al.*, 1999). Many R&D projects do not result in a successful new product or service, but the returns from successful projects can more than compensate. The role of management is to direct investment to areas of higher expected returns and develop processes that ensure that those returns are realised. There is now significant empirical work to support the view that effective use of intellectual assets and technologies depends on the quality of management. However, management practices, including management of human capital and technology, setting targets and reporting on performance, have been shown to vary widely both within and between countries and within industries (Bloom and van Reenen, 2005).

135. The ability of companies to manage risks is also important. This requires systems of internal control – and not only just financial controls. Information about intellectual assets such as patent portfolios, key technologies and brands is crucial for management and for the boards that monitor companies. In spite of increasing obligations for companies to examine their internal systems (*e.g.* United Kingdom, France), there appears to be a great difference between actual and good practice - what is not counted or reported is often not managed. For example, one study found that "while the overwhelming majority of board members and senior executives said they need incisive information on their companies' key non-financial drivers of success, they often find such data lacking; when non-financial information is available, it is of

mediocre or poor value" (Deloitte and EIU, 2004). Difficulties arise from the interrelated nature of intellectual assets: knowing more precisely which combination of intellectual assets favours innovation and value creation contributes to improved allocation of scarce resource and strategy formulation, and hence increases a company's competitiveness and growth. Increasing the efficiency of resource allocation is a major challenge as research has shown that, for example, an increase in R&D expenditures is not necessarily linked with more and successful innovation. By managing and reporting their intellectual assets, the experience seems to be that managers obtain new insights into the value and performance of the organisation's knowledge intensive resources. Some examples of how firms can create value from intellectual assets in practice are given in Box 5.

Box 5. Examples of firms creating value from intellectual assets

There are essentially three ways in which value can be created at the firm level: by increasing the consumer surplus, the producer surplus, or the stock market valuation of the firm (see Appendix Figure 4 for an illustration of consumer and producer surplus). Three examples are given below.

A study of the pharmaceutical industry showed that the average stock price reaction to US Food and Drug Administration (FDA) approvals was 0.51 per cent in the absence of further information. The returns rose to 1.13 per cent when the announcement was accompanied by qualitative information, and increased further to 2 per cent when quantitative information was also provided (Lev, 2002).

The stock market value of listed firms has been found to respond positively to announced R&D expenditures. An increase in R&D leads to an increase in market valuation, and the market reaction is greater than for tangible investments (Hall and Oriani, 2004; Ballardini *et al*., 2005).

One study used as a benchmark is the PricewaterhouseCoopers system of value added reporting, which includes disclosure about a wide range of strategic issues and value creation going well beyond mandatory standards. Those companies with better general reporting in line with this PricewaterhouseCoopers benchmark enjoyed a lower cost of capital than others whose reporting went no further than required by existing standards of disclosure (Barnett, 2003). Lower cost of capital increases the firm's producer surplus.

These examples also illustrate the importance of improving corporate reporting of intellectual assets since this is intrinsically linked to value creation by the firm.

Source: OECD, based on Bismuth (2006).

Knowledge management

136. Sound corporate management of intellectual assets is needed in addition to measurement, accounting and reporting of intellectual assets in order for a firm to create value of its intellectual assets. This is sometimes referred to as knowledge management. KPMG Consulting (2001) describes the knowledge management as "a collective phrase for a group of processes and practices used by organisations to increase their value by improving the effectiveness of the generation and application of intellectual capital."

137. Marr and Stratovic (2004) found that many companies that stated wanting to use knowledge management initiatives in order to create economic value from their intellectual assets did not have a clear idea of the exact expected benefits and required changes within corporate systems. The study argues that knowledge management is conceptually linked to organizational culture and processes thus the overall target for companies should be to manage cultural and organizational means instead of knowledge. It then provides an organization system model in which systemic variables of knowledge management are identified and depicted on a visual diagram (Jeans, 1998).

138. A similar conceptual framework developed by the Cranfield School of Management is in the form of a knowledge process wheel that defines and links a set of corporate processes to effectively

maintain and accumulate knowledge assets which, in turn, can boost the tangible value of a firm. For a successful company, seven interdependent stages of knowledge management process can be identified: knowledge generation, knowledge codification, knowledge application, knowledge storing, knowledge mapping, knowledge sharing and knowledge transfer (Marr and Stratovic, 2004). According to the knowledge wheel concept, companies should attach adequate importance and balanced focus to each of the components of the wheel if they want to move their intellectual assets and long run company value forward.

139. The historical roots of these new paradigms are relatively recent. As corporate awareness about the importance of intellectual assets develops, the alignment of management systems has gradually shifted from a passive stance to much more integrated approaches. Similar corporate paradigms are emerging, such as Balance Scorecard (Kaplan and Norton, 1992), the Intangible Asset Monitor, and Intellectual Capital Accounting, each of which implicitly deals with multifaceted feedback mechanisms in the corporate environment. Management theories, though from different origins of thought, are trying to fill the void by employing integrated approaches based on causal loop diagrams and decision support tools.

Creating value … and retaining it

140. As the importance of intellectual assets as a source of value creation increases, so does the importance of the ability to retain them. Changes in IPR policies over the past decades have often shifted the balance between right owners and users of innovations towards owners: more subject matter is protected, the term of protection has increased and higher damages are awarded by courts to IPR holders. At the same time, the innovation process itself is becoming more open; ideas and knowledge for innovation are now drawn from many, often global, sources, and linkages and co-operation are of growing importance for successful innovation. There is a need to further explore the trade-offs between open and controlled access to intellectual assets and their effects on business innovation and economic performance, especially in industries where innovative products become commodities rapidly through follow-on innovation and imitation

Policy Challenges

141. Although creating innovations and value through the efficient use of intellectual assets is primarily the role of company management and their boards, public policy is nevertheless important. Better information on intellectual assets in the national accounts and corporate balance sheets would facilitate the implementation of more efficient public policies. Likewise both public policy and corporate strategy making would benefit from a better recognition of the impact of investing in intellectual assets to generate economic value.

142. As intellectual assets contribute a larger share of economic value, policy makers will be confronted with a growing need to balance the benefits of gaining control over them against the benefits of mobility and open access. As the nature of innovation becomes more collaborative, within and across firms, and as the pace of innovation accelerates, policies need to strike a proper balance between private and public goals. There is need for further exploring the trade-offs between open and controlled access to intellectual assets and their effects on business innovation and economic performance, especially in an environment that is quickly changing because of technical developments, especially with the Internet and high speed broadband communications networks.

143. Providing the market with sufficient and appropriate information about intellectual assets improves decision-making by investors and helps discipline management and boards with positive economic consequences. Ensuring that the non-financial information is consistent, comparable over time and across companies, would allow investors to better assess future earnings and the risks associated with different investment opportunities. This should contribute to making financial markets more efficient by

reducing information asymmetry, reducing biased or unfounded earnings estimates, unrealistic valuations and unjustified share price volatility. Improved information about intellectual assets and company strategy also improves the ability of firms to secure funding at a lower cost of capital. Any policies aimed at improving value creation from intellectual assets should also take into account that the type of intellectual assets held by firms varies across industries. To date, best practices have not been widely disseminated and governments could play a role in helping to diffuse those pioneered by high-performance firms. Dissemination of knowledge about the potential benefits be more widely disseminated would also encourage more companies to improve their disclosure practices as well as their internal management systems.

Conclusion and next steps

144. The analyses conducted in the context of the present phase of OECD work on intellectual assets and value creation underscore the economic importance of intellectual assets and the central role that they play in the modern knowledge economy. Effective development and deployment of intellectual assets can fuel value creation both in terms of expansion of the stock of wealth and in the generation of current value through new or improved products and processes. Failure to correctly assess intellectual assets can lead to misallocation of resources and other inappropriate decisions by managers, policymakers and others.

145. With respect to the follow up to the present project, the analyses clearly highlight gaps in our understanding of intellectual assets and value creation. There is room for increased standardisation in the terminology, development of statistical indicators and expanded analytical work across the three tiers of current OECD studies on this issue area (national, regional and firm-level).

146. Particularly promising areas for follow on work might include such topics as the following:

- Intellectual assets and new business models -- Intellectual assets are increasingly important for innovation, and in particular non-technological innovation and other new forms of innovation. An extension of the current analysis could examine the impact of intellectual assets on the emergence of new business models.

- Value creation and globalisation -- Intellectual assets play a pivotal role in the increasing fragmentation of global value chains and in the globalisation of business services. An extension of the current analysis could explore the relationship between intellectual assets and organisational change, with particular regard to value creation in the globalising world economy.

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APPENDIX

Appendix Table 1. Distribution of EPO patent filings, Regions, 1990-1995

	Number of TL3 Regions			Patents		
Country	*All Sample*	*Top KW regions*	*share %*	*All Sample*	*Top KW regions*	*share %*
Australia	61	4	6,6%	6790	3968	58,4%
Canada	229	5	2,2%	12113	4548	37,5%
EU27*	1312	120	9,1%	375847	182044	48,4%
Japan	47	26	55,3%	111617	105836	94,8%
Korea	10	0	0,0%	76	0	0,0%
US	401	51	12,7%	227410	189385	83,3%
Total	2060	206	10,0%	733853	485781	66,2%
Total (no double counts)				422893	312738	74,0%

Source: Thoma (2008).

Appendix Table 2. Programmes aimed at developing intellectual assets management capabilities in enterprises, by country

Are there programmes aimed to:	NO	No, but had in the recent past	No, but under consideration	YES	Yes Targeting ALL firms	Yes Targeting SMEs	Total
Australia				X	1	2	3
Austria				X	0	1	1
Belgium				X	2	1	3
Canada	X				0	0	0
Czech Republic					0	0	0
Denmark					0	0	0
Finland				X	0	6	6
Greece			X		0	0	0
Hungary				X	1	1	2
Ireland					0	0	0
Italy				X	1	0	1
Japan				X	1	1	2
Korea				X	0	4	4
Mexico				X	0	1	1
New Zealand				X	2	0	2
Slovak Republic	X				0	0	0
Spain				X	1	1	2
Switzerland	X				0	0	0
Turkey				X	0	1	1
United Kingdom				X	0	1	1
Israel					0	0	0

Source: OECD WPSMEE (preliminary unpublished results).

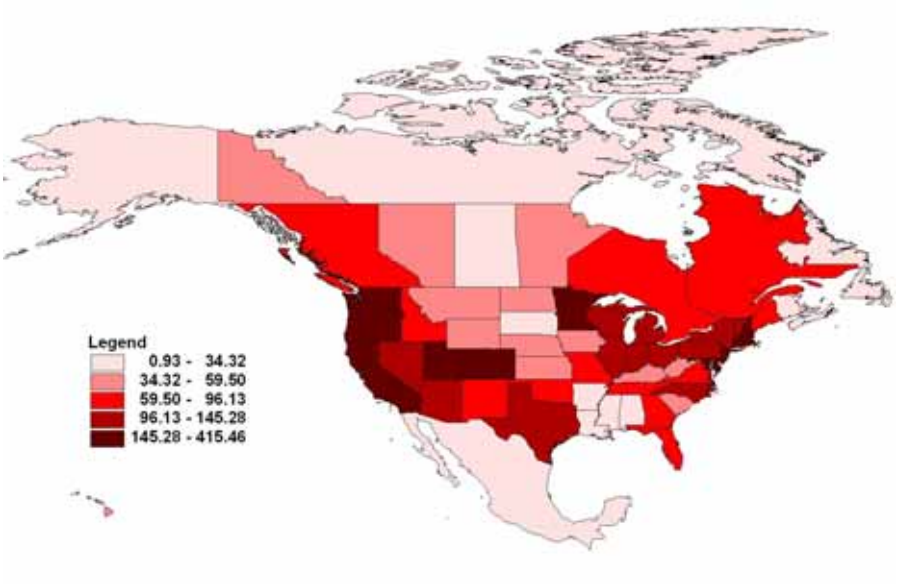
Appendix Table 3. Examples of taxonomies for intellectual assets

OECD Technology Economy Project (1992)	• **Intangible investments in technology**, e.g. R&D, design, development engineering, scanning and search activities, technology acquisition and licensing • **Enabling intangible investments**, e.g. human resources, organisation and information structures • **Intangible investments in markets**, e.g. market exploration, market development including brands, market organisation including developing customer information • **Investments in software**, e.g. computer-controlled manufacturing processes, quality control, testing, storage, handling and services systems such as sales and delivery
International Federation of Accountants (1998)	• **Human capital**, e.g. know-how, education, vocational qualification, work-related knowledge, occupational assessments, psychometric assessments, work-related competencies, entrepreneurial élan, innovativeness, proactive and reactive abilities, changeability • **Relational capital**, e.g. brands, customers, customer loyalty, company names, backlog orders, distribution channels, business collaborations, licensing agreements, favourable contracts, franchising agreements • **Organisational capital which comprises:** ➢ **Intellectual property**, e.g. patents, copyrights, design rights, trade secrets, trademarks, service marks ➢ **Infrastructure assets**, e.g. management philosophy, corporate culture, management processes, information systems, networking systems, financial relations
The Brookings Institution Task Force on Understanding Intangibles (2001)	• **Assets that can be owned and sold**, e.g. intellectual property, contracts, business agreements, licenses and franchise rights, quotas and resource allocations, employment contracts • **Assets that can be controlled but not separated out and sold**, e.g. business secrets, in-process R&D, business processes • **Intangibles that may not be wholly controlled by the firm**, e.g. human capital, core competencies, organisational capital, relationship capital
European Commission, MERITUM Project (2002)	• **Human capital**, e.g. innovation capacity, creativity, know-how, previous experience, teamwork capacity, employee flexibility, tolerance for ambiguity, motivation, satisfaction, learning capacity, loyalty, formal training, education • **Relational capital**, e.g. resources linked to the external relationships of the firm with customers, suppliers and R&D partners. • **Structural capital**, e.g. knowledge that stays with the firm after the staff leaves
Japan, Ministry of Economy, Trade and Industry, Interim Report by Subcommittee on Management & Intellectual Assets (2005)	• **Human resources** • **Organizational assets** • **Related structural assets**

Source: Bismuth (2006).

Appendix Figure 1. PCT applications, USA, 2002-2004

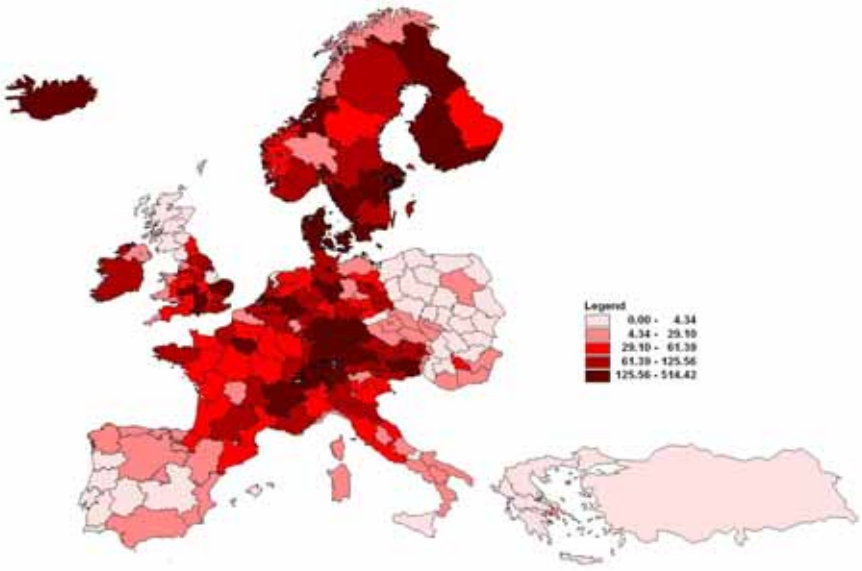
(per million population)



Source: Usai *et al* (2008), based on the OECD Regional Database.

Appendix Figure 2. PCT applications, European countries, 2002-2004

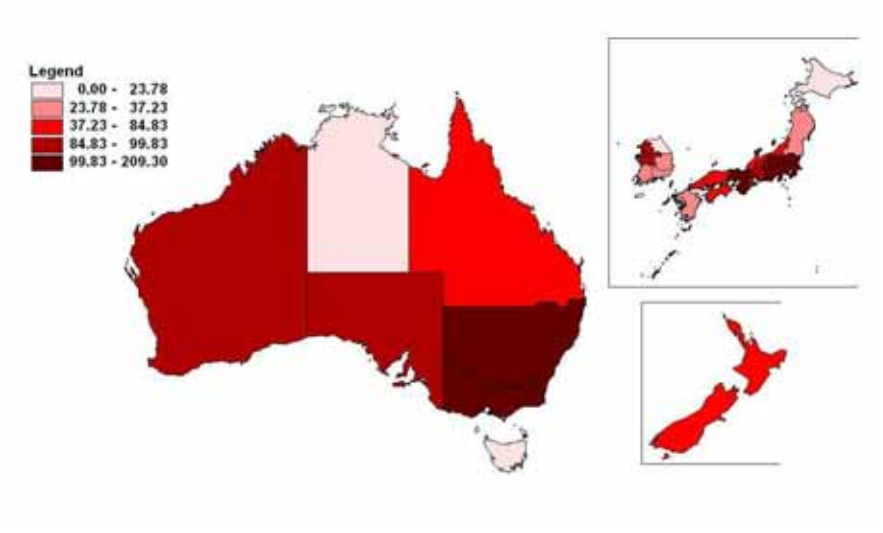
(per million population)



Source: Usai *et al* (2008), based on the OECD Regional Database.

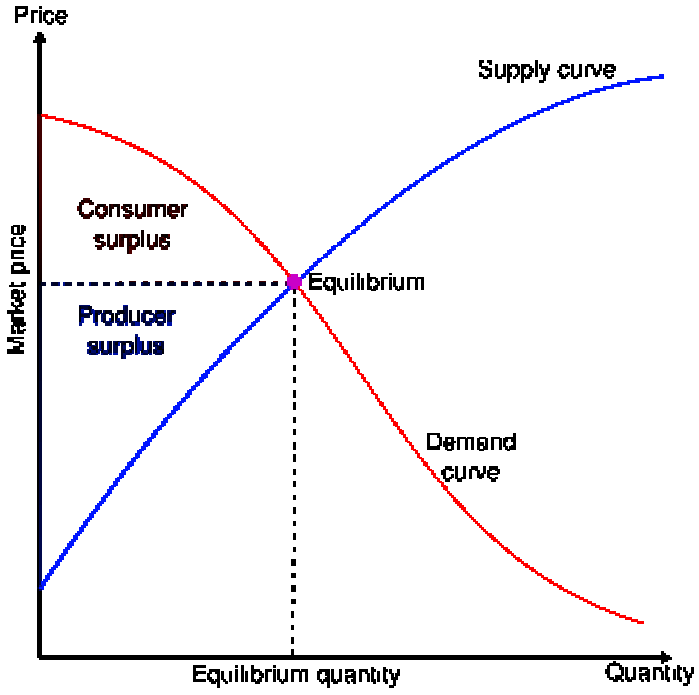
Appendix Figure 3. PCT applications, Asia Pacific, 2002-2004

(per million population)



Source: Usai *et al* (2008), based on the OECD Regional Database.

Appendix Figure 4. An illustration of consumer and producer surplus



Source: http://en.wikipedia.org/wiki/Consumer_surplus (last accessed 21.02.2008).