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Approaches to Measuring the Stock of Human Capital: A Review of Country Practices

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APPROCHES TO MEASURING THE STOCK OF HUMAN CAPITAL: A REVIEW OF COUNTRY PRACTICES

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This document represents the outcome of a stock-taking report prepared by the OECD to support discussions by the Conference of European Statisticians (CES). The decision to undertake such a review was taken by the CES as a follow-up to a seminar on human capital organized in June 2011, in Geneva. The report was discussed by the CES Bureau at its November 2012 meeting, and will now be submitted to the CES 2013 plenary session.

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ABSTRACT

In recent years, many researchers and organisations have taken steps to produce more comprehensive measures of the stock of human capital. These measures have been developed to serve different analytic purposes and have typically relied on a variety of approaches. Notwithstanding these differences, several statistical offices have expressed a common interest in developing monetary measures of the stock of human capital as a useful complement of physical measures of the quantity and quality of education. The paper reviews a number of national initiatives in this field, indentifies some of the conceptual and statistical challenges that should be addressed in order to improve the quality of the existing monetary measures of human capital, and suggests developing experimental satellite accounts for education, with different level of complexity, to better understand how human capital is produced and the linkages between education and its non-monetary outcomes.

RÉSUMÉ

Ces dernières années, nombre de chercheurs et d'organisations ont menés de travaux visant à mesurer le capital humain de façon plus globale. Les indicateurs élaborés à cette fin sont destinés à différents usages analytiques et reposent sur une grande diversité de méthodes. Malgré ces différences, plusieurs offices statistiques ont fait part de leur volonté d'élaborer des indicateurs monétaires du stock de capital humain pour compléter les indicateurs physiques de la quantité et de la qualité de l'éducation. Dans le présent document, les auteurs passent en revue un certain nombre de projets nationaux et recensent une partie des problèmes conceptuels et statistiques à résoudre pour améliorer la qualité des mesures monétaires du capital humain qui existent déjà. Les auteurs recommandent également de mettre au point, à titre expérimental, des comptes satellites de l'éducation présentant différents degrés de complexité pour mieux comprendre le processus de formation du capital humain, ainsi que les liens entre l'éducation et les bénéfices non-monétaires que celle-ci apporte.

I. INTRODUCTION

1. Following discussions at its June 2011 seminar on measuring human capital, the UNECE Conference of European Statisticians (CES) decided to prepare a stock-taking report aimed at providing an overview of what has hitherto been done in the field of human capital measurement. To facilitate the preparation of the stock-taking report, Statistics New Zealand proposed the establishment of a small expert group. This group was chaired by Geoff Bascand (Government Statistician of New Zealand) and included representatives from Canada, Norway and the United States, with the OECD providing technical leadership in the drafting of the report – in consultation with other members of the expert group. UNECE provided a link to the non-OECD countries and helped in collecting information from these countries. The CES Bureau approved the proposal to launch the stock-taking exercise at its meeting in November 2011.

2. To support this review, the OECD Secretariat designed a questionnaire in February 2012 with the purpose of collecting information on what CES countries have done, are doing, and are planning to do in terms of measuring human capital. The questionnaire was sent to members and regular observers of the OECD Committee on Statistics (CSTAT) by the OECD Secretariat, and to non-OECD CES members by the UNECE Secretariat. Results of this questionnaire are reflected in this report and presented in more detail in Annex I.

3. The stock-taking report aims to:

- Summarise country experiences and international initiatives in measuring human capital.
- Discuss the main issues and measurement challenges identified by member countries.
- Make recommendations to address the identified problems.

4. While the concept of human capital is broad (encompassing a range of personal attributes, such as people's health conditions), the focus of this report is limited to people's skills and competences and, in particular, on the role of formal education in enhancing them. Further, the report mainly looks at *monetary measures* of the stock of human capital, rather than physical measures of its various dimensions (e.g. measures of the share of people having completed different educational degrees, pencil and paper assessment of people's skills). This more narrow focus reflects the view that these monetary measures, while still experimental, hold the promise for being integrated, at some later stage, into conventional economic accounting.

5. The report is organised as follows. First, it presents a brief summary of the main analytic and policy purposes for undertaking human capital measurement. Second, it describes and compares the concepts and definitions of human capital used in a variety of studies, as well as the methodologies typically applied by researchers for its measurement. Third, based on the information gathered from both the questionnaire and other sources, it provides an overview of country experiences and international initiatives, with a focus on the lessons learned and the knowledge gained from these activities. Fourth, the paper discusses some of the main measurement challenges, in terms of data availability and conceptual issues, and discusses how the construction of human capital (or educational) satellite accounts might allow bringing together in coherent way information on the key aspects shaping the accumulation of human capital. Finally, the paper summarises the main conclusions and makes recommendations for future work in this field.

II. PURPOSES OF HUMAN CAPITAL MEASUREMENT

6. Measuring the stock of human capital can serve many purposes, i.e. to better understand what drives economic growth, to assess the long-term sustainability of a country's development path, and to measure the output and productivity performance of the educational sector. While all these perspectives emphasise the importance of measuring the total stock of human capital, more recent discussions on 'beyond GDP' has led to growing attention being paid to the distribution of human capital across households and individuals, and on the non-monetary benefits stemming from it. Each of these perspectives is described below.

A. Growth accounting and productivity analysis

7. The modern concept of human capital has its origin in efforts by economists to explain the 'puzzle' of economic growth based on conventional production functions, i.e. the large size of the residual not explained by either economic/produced capital or labour inputs. Investment in human capital – through education, training and work experience enhances the quality the quantity of labour inputs, and may thus explain a large part of this residual (Schultz, 1961).[1] More recently, further research on economic growth, represented by the so-called "new growth" models (e.g. Lucas, 1988; Romer, 1990a; Barro and Sala-i-Martin, 1995), has argued that investment in human capital does not just improve labour quality at a point in time, but can also lead to technological progress and innovation, i.e. positive "externalities" that increase the productivity of other factors.

8. Following this line of argument, many empirical studies have tried to expound the positive relationship between human capital and economic growth. However, due in large part to measurement errors, earlier findings on the impact of human capital on economic growth were rather mixed. More recently, improved data on educational attainment have led to more robust estimates of the impact of human capital on economic growth (e.g. Arnold *et. al.*, 2007; Sianesi and Van Reenen, 2003), suggesting a sizable impact of human capital accumulation on economic growth. This evidence, while based on physical proxies of the human capital stocks, suggest that better measures of the stock of human capital could significantly improve our understanding of the drivers of economic growth.

B. Sustainability assessment

9. Maximizing current income and consumption in a context of limited resources will not assure the sustainability of a country's development path. Sustainable development, in its inter-generational dimension, is usually understood as requiring that an unchanged stock of total capital (including human capital) per capita to be passed on to the next generation (UNECE, 2009).

10. To produce meaningful measures of the total capital stock of each country, measures of each of its components are needed. Further, these measures should (when assuming that different capital stocks can be substituted for each other in the production process) be expressed in common metric, so as to allow gauging whether, for example, increases in economic capital more than offset declines in the stock of oil reserves. Because of its role in economic accounting, the metric typically used to measure the different types of capital is that of 'money'. Devising a robust methodology for the monetary valuation of the stock of human capital is especially important as a number of studies have suggested that human capital, measured in this way, is by far the most important component of the

[1] Within the standard growth accounting framework, such as the ones recommend by Schreyer, 2001 and applied in the EU KLEMS project (O'Mahony and Timmer, 2009), incorporating the quality of labour inputs into a production function may significantly reduce the unexplained residual (i.e. multifactor productivity growth, MFP), which is, in fact, simply a measure of our "ignorance".

total capital stock in most advanced economies (e.g. Greaker et al, 2005; Gu and Wong, 2008; World Bank, 2006, 2011).

11. Not only the total stock of human capital but also its evolution over time provides important information for monitoring sustainability. For instance, better measures of changes in human capital due to demographical factors such as population ageing, may provide an early warning of the risk that the accumulation of human capital may not be sustainable over time. This would allow pre-emptive policies aimed at encouraging alternative forms of investments, to offset the decline of total capital stock due to ageing.

C. Measuring the production and productivity performance of the education sector

12. Education is a key driver of human capital investment. When considered as a 'sector', education accounts for around 6% of OECD GDP. A large part of educational expenditures come from public sources, and this share has been growing in recent years. On average, OECD countries devoted to education around 13% of their total public expenditures in 2008, a share that has been rising in most countries since 1995 (OECD, 2011a). To justify the allocation of such a large part of public funds to education, rather than to other objectives, requires a better understanding the productivity performance of the education sector.

13. The value of the economic production of the education sector is conventionally measured based on the costs of the market inputs that are used in this sector. These costs include teachers' wages and salaries, the consumption of fixed capital (e.g. due to the use of school buildings), household expenditures for school fees and educational material, etc. This input-based approach is, however, inadequate for productivity analysis since it ignores changes in the efficiency with which various inputs are used in production. To support an analysis of the productivity of the education sector, output-based measures of its economic production are called for.

14. Several approaches may be used to derive an output-based estimate of the volume of production in the education sector (e.g. Schreyer, 2010; Gu and Wong, 2010a). When the production of the educational sector is conceived as the annual addition to the stock of human capital, a productivity measure for the sector could be established by comparing changes in the volume of inputs and changes in the volume of outputs. Separate measures of the two elements are therefore required.

15. Besides better understanding the productivity of the educational sector, detailed information such as how the education sector is financed, how its resources are allocated, how its different outputs (i.e. graduates with different levels of educational attainment) are 'produced' and then employed in different industries and occupations are of vital importance for education-related policies. To that end, education satellite accounts, sometimes extended to human capital accounts, have been used by some countries.

D. Broader measures of people's well-being and societal progress

16. Recent reflections on the limits of GDP as a welfare measure (e.g. Stiglitz et al.. 2009; OECD, 2011; and various EU initiatives[2]) have underscored that people's material conditions (i.e. their economic well-being) is determined not only by current income and consumption but also by the assets they own – e.g. housing property, financial assets but also, importantly, human capital. All these assets generate income streams over their lifetime and provide a buffer against sudden shocks. This

[2] For more information on this initiative and a later European Commission Communication on "GDP and Beyond - Measuring progress in a changing world", please visit the following links: http://www.beyond-gdp.eu/ and http://www.eubusiness.com/topics/finance/beyond-gdp.

individual perspective suggests that, beyond looking at the total stock of a country's human capital, measures of how this capital is distributed are also important.

17. The distribution of human capital matters both in itself and for its influence on other aspects. Empirical evidence shows that countries characterised by a more equal distribution of human capital also experience greater income equality (e.g. Alesina and Rodrik, 1992; OECD and Statistics Canada, 2000). Recent OECD analysis of the factors shaping income inequalities in industrialised countries has shown that, over the past two decades, the trend to higher educational attainment has been one of the most important elements counteracting the increase in earnings dispersion (OECD, 2011b).

18. Further, the concept of people's well-being stretches beyond its material side, to encompass a variety of non-monetary dimensions which, together, define people's quality of life. This broader perspective has implications for the measurement of human capital as it highlights that, in addition to its economic returns, investment in human capital can generate other benefits that will improve individuals' well-being. These 'non-economic benefits can include the improved heath conditions that are generally associated to higher education and which may enhance not just an individual's productivity and earnings but also his/her subjective well-being (Dolan et al, 2008). Furthermore, these non-economic benefits are not restricted to individuals, but can extend to the society at large. For example, education may lead to better-informed citizens, more tolerant of social and cultural diversity and more willing to actively take part in a modern democratic society.

19. While some of these non-economic benefits of education are captured through the monetary measures of human capital that are reviewed in this paper (e.g. the longer life-expectancy of more educated individuals), this is not the case for most other benefits. Moreover, the formation of human capital itself may be impacted by activities that enhance health conditions as well as family and community well-being. This, again, has also implications for human capital measurement.

III. CONCEPTS AND METHODOLOGIES

A. Concepts and definitions of human capital

20. The origin of the human capital concept can be traced back to the work of Adam Smith in the 18th century. Smith underlined the importance of "the acquired and useful abilities of all the inhabitants or members of the society"; while an individual will incur costs to obtain such abilities, once acquired they stand as "a capital fixed and realised, as it were, in his person" (Smith, 1776).

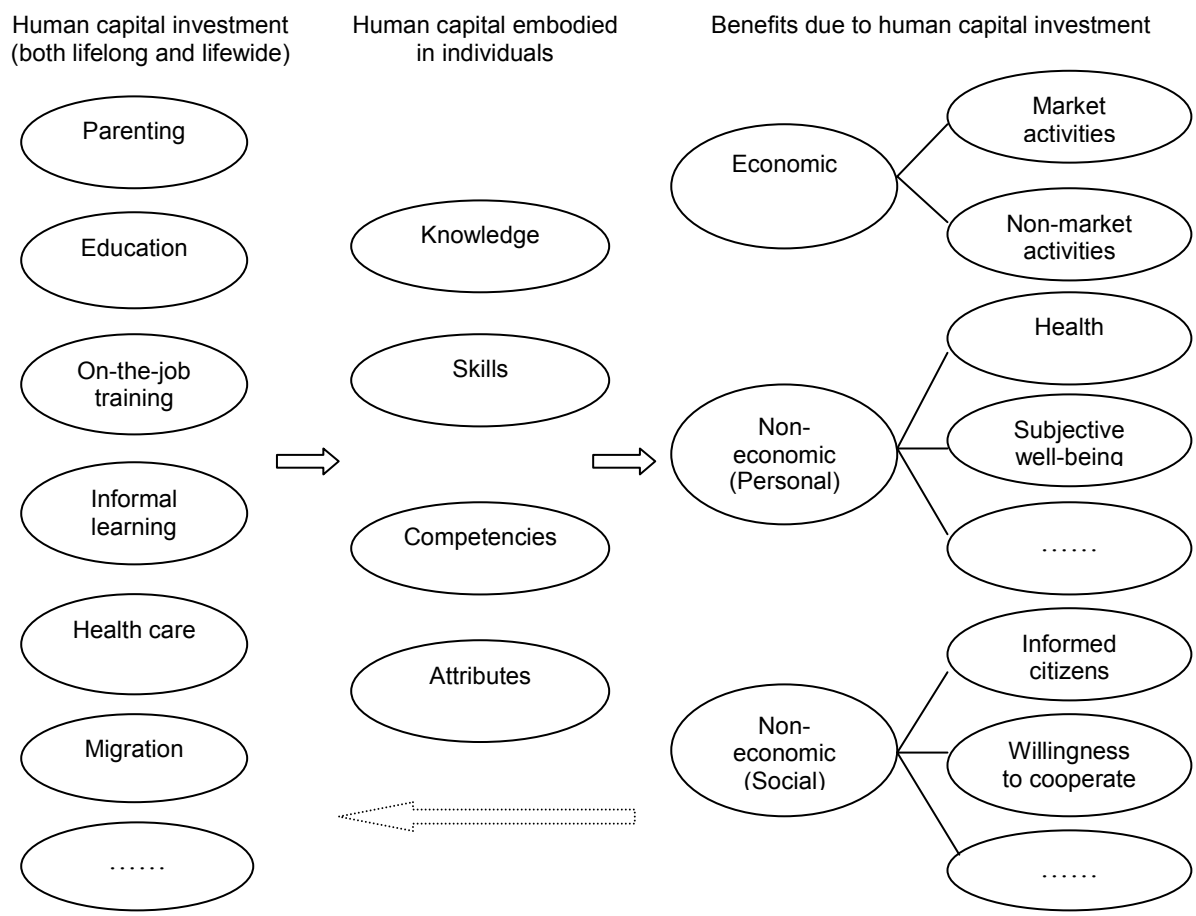
21. The practical implications of the idea of treating individual's abilities as a kind of capital (i.e. as an asset) were not widely recognised until the 1960s, when economists began to incorporate such notion into their work. As mentioned above, this shift partly reflected the view that the concept of human capital could explain the large difference between the increase of the economic output of a country and that of the traditional inputs (land, labour and economic capital) entering its production. Some economists contended that investment in human capital was probably the major explanation for this difference (e.g. Schultz, 1961).

22. There are many definitions of human capital used in the literature, but most of them stress the *economic* returns of human capital investment. Schultz (1961), for example, defined human capital as "acquired skills and knowledge", to distinguish raw (unskilled) labour from skilled labour; similarly, the Penguin Dictionary of Economics (1984) defined human capital as "the skills, capacities and abilities possessed by an individual which permit him to earn income", a definition which emphasises the improvement of people's economic situation due to human capital investment. The World Bank (2006) similarly defined human capital as the productive capacity embodied in individuals, with special focus on its contribution to economic production.

23. As economies become more knowledge-based and globalised, the economic importance of human capital to both individual's competitive advantage and to countries' economic success become more significant than ever. However, as mentioned above, human capital investment delivers many other non-economic benefits as well, such as improved health status, enhanced personal well-being and greater social cohesion. These broader benefits are viewed by many authors as being as important as, if not larger than, the economic benefits in the form of higher earnings and economic growth.

24. Acknowledging these broader benefits, the OECD gradually extended its definition of human capital. In an OECD report published in 1998, human capital was defined as "the knowledge, skills, competences and other attributes embodied in individuals *that are relevant to economic activity*" (OECD, 1998). A later report, however, defined human capital as "the knowledge, skills, competencies and attributes embodied in individuals *that facilitate the creation of personal, social and economic well-being*" (OECD, 2001). Box 1 provides a brief overview of the elements that are included in this broader definition of human capital according to the 2001 OECD report, displaying the various channels through which human capital is developed and the diverse benefits that it delivers.

Box 1. Human capital: a sketch of its formation, composition and benefits generated



What is included in human capital?

25. The OECD definition is all-embracing. It incorporates various skills and competencies that are acquired through learning and experience but may also include innate abilities. Some aspects of motivation and behaviour, as well as the physical, emotional and mental health of individuals are also regarded as human capital in this broader definition (OECD, 2011).

26. The components of human capital proposed by the OECD reflect its multi-faceted nature. For instance, they include both general and work-specific skills, both tacit and explicit ones. They cover not only the cognitive skills that were conventionally recognised by research in this field but also non-cognitive skills such as intra- and inter-personal skills that have assumed an increasingly important role in modern societies.

27. Differently from economic capital, all types of knowledge, skills, competencies and attributes are invisible. However, both human and economic capitals accumulation through investments and decline through use and obsolescence, although in different ways. For example, while economic capital will wear out through use, human capital typically grows through use and experience, while it depreciates due to lack of use, obsolescence of knowledge, population ageing and many other factors.

How is human capital acquired?

28. The overarching OECD definition also implies that human capital can be accumulated through many channels. These channels could be characterised as both *lifelong*, in terms of learning from birth to death, and *lifewide*, in terms of learning at various occasions, including within families (through parenting), schools (through formal and informal education), workplaces (through on-the-job training and work practice) and daily life (through informal learning, anywhere and anytime).

29. In a similar way, human capital investment can take a variety of forms, covering private and public sources, and be produced through market and non-market inputs. A fundamental feature that differentiates investment in human capital from that in economic capital is that almost all types of human capital investment require non-market activities, i.e. learning processes by each individual. Since such learning cannot be undertaken by anyone else than the person considered (i.e. they do not satisfy the 'third party criterion' that defines economic production), it is not regarded as a process of production according to the System of National Accounts (SNA 2008, 1.54).

30. The way that human capital is developed also depends upon a range of specific settings, which relate to cultural backgrounds, social relationships, and political, legal and institutional arrangements. For example, investment in skills takes place in many different stages of the lifecycle of individuals, while social capital (i.e. networks and norms) plays a critical role in fostering a culture of learning within society (Coleman, 1990). There is considerable agreement in applied research that the family, as well as social- and home-backgrounds, shape school outcomes, although the relative importance of the various factors is not always clear.

31. Another issue pertinent to human capital measurement, which raises both conceptual and practical difficulties, is how to distinguish, within educational expenditures, between consumption and investment. While the distinction between the two elements is conceptually clear, in practice it is not easy to verify which of the two perspectives is more relevant in any situation. In practice, most of the

activities contributing to human capital accumulation are likely to include both consumption and investment elements, as in the case of household expenses for buying clothing for students.[3]

32. Things become even more difficult when health is taken into account. Health care is recognised in Box 1 as one type of human capital investment. This inclusion reflects not only the fact that people's health conditions are a key dimension of those people's attributed that are encompassed by the notion of human capital,[4] but also because a better health status enhances an individual's learning abilities as well as job market performance. However, it is not always clear whether activities related to health care are pursued for the purpose of investment rather than consumption. For instance, doing exercises may qualify as an investment, but expenses for buying tonic foods and beverages could serve both purposes.

33. Human capital investment in any given country may also take the form of migration, with the immigration of skilled people representing an addition to the stock of human capital for the country of destination and a depletion of human capital for the country of origin of skilled workers.

What benefits stem from human capital investment?

34. Box 1 suggests that human capital investment generates both economic and non-economic benefits, which can accrue to both the person undertaking the investment and to society at large. Economic returns accruing to the individual include enhanced employability and, if the person is employed, improved earnings and career prospects; while non-economic benefits can take the form of an increase in the person's productivity in performing non-market activities (e.g. household production) or of personal benefits that are not related to production (e.g. greater enjoyment of arts and culture, higher health status and subjective well-being).

35. The benefits of human capital investment can also spill-over to other agents. At the firm level, the higher productivity of some employees, due to their higher education, may increase the performance of other workers and, hence, firms' profitability. At macro-economic level, recent evidence has highlighted the positive impact of human capital on economic growth. Further, these spill-overs are not limited to economic returns: education may make people better citizens and better parents, leading to greater social cohesion.

36. Finally, as illustrated by the dotted arrow in Box 1, there are also feedback effects, running from the benefits generated by human capital investment onto the human capital stock itself. For example, workers with higher educational attainment are more likely to benefit from further education and training. In addition, the feedback process may lead to a virtuous cycle where more education makes further learning easier and faster, and thus more efficient. At the national level, there is a long-standing debate on the direction of causality between education and economic growth. Recent studies have shown that the causality may operate in both directions, suggesting that a feedback loop may also operate at the macro level.

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[3] Due in part to this reason, there exists an additional difficulty if human capital is measured in the same way as is physical capital, i.e. to sum all expenditures made to produce the capital goods. More discussions on this methodological issue are in Section III B of this report.

[4] For example, Gary S. Becker who was among the first to use the term "human capital", viewed education, on-the-job training and health as components of human capital with consequences for earnings and economic productivity (Becker, 1993).

Implications for the measurement

37. In short, getting a full picture of each component encompassed by the broad OECD definition of human capital, of the causal links between each type of human capital investments, of the corresponding benefits and feedback loop among them, is complicated. This implies that encompassing all the elements of Box 1 into a single measure of the stock of human capital is a daunting task, which could not be accomplished in the foreseeable future. The most sensible approach is to address this task step-by-step.

38. A practical way to implement this principle of gradualism is to focus on a narrower range of elements of human capital, starting from those aspects characterised by either lower conceptual challenges or greater data availability. The option pursued in this review is to focus on formal education, as the main form of human capital investment; and on the economic returns to the individual, as the main benefits due to human capital investment. The last section of the review will discuss possible ways to move beyond these assumptions.

39. Currently, many researchers and institutions are using definitions that focus on the productive capacity of individuals. Even when accepting the broader OECD definition as a useful reference point, most of the ongoing statistical work on measuring human capital takes formal education and the economic returns to individuals as points of departure; this approach is in accordance with the principle of gradualism used in this paper.

40. The pragmatic approach advocated here has practical implications. For instance, focusing on economic returns implies that the health component of human capital will have to be dealt with separately from the education aspect of human capital. As a matter of fact, health status is sometimes considered as a specific kind of asset, i.e. as health capital (e.g. Abraham and Mackie, 2005). A framework for the systematic description of the financial flows associated with health care has been developed jointly by the OECD, Eurostat and World Health Organisation (OECD et al, 2011). Treating health as a separate type of capital does not imply that health status is irrelevant for the measurement of the 'educational' capital explored here. However, it implies that the measure of the human capital stock described here will only reflect the impact of health care activities in improving people's economic returns.

B. Measurement methodologies

A taxonomy of different measurement approaches

41. Different approaches to measuring human capital currently exist. A broad distinction is that between indicators-based approach and approaches based on monetary measures. Measures based on the indicators-based approach rely on physical measures (e.g. OECD *Education at a Glance*). These might be further divided into quantity measures (e.g. measures of educational attainment, average years of schooling) and quality measures (e.g. class size, test scores). Conversely, monetary measures of the stock of human capital include estimates based on the indirect or residual approach (e.g. World Bank, 2006, 2011)[5], as well as the direct estimates based on information on its various components. The two main types of direct measures are the cost-based approach (e.g. Kendrick, 1976) and the income-based approach (e.g. Jorgenson and Fraumeni, 1989, 1992a, 1992b).[6]

[5] Here the use of "direct" and "indirect" has only relative meaning. Unlike physical capital, human capital is invisible. Therefore, in a strict sense, all methods trying to measure it can only be "indirect".

[6] The above typology is not the only way to classify the various approaches. For instance, a distinction can also be made between parametric and non-parametric approaches to measuring human capital. The former

Advantages and disadvantages of different monetary approaches

42. Different measurement methodologies have both advantages and disadvantages. The present section reviews some of the most important advantages and disadvantages focusing on monetary approaches. Some of these pros and cons are specific to each approach, while others are common across different methodologies. In particular, all monetary approaches effectively ignore the non-market benefits of human capital investments. This implies that these approaches will tend to 'under-estimate' the value of the stock of human capital relative to an 'ideal' norm that would include a monetary estimate of these non-market benefits.

43. The ***indirect (residual) approach*** to measuring human capital is applied by the World Bank through its national wealth accounting. This approach measures the total stock of human capital as the difference between the total discounted value of each country's future consumption flows (which is taken as a proxy for total wealth) and the sum of the tangible components of that wealth, *i.e.* produced capital and the market-component of natural capital (World Bank, 2006, 2011; Ruta and Hamilton, 2007; Ferreira and Hamilton, 2010).[7] A similar approach has also been applied by Statistics Norway (Greaker et al., 2005) at the country level. While this indirect approach can be applied to a large number of countries based on limited statistical information, it has limits.[8] First, by taking as its starting point the discounted value of future consumption flows, it obviously ignores both inputs to human capital formation and the non-market benefits of various capital stocks. Second, this measure is affected by measurement errors in all the terms entering the accounting identities, resulting in potential biases in the final estimates of human capital. Third, the approach cannot explain what drives the observed changes of the stock of human capital over time, thus offering less valuable information for policy intervention.

44. Among direct measurement approaches, the ***cost-based approach*** measures human capital by looking at the stream of past investments undertaken by individuals, households, employers and governments (*e.g.* Shultz, 1961; Kendrick, 1976; Eisner, 1985). This approach relies on information on all the costs that are incurred when producing human capital. These costs include monetary outlays by each of the agents mentioned above, but can also be extended to non-market inputs (e.g. the imputed value of the time devoted to education by students, their parents and volunteers).

45. The cost-based approach is relatively easy to apply, at least when limited to market inputs, because of the ready availability of data on both public and private expenditures in formal education. The approach can also be extended to account for expenditure undertaken for in-work and adult training. However, the approach has been criticized on a conceptual ground as the value of human capital should be regarded as determined by demand and supply rather than solely by production-costs (Lee et al, 2003).

46. An additional problem with the cost-based approach is that it is hard, if not impossible, to distinguish expenditures between investment and consumption. This implies that estimates based on this approach rely on arbitrarily allocating spending between these two categories. For instance, during one's education, part of household expenditures is used for paying students' food and clothes, which could serve both consumption and investment purposes. Challenges are also involved with the choice

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involves econometric techniques (e.g. Kyriacou, 1991; Mulligan and Sala-i-Martin, 1995; Barro and Lee, 2010), while the latter does not.

7 This difference is labelled by the World Bank as 'intangible assets', of which human capital is the most important component (World Bank, 2006, 2011).

8 The World Bank work of national wealth accounting covers more than 100 countries over the decade from 1995 to 2005 (World Bank, 2011).

of the price index used to deflate historical expenditures related to human capital investment to construct a stock value based on the perpetual inventory method. Finally, the depreciation rate, which matters a great deal when constructing the stock of human capital based on this method, is usually set arbitrarily. Overall, the cost-based approach ignores a fundamental feature of the process of education, i.e. the lengthy gestation period between the current outlays for educational inputs and the emergence of human capital embodied in more competent people (Jorgensen and Fraumeni, 1989, 1992a).

47. The ***income-based approach*** measures human capital by looking at the stream of future earnings that human capital investment generates over the lifetime of a person (e.g. Weisbrod, 1961; Graham and Webb, 1979; Jorgenson and Fraumeni, 1989, 1992a, 1992b). Hence, in contrast with the cost-based approach, which focuses on the input side, the income-based approach measures the stock of human capital by looking at the output side.[9]

48. By focusing on the earning power of each person, the income-based approach values human capital at market prices, under the (strong) assumption that these prices are good signals of the value of human capital services that result from the interaction of demand and supply in the labour market. The lifetime income approach has other advantages. In particular, the extension of this approach naturally leads to an accounting system that includes values, volumes, and prices as basic elements. This opens the way to the construction of a sequence of accounts similar to those used for economic capital within the SNA (Fraumeni, 2009).

49. However, the income-based approach is not immune from drawbacks. For instance, in order to calculate expected future earnings, subjective judgements are made about the discount rate, future real income growth rate, etc. Most importantly, the valuation method of this approach has its limits. On one side, labour markets do not always function in a perfect way: hence, the wage rate used as a proxy for earnings power may exceed the marginal value of a particular type of human capital, for example where trade unions impose a wage premium for their members.[10] On the other side, several factors may impact on workers' productivity (and hence their earnings) beyond formal education: these include in-work training, on-the-job-learning, and firms' characteristics; this implies that worker's earnings overstate the contribution of formal education to human capital, leading to an 'over-estimate' of its size.[11]

50. As mentioned, the three approaches (indirect/residual, cost-based, and income-based) all refer to monetary measures. One common advantage of these measures is that they combine many

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[9] While the outputs from human capital investment are of many types (*i.e.* monetary and non-monetary, private and public), the output measured by the lifetime income approach is limited to the private monetary benefits that accrue to the person investing in human capital.

[10] Cyclical effects on the labour market may also bias estimates of the human capital stock based on the income-based approach. For example, the use of current earnings to value future labour income will imply that estimates of human capital during a recession, where real wages fall and unemployment rate increase, will be under-estimates relative to normal conditions.

[11] Abow et al. (2005), based on evidence from research based on firm-level data for the United States, conclude that "the contribution of worker and firm effects to workers earnings are roughly equal (page 167). The same authors also observe that "the unobserved component of the person effect is much more important and more highly correlated with wages than the observed component" (Abowd et al., 2008). This conclusion hence questions the assumption of the life-time income approach that individual earnings accurately reflect workers' human capital. Similarly, observations drawn from the corporate training literature suggests that productivity differentials among workers with different characteristics stem mainly for about 70% from on-the-job experience, tasks and problem solving, for about 20% from feedback and from working around good or bad examples, and for 10% from courses and reading (Lombardo and Eichinger, 1996).

different aspects that contribute to human capital in a single metric, i.e. money. In other terms, they reflect the different factors that contribute to human capital accumulation. For example, estimates based on the income-based approach allow comparing the importance of demography (the age and gender structure of the population), educational factors (the number of people with different levels of educational attainment, enrolment rates) and labour market factors (employment probabilities and earning by educational characteristics). Similarly, human capital estimates based on the cost-based approach allow comparing the relative importance of the expenditures incurred by different sectors (public administration, households, firms) and of non-market inputs (e.g. time devoted to educational-related activities by students, parents, support staff).

51. However, single measures may also hide as much information as they reveal. For example, monetary values of human capital may increase when underlying volumes are falling, e.g. when scarcity in a resource triggers large increases in its price; or when higher earnings premia for more educated workers more than offset the greater concentration of educational opportunities on a more narrow range of the population. Under most circumstances, monetary measures of the value human capital will need to be complemented by information on volumes and prices, by detailed decomposition analysis or by more specific measures based on physical indicators.

52. The ***indicators-based approach*** measures human capital through various types of educational characteristics of the population. Indicators that are often used as single proxies for human capital in the academic research include adult literacy rates (e.g. Azariadis and Drazen, 1990; Romer, 1990b), school enrolment ratios (e.g. Barro, 1991; Mankiw et al., 1992; Levine and Renelt, 1992), average years of schooling and other measures drawn from the distribution of the population across various educational attainment categories (e.g. Benhabib and Spiegel, 1994; Barro and Sala-i-Martin, 1995; Gundlach, 1995; Islam, 1995; O'Neill, 1995; Temple, 1999; Barro, 1997, 2001; Krueger and Lindahl, 2001). However, use of a single physical indicator as a proxy for human capital, though appealing for its simplicity, cannot on its own adequately measure the various dimensions of skills and competences (OECD, 2001), and sometimes poorly specify the relationship between education and the stock of human capital (Wößmann, 2003; Kokkinen, 2010). Therefore, only a wider definition can provide useful clues about where investment is most needed and where the benefits go.

53. Dashboards of indicators (such as those provided in various issues of *Education at a Glance*; or used by Ederer et al, 2007, 2011) rely on a number of statistics that, though rich in information, lack a common metric and, as a result, cannot be aggregated into an overall measure. This makes them less suitable for comprehensive comparisons of the total stock of human capital across countries and over time. Also, indicator sets do not allow comparing the relative importance of different types of capital, i.e. stocks of economic, natural and human capital (Stroombergen et al., 2002), nor assessing the relative returns to educational investments (e.g. between secondary and tertiary education) that monetary measures of human capital may do.

54. In recent years one type of indicators has attracted increasing attention in the international arena, i.e. pencil and paper test scores of people's competencies. Examples of this approach are the OECD Programme for International Student Assessment (PISA), which tests 15-16 year olds students for their cognitive skills in terms of reading, mathematics, science and problem solving; and the OECD Programme for International Assessment of Adult Competencies (PIAAC), which tests adults for their competencies in terms of literacy, numeracy and ability to solve problems in technology-rich environments.[12] These programmes provide important information for policy making and decision making.

[12] For more information on PISA and PIAAC, please visit the following websites: http://www.pisa.oecd.org/pages/0,2987,en_32252351_32235731_1_1_1_1_1,00.html; http://www.oecd.org/document/35/0,3746,en_2649_201185_40277475_1_1_1_1,00.html.

55. However, like all surveys, they are subject to survey and test limitations (e.g. with respect to sample size, range of variables included, country coverage, etc.). More importantly, since these programmes are resource-demanding in terms of both money and time required to implement, administer, process, analyse and report, they are typically undertaken with low frequency. Finally, the information generated from these programmes is not easily integrated into human capital accounts.[13]

56. To sum up, all approaches to measuring human capital have their pros and cons. One approach's disadvantage might be the other approach's advantage. There are also complementarities among these approaches. Depending upon the purpose, different approaches may be therefore be used, either individually or jointly with others. However, given the role of the System of National Accounts (SNA) in official statistics, monetary approaches, in particular the cost-based and the income-based approaches, are most likely to be used to construct human capital measures based on an explicit accounting framework. Arguably, to address issues related to growth accounting, monitoring sustainability and measuring the productivity performance of the education sector, monetary measures of human capital, complemented by physical indicators, have a key role to play.

IV. OVERVIEW OF THE LEADING INITIATIVES AND ACTIVITIES

A. Country experiences

57. Acknowledging the importance of human capital, many countries have conducted national studies trying to measure it. Most of these studies are or have been undertaken by individual researchers. While, in some cases, these studies have been conducted by statisticians working within national statistical offices, the estimates produced generally have the status of research outputs rather than official statistics.

58. This section provides an overview of national studies conducted either as part of the research activities of NSOs, or by independent researchers. This overview is based on the results of a questionnaire on national practices in measuring human capital sent to CES countries. The focus of this section is on the purpose, concept, methodology, and data sources used for measuring human capital in different countries. Drawing on the results from this questionnaire, this section also presents selected findings from national studies based on both the cost-based and the income-based approach.

Results of the CES questionnaire on measuring human capital

59. Overall, out of the 70 CES countries contacted, 46 answered the questionnaire, with 17 providing detailed answers. These include, among OECD countries, Austria, Canada, Finland, France, Germany, Israel, Italy, the Netherlands, New Zealand, Norway, Poland, Slovenia, the United Kingdom and the United States; and, among CES non-OECD countries, Liechtenstein, Romania and Ukraine. Highlights from countries responses include the following:

- Most NSOs indicated that the purpose of measuring human capital is multiple, implying that measures of human capital are undertaken to address various issues. In general, countries selecting "Measuring well-being and social progress" as one purpose of their measurement initiative also referred to the OECD definition of human capital outlined in section III A.

[13] The last point is also relevant when considering differences between parametric and non-parametric approaches to measuring human capital. Parametric approaches are frequently used in academic research; however, since they rely on econometric techniques, different assumptions and model specifications, even based on the same dataset, will typically lead to different estimates. On the contrary, non-parametric approaches avoid these problems and are more akin to the tools typically used by NSOs and other producers of human capital statistics.

However, many NSOs referred to definitions of human capital that have narrower scope, tending to focus on the economic/ dimension;

- Data sources used by NSOs to measure the stock of human capital are diverse, but almost all are available within the statistical system of each country. Many of the existing human capital estimates are in the form of research results but some NSOs published these estimates in their statistical publications and a few qualify these measures as 'official statistics'. Many NSOs reported measuring human capital on a regular basis, most of them annually;
- Only a few NSOs report that they plan to construct satellite accounts for human capital in general and for educational sector in particular. Likewise, few report having considered the possibility and potential implications of incorporating measures of the stock of human capital into the SNA;
- Most NSOs report relying on multiple human capital measures, with physical indicators and monetary measures most often applied. Among those NSOs reporting that they rely on only one type of measure, most of them declared relying on monetary measures.
- As for the specific physical indicators used, many NSOs report that they rely on conventional indicators drawn from education statistics. Very few NSOs report undertaking their own collection of indicators of the quality of education and skills, such as those undertaken as part of the OECD Programme on International Student Assessment (PISA) and Programme for the International Assessment of Adult Competencies (PIAAC);
- Among the monetary measures, the income-based approach is predominant over the cost-based and the indirect/residual approaches. Most NSOs answering the questionnaire report that they rely on only one approach, while just a few indicated using multiple approaches. The main reason provided for relying on the residual approach is its simplicity;
- The main reason indicated by NSOs for choosing the cost-based approach is data availability, applicability in the SNA, and the fact that they it does not require making assumption about the future, while the main challenges are the issues related to data availability. Some NSOs reported including in their estimates not just the costs incurred by educational institutions, but also expenditures by firms and private households. Conversely, no NSOs indicated having ever included non-market costs in their estimates of the human capital stock based on the cost-based approach;
- The main reason reported by NSOs for using the income-based approach is that it is regarded as being consistent with economic theory and with the way in which other assets (such as natural resources) are measured in the SNA. This approach is also considered to be well established and widely employed, and to be suitable for constructing a full-fledged human capital account with volumes, values and prices as basic elements. Issues related to the methodology and data availability, rather than the concept itself, are regarded as the main challenge for applying this approach. Partly due to data limitations, almost all NSOs having used the income-based approach limited their estimates to people of working age and to market activities.

60. As several NSOs appear to have developed monetary measures of the stock of human capital, the next section presents some examples for the cost-based and the income-based approaches.

Representative studies using the cost-based approach

61. The cost-based approach to measuring human capital is similar to that conventionally applied to measuring economic capital. As in the case of economic capital, the perpetual inventory method measures the stock of human capital as the accumulated value of all the expenditures concurring to its formation, which are considered as human capital investment.

62. The most well-known application of the cost-based approach is that provided by Kendrick (1976) for the United States. Kendrick's estimates are more inclusive than most other applications of this approach, as they include the cost of child rearing, spending on education and other expenditures considered as having educational value. In addition to these expenditures, Kendrick also includes the opportunity cost of student time, i.e. earnings forgone by students when studying. Following the same approach, Eisner (1978, 1985, 1988, 1989) estimated the value of the stock of human capital in the United States through a number of modifications to the US national income accounts. Both Eisner and Kendrick included in their estimates of human capital formation the opportunity cost of students' time while in school, as well as the actual costs of education undertaken by both households (e.g. costs for tuition and educational materials) and governments (e.g. costs for salaries and investments of educational institutions). However, unlike Kendrick, Eisner excluded the costs of child-rearing from the investment in human capital.

63. As discussed in Section III. B, applying the cost-based approach requires confronting several challenges. One is how to distinguish between consumption and investment expenditures. Kendrick included in human capital investments all household expenditures related to child rearing up to the age of 14, as well as half of household expenditures on health and safety, while considering the other half as consumption. Another challenge in implementing this approach is how to choose the depreciation rates when constructing the stock of human capital. Because of a lack of empirical evidence, Kendrick used for this purpose a modified double declining-balance method, while Eisner used straight-line depreciation.

64. The cost-based approach to measuring the stock of human capital was also applied in Germany (Ewerhart, 2001, 2003), while the Netherlands used this approach to measure firm-specific human capital (Rooijen-Horsten et al, 2007, 2008). Finally, within the framework of the SNA, the cost-based approach was used by the Finnish NSO to measure the human capital in an empirical analysis of the relation between human capital and economic growth in Finland (Kokkinen, 2008, 2010). Statistics Canada also plans to apply the cost-based approach, together with the income-based approach already used, and to reconcile the estimates from the two approaches.

Representative studies using the income-based approach

65. One of the main conclusions from the questionnaire responses is that several countries are currently applying variants of the income-based approach. The income-based approach has been used for measuring human capital at least since the 1960s (e.g. Weisbrod, 1961). However, it was the seminal work by Jorgenson and Fraumeni (1989, 1992a, 1992b) that spawned interests in measuring human capital by applying the lifetime income approach (also called the Jorgenson-Fraumeni method).

66. The lifetime income approach measures the stock value of the human capital embodied in individuals as the discounted present value of the expected future labour incomes that could be generated over the lifetime of the people currently living. By bringing together the influence of a broad range of factors (demography, mortality, educational attainment and labour market aspects), this approach allows comparing the relative importance of these factors and drawing useful policy implications from the estimates.

67. Table 1 presents a list of national studies that have applied this approach to measuring human capital. This list is meant to highlight the broad range of countries (11) for which these estimates exist, rather than being exhaustive of the full range of studies based on this approach.

Table 1. An overview of selected national studies applying income-based approach

Examples of national studies	*Country*	*Motivation*	*Time range*	*Main data sources*	*Population covered*	*Market/Non-market activities*
Jorgenson and Fraumeni (1989, 1992a, 1992b)	United States	New systems of national accounts, Output of education sector	1948-1984, 1947-1987	Rich data based on decades of research	Age 0-75	Both
Ahlroth, et al. (1997)	Sweden	Output of education sector	1967, 1973, 1980, 1990	Level of living surveys	Age 0-75	Both
Ervik, et al (2003)	Norway	Output of higher education sector	1995	Register data	Age 20-64	Market only
Wei (2004, 2008)	Australia	Incorporating human capital into the SNA (Stock/Flow)	1981-2001	Census data	Age 18 (25)-65, labour force/whole population	Market only
Le, et al (2006)	New Zealand	Measuring human capital (Stock)	1981-2001	Census data	Age 18-64	Market only
Gu and Wong (2008)	Canada	Human capital contribution to national wealth account	1970-2007	Census /labour force survey	Age 15-74	Market only
Liu and Greaker (2009)	Norway	Measuring human capital (Stock)	2006	Register data	Age 15(16)-67(74), labour force/ whole population	Market only
Christian (2010, 2012)	United States	Measuring human capital (Stock/Investment)	1994-2009	Rich data	Age 0-80	Both
Coremberg (2010)	Argentina	Measuring human capital (Stock)/Output of education sector	1997, 2001, 2004	Household permanent survey	Age 15-65	Market only
Li, et al. (2010)	China	Measuring human capital (Stock)	1985-2007	Household survey/Health and nutrition survey	Urban/rural, Age 0-60 (55 for female)	Market only
Jones and Chiripanhura (2010)	United Kingdom	Measuring human capital (Stock)	2001-2009	Labour force survey	Age 16-64	Market only

68. Data availability varies across national studies. For many countries, the data needed for applying the income-based approach are compiled by the researcher, with many assumptions made during the data construction process. In part due to this, and differently from the studies by Jorgenson and Fraumeni, most of the national studies listed in Table 1 focused on people of working age (typically based on exogenous age thresholds, e.g. 16 and 65) and on market activities. These limitations reflect a pragmatic way to sidestep a number of conceptual and data issues that arise when applying the full Jorgenson-Fraumeni approach. Incorporating non-market activities into human capital estimates remain controversial and focusing on working age population is more relevant for measuring a country's productive capacity (Wei, 2004; Gu and Wong, 2008; Greaker and Liu, 2008). Methodological modifications of the Jorgenson-Fraumeni methodology were also made in some of national studies. For example, to smooth the business cycle effects that affects the Jorgenson-

Fraumeni approach (which relies exclusively on current cross-sectional information), Wei (2008) applied a cohort-based estimation to simulate future earnings.[14]

69. These national studies suggest that the estimated value of the stock of human capital is substantially larger than that of economic capital, even when measures of the former are restricted to market activities. Measures of the stock of human capital based on the income-based approach tend also to exceed those based on the cost-based approach, a pattern that may reflect the fact that the former approach implicitly attributes the impact of in-work training and work experiences to formal education. When considering the whole output of the education sector as human capital investment, the value of such investment is also high compared to the gross fixed capital formation traditionally considered in the SNA. Considering educational expenditures as investment rather than consumption would significantly change our appreciation of the extent of capital formation in any given year.

70. Estimates of the value of the human capital stock based on the life-time income approach are sensitive to choices on key parameters employed in this approach, namely the real annual growth of labour income that is assumed to prevail in the future, and the rate used to discount future earnings. Growth rates of the human capital stock as well as its distribution across different groups of people are however less sensitive to the choice of these parameters. Despite many challenges, attempts have also been made to construct flow and stock values of human capital in a systematic way by applying this approach (Wei, 2008, Gu and Wong, 2010b).

B. International initiatives

71. Developing comparable measures of human capital has been pursued by several researchers and international organisations. One example of the research in this field is represented by the work by Barro and Lee (1993, 1996, 2001, 2010) to construct an international dataset of educational attainment, school years and schooling quality as proxies for human capital, based on census and survey information compiled by UNESCO and other sources.

72. Among international organisations, developing comparable measures of human capital has been one of the priorities of the OECD. Much OECD work in this field has aimed at developing a better understanding of how teaching and learning outcomes can be improved in the classroom, and helping policy makers to learn from each other's successes and failures. A large range of physical indicators are published in the OECD flagship publication *Education at a Glance*. Recently, the PISA has attracted much attention in the international arena. The OECD also has a long tradition in the field of measuring human capital beyond formal education. Earlier works include the investigation of further education and training and of its impacts on the job market (e.g. OECD, 1994). To deepen the understanding of the determinants of learning, attempts have been made to develop a framework for rethinking human capital information and decision-making; based on this framework, the OECD has analysed obstacles to measurement, and suggested methods for improvement (OECD, 1996).

73. In response to the growing interest in human capital, an OECD report in 1998 proposed an initial set of indicators of human capital investment based on existing data. The report identified areas where significant gaps in internationally comparable data existed, and the cost of development of data collection for new measures and performance indicators (OECD, 1998). Building on the 1998 report, a later report (OECD, 2001) extended the OECD definition of human capital with a view to: i), describe the latest evidence on investment in human capital and its impact on economic growth and well-being; ii) clarify the more novel concept of social capital; and iii) identify the roles of human and social

[14] For more detailed discussions on the technical issues, besides the conceptual, methodological and data issues, in national studies that applied the lifetime income approach to measuring human capital, see Liu (2012).

capital in realising sustainable economic and social development. This report was an input to the OECD projects on economic growth and sustainable development (OECD, 2001).[15]

74. Since then, the OECD work on human capital has continued along two lines:

- To extend the measurement of students' competences in schools (PISA) to those of adults (PIAAC). In 2011, the PIAAC was launched with first results expected to become available in 2013. The PIAAC programme also links with the previous OECD work on the International Adult Literacy Survey (IALS);
- To identify the common methodology and data requirements for building human capital accounts. In cooperation with a number of national statistical agencies, a project was launched in 2009 by the OECD Statistics Directorate to build monetary estimates of human capital for international and inter-temporal comparisons. Results from this project, summarised in Liu (2011), show the feasibility of applying the lifetime income approach to measuring human capital for comparative analysis, based on data that are currently available within the OECD statistics system.[16]

75. Beyond the OECD, many other activities on measuring human capital in the international arena have taken place. These include the following:

- The UNECE/OECD/Eurostat Working Group on Statistics for Sustainable Development has worked to develop a broad conceptual framework for measuring sustainable development with the concept of capital at its core, and to identify a small set of indicators that might be used for international comparisons (UNECE, 2009). The forthcoming report of a new UNECE/OECD/Eurostat Task Force on measuring sustainable development will include a specific section on human capital measurement;
- The UNDP Human Development Index (HDI), which aims to illustrate the state of development of a society, is a composite index that combines measures of average achievements in a country in three basic dimensions of human development, i.e. health, education and knowledge, and standards of living. The 2012 Human Development Report includes two measures of education and knowledge, namely school attainment, expressed in terms of the number of years of schooling, and school-life expectancy;[17]
- The EU KLEMS project has constructed a database (the EU KLEMS Growth and Productivity Accounts) for empirical research of economic growth. Although the primary aim of the EU KLEMS database is to generate comparative information on productivity trends, the data collected are also useful in other contexts. Thanks to its extensive country and industry coverage, potential applications of the database vary widely;

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15 To communicate the findings from OECD research to a wider audience, one book of the OECD Insights series summarised the work on human capital undertaken by the OECD in the message that "how what you know shapes your life" (Keeley, 2007).

16 Other relevant streams of recent OECD on human capital are the 'Social Outcomes of Learning project', the OECD Skills Strategy; work on intangible assets undertaken as part of the OECD work on New Sources of Growth; and the OECD Better Life Initiative. For more on these streams of work see the information on the following websites:
http://www.oecd.org/document/9/0,3746,en_2649_39263294_33706505_1_1_1_1,00.html
http://www.oecd.org/dataoecd/58/28/47769132.pdf http://www.oecd.org/dataoecd/60/40/46349020.pdf
http://www.oecd.org/document/0/0,3746,en_2649_201185_47837376_1_1_1_1,00.html

17 More information is available at http://hdr.undp.org/en/.

- The World Bank developed comprehensive wealth accounts, which include estimates of human capital, for more than 120 countries, to answer the question "Where is the Wealth of Nations?" (World Bank, 2006). Beyond the snapshot of national wealth at a point in time, the World Bank extended the accounting of wealth over the decade from 1995 to 2005 and provided the first inter-temporal assessment of global, regional, and country performance in building comprehensive wealth and achieving sustainable development (World Bank, 2011);

More recently, the UN "Inclusive Wealth Report", undertaken by the UN University International Human Dimension Programme and the UN Environment Programme, presented estimates of inclusive wealth (the sum of manufactured, human and natural capital) for 20 countries; in this approach, human capital is captured by measuring the population's educational attainment and the additional compensation over time of this training (UN-IHDP, UNEP, 2012).

C. Lessons learned from national and international initiatives

76. The concept of human capital has evolved over time, from a narrow scope focusing on cognitive knowledge, working skills and economic returns associated to them, to today's more comprehensive definition that embraces a broader range of attributes of individuals and of benefits stemming from it. The human capital concept defined by OECD (2001) has received wide acceptance.

77. However, implementing this overarching definition raises significant measurement challenges. The multi-faceted nature of human capital, the complex links between the various types of human capital investment and the diverse benefits that it delivers make it impossible to find a one-size-for-all measure of human capital, given current knowledge in this field. By necessity, the measurement of human capital has to be undertaken step by step.

78. Currently, many countries are using the definitions of human capital that focus on the productive capacity of individuals. Even among the countries that refer to the wider OECD definition, most of their measurement initiatives focus on formal education and on the economic returns accruing to individuals, rather than to human capital in general and to all the benefits (economic and non-economic, private and collective) from human capital investment. Given the current state of knowledge, this seems to be a practical and reasonable point of departure.

79. Following from this more narrow focus, measurement activities in this field have aimed to develop summary indicators providing simple proxies for human capital (e.g. average years of schooling, educational attainment). While the data requirements of such indicators are limited, so is the scope of these proxies. As a result, in more recent years, human capital measurement has moved in the direction of quantifying the knowledge and cognitive skills of students of adults after they left school. In more recent years, the challenge of developing monetary measures of human capital in a systematic way has received increasing interest.

80. All the approaches to measuring human capital described above have advantages and disadvantages. Depending on the purpose, different approaches can be applied individually or jointly to address different issues. However, the monetary measures generated from the cost-based and income-based approaches should arguably have core status. One reason for the increased interest in monetary measures of the stock of human capital is that these measures can be compared with those for economic capital based on the SNA, whose construction is one of the main tasks of national statistical offices. Steps in the direction of broadening the 'capital boundary' of the SNA have been taken in recent years following the decision to treat research and development as a 'produced asset'.[18]

[18] SNA 2008 recommends that research and development expenditures be values at either the contract price or cumulated costs. Increased for changes in prices and reduced because of consumption of these fixed assets over their asset lie.

The development of satellite accounts for human capital (or education) is a first step in the direction of a similar extension of the capital boundaries of economic accounts with respect to human capital.

V. MAIN ISSUES AND CHALLENGES AHEAD

81. Despite the fact that an increasing number of countries have applied, or are planning to apply, the income-based approach to measuring human capital, several issues and challenges remain. These challenges relate to both data availability and to methodological issues, both of which are discussed below. One way of bringing together the range of information in this field, and to explore the source of the differences between various approaches, is to construct satellite accounts for human capital or education, an option that is also described in this section.

A. Data availability

82. The data needed by the income approach are currently either not available for some countries or are not in a form suitable for direct use. Based on the OECD experience in constructing monetary estimates of the stock of human capital (Liu, 2011), several issues stand-out:

- First, the quality and sources of earnings' data cross-classified by different characteristics of workers vary significantly across countries. Data may refer to different earnings concepts (hourly and weekly earnings in most cases, annual and monthly earnings for some countries) and may include different elements of the remuneration packages of workers. In some cases, data on earnings refer only to the main job while in other countries they may also cover secondary jobs and other remunerated activities. Finally, earnings data for different countries typically refer to different categories of educational attainment, and may be collected as either point estimates or in the form of earnings brackets.
- Second, despite the great progress accomplished in collecting harmonised educational statistics, there remain issues with the quality of data on school enrolment and graduation rates, as definitions and classifications are not always comparable across countries, due for instance to differences in educational systems and in ways of counting students (e.g. students who repeat the year, students who graduate for a second time, etc.).
- Third, human capital estimates would ideally require data on survival rates broken down by education. While some national estimates exist, and they highlight large mortality differentials by socio-economic characteristics, these breakdowns are not available for all countries and they are rarely comparable across countries. More generally, mortality statistics by educational level are not compiled through common standards across OECD countries, and in several countries they simply do not exist (OECD 2011).

83. More generally, constructing estimates of human capital based on the income-approach requires that data from a range of sources – e.g. earnings statistics, population census, labour force surveys, mortality records – are integrated and harmonised to meet the requirements of human capital accounting.

B. Methodological issues

84. Besides data issues, several methodological challenges also need to be addressed. First, most human capital estimates currently available rely on the assumption that cross-sectional earnings data are good predictors of future cohorts' earnings. However there is ample evidence that cohort effects are typically large. This suggests that it would be appropriate to use longitudinal earnings data that disentangle age and cohort effects, and that make it possible to account for cohort-specific factors. Similarly, it would be important to separate wage premia due to educational attainment from those due to adult-training, on-the-job learning and other firms' characteristics, as failure to do so may lead to

overstate the educational contribution to human capital. With respect to labour market indicators (e.g. employment rates and earnings), it is also important to separate business cycles effects that distort comparisons (e.g. by depressing earnings or employment rates for different categories of workers during a recession).

85. A further difficulty when applying the lifetime income approach relates to the choice of some of the key parameters required by the method, such as the expected real growth of labour income in the future, the discount rate and the price deflators used for temporal and country-comparisons. While assumptions on these parameters are currently left to the discretion of researchers, their choice would ideally require further theoretical and empirical backup: clear guidance in each of these fields is clearly needed. Similar challenges confront the cost-based approach with respect to the choice of depreciation rates and price deflators.

86. Perhaps the biggest challenge for developing monetary measures of the stock of human capital is represented by the large discrepancies between estimates of the value of the stock of human capital based on the income-based and the costs-based approaches. These discrepancies should be better understood and reconciled. One way to address this challenge would be to apply the two approaches simultaneously, which would offer an opportunity to identify the main factors accounting for the differences and to reconcile the two methods. Satellite accounts could be used for such purpose, as they would allow linking stock and flow measures of human capital in a fully-fledged accounting system which is consistent with rest of SNA. The next section discusses in more details the rationale and feasibility of developing human capital satellite accounts.

C. Satellite Accounts for Human Capital

87. Currently, both the investment and the stock of human capital are considered to fall outside the boundaries of the SNA 2008. This is because, on one side, human capital investment is considered as an activity that cannot be delegated to a third party, the basic criterion used to define 'production' in the SNA; and, on the other side, because ownership of human capital is hard to ascertain in a legal sense since human capital is embodied in each individual and cannot be sold or transferred to others (with the partial exception of the offspring). Extending the production and asset boundaries of economic accounts to incorporate human capital investment would change the SNA fundamentally, and the construction of a satellite account for human capital is one way in which these objectives could be pursued. Box 2 describes basic principles underlying the construction of satellite accounts according to the SNA 2008.

88. Satellite accounts for human capital would describe in a coherent framework the relation between the different aspects of the education and training system, while preserving a link to the core accounts of the SNA. However, no common conceptual framework for human capital satellite accounts currently exists. Some countries have developed basic satellite accounts of education focusing on the services provided by the formal education system[19]; while others (e.g. Italy) are in the process of developing them.[20]

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[19] The French Ministry of Education has produced satellite accounts for education since 1980. These are based on the input approach, and aim to provide a systematic description of the financial flows related to the consumption of educational services in the French system. These accounts tabulate expenditures to provide information on how much is spent; who is undertaking these activities; who is financing them; and who benefits from them. Consistency with the central framework of the national accounts is ensured by linking the concepts of the satellite account and the concepts of the SNA central framework, and the definitions of expenditures in the satellite account and of output in the central framework. (MENJVA, 2010). Similarly, the Australian Bureau of Statistics has developed experimental measures of the value of the human capital stock. The approach is an adaptation of the JT method, and focuses on human capital

Box 2. Basic principles of satellite accounts

The goal of satellite accounts is to supplement the main aggregates of the central framework of the SNA with measures that give a different picture of the economic process. Satellite accounts are frameworks designed to expand the analytical capacity of the core SNA accounts without overburdening them or interfering with their general-purpose orientation. Satellite accounts organize information in an internally consistent way that suits the particular analytical focus at hand, yet they maintain links to the existing national accounts. They can add detail or other information about a particular aspect of the economy, for instance integrating monetary and physical data. Or they can arrange information differently, by cutting across sectors to assemble information on both intermediate and final consumption. For example, satellite accounts could gather business expenditures on training (treated as intermediate consumption in the core accounts) and education–related expenditures by households and government. They can also rely on different classifications than those used in core accounts. The SNA distinguishes between two types of satellite accounts.

First, those created by rearranging items in the central SNA classifications, with the possible introduction of complementary elements. This type of accounts is typically applied to specific fields, and may be regarded as an extension of the sector accounts in the core set. Satellite accounts of this type may differ from the core accounts due to alternative treatments of ancillary activities, but do not depart for SNA concepts in a fundamental way. The main reason for developing such a satellite account is to encompass all the flows recorded in the core accounts for the sector of interest

Second, those based on concepts that depart from those used by the SNA. The sorts of variations in basic concepts may include a different production boundary, an enlarged concept of consumption or capital formation, an extension of the scope of assets, etc.. This type of analysis may involve experimental methodologies, changes in classifications, and will give rise to complementary aggregates, the purpose of which is to supplement the central system.

The terminology and concepts associated to satellite accounts reflect the experiences of the countries that have constructed them. These accounts aim to answer different types of questions. Who is producing? What are the products stemming from these production processes? What are the inputs used in production? Who is financing these production activities? What are the returns from these expenditures? Who is benefiting from them? Satellite accounts present information in ways that differ from the core accounts in terms of definitions, classifications, and accounting conventions, in order to answers some of the questions listed above.

89. In its basic form, a satellite account of this type would comprise detailed information on all the financial transactions recorded in the core accounts that pertain to the educational sector, distinguishing transactions by *spending, production and financing*. These transactions could be further broken down into various levels and subgroups (production units, financing units, etc) and by sector of the educational system (e.g. primary education, secondary education, etc.). In practice, education satellite accounts of this type consist of the three sets of tables on spending, production and financing, disaggregated into a finer level of detail. This type of satellite account informs on who is financing and who is producing educational services; on human capital investment in different products, activities and from different institutional sectors; and on the amount of investment by its main use (intermediate consumption, final consumption, export of educational services). Construction of this type of satellite account requires making choices on the following aspects:

formed through investment in post-school education and working experience for Australia; the goal is to estimate human capital flows and to integrate them flows with the corresponding changes in stocks (Hui, 2008).

[20] The Italian NSO (ISTAT) is developing a strategy to measure human capital stocks and to advance towards the construction of a satellite account on human capital (DiVeroli and Tartamella, 2010). Bos (2011) details a proposal to construct a satellite account for the Netherlands, based on an input approach and focused on the supply of human capital.

- Defining the boundaries of the educational sector (e.g. formal education, in-work training) and the various activities connected with the production of human capital (e.g. teaching; tutoring, parenting, nurturing, etc.);
- Identifying categories of beneficiaries of human capital investment (beyond the standard institutional categories of the SNA such as government, households), i.e. resident versus non resident households, household with different characteristic;
- Identifying the units financing investment in human capital (i.e. government, non-financial corporations, financial corporations, non-profit institutions serving households and households).

90. Building satellite accounts of this type that are comparable across countries would require making choices on the issues listed above, as well as compiling information based on harmonised criteria. While most educational statistics are now based upon common standards and definitions (e.g. levels of education are classified through the ISCED 97 methodology; statistics on beneficiaries and funders are collected through the OECD-Eurostat-UNESCO questionnaire), there is much heterogeneity with respect to the detailed breakdown available in various countries. Data sources such as the OECD Educational dataset could provide a starting point to gather the information needed to support the construction of basic satellite accounts of education for OECD countries.

91. A more ambitious approach to satellite accounts is that described in Abraham et al. (2005). The basic idea of these satellite accounts is that formal and informal educational services as well as training are seen as a production process, where people transform inputs (teacher's time, parenting time, etc.) into outputs (cognitive and non cognitive skills). The separate recording of inputs and outputs would allow going beyond the standard conventions that value the production of the educational sector in terms of the costs of inputs used in production and that consider expenses incurred in purchasing such inputs as a form of consumption rather than investment). Human capital resulting from long-life accumulation of skills would hence be considered as an asset subject to depreciation and revaluation.[21] These basic principles may constitute the core conventions of satellite accounts that aim at providing independent estimates of the inputs and outputs that enter human capital production and at estimating productivity of human capital.

92. In practice, countries may decide to develop satellite accounts with varying levels of complexity, opting for a more or less broad definition of human capital and for a more or less exhaustive inclusion of the inputs and outputs associated to human capital investment. In general inputs would be estimated through the cost-based approach, while outputs might be estimated through the income-based approach or other pricing methods that are independent on human capital inputs.

93. The key distinction for constructing this type of satellite accounts is that between market and non-market inputs, on one side, and market and non-market outputs, on the other. Measuring non-market inputs and outputs pose additional challenges, as values are not directly observable. Abraham et al. (2005) suggest the following list of inputs and outputs:

- Market inputs include paid labor (teacher and support staff), materials (books, etc), fixed capital (school buildings, equipments, etc). These inputs may be purchased by both private and public sectors (a non-market producer). While evaluating these inputs is not trivial, the SNA already provide this type information, especially for current expenditures, while information on capital spending and depreciation would be more challenging to compile.

[21] One implication of this approach for core SNA would be that outlays for education and training (or, at least, part of them) should be considered as capital formation in human capital assets (as opposed to final or intermediate consumption, as they are at the moment). In practice, developing satellite accounts for human capital does not entail changing the status of educational expenditures in the SNA.

Information on market and government inputs could be compiled by spending units, production units and financing units – as discussed in the case of basic satellite accounts;

- Non-market inputs include volunteer labor, parent and student time, but also inputs to informal learning activities (e.g. participation into cultural events) and social capital. Measuring non-market inputs raises two challenges, i.e. measuring the quantity and the price of these inputs. With respect to the former, time-use surveys are a good source for collecting information on the amount of time devoted to learning activities, while pricing of these non-market inputs could be done through either the opportunity- or the replacement-cost methods (see Abraham et al., 2005 for a discussion of these two methods in the case of education). Including other types of non-market inputs is significantly more challenging. Estimating non-formal learning would require information on time spent on cultural activities or reading books, information which is sometimes available in time-use surveys, but also distinguishing between activities that increase skills and those undertaken for simple entertainment. Even more challenging would be to include in the accounts monetary measures of the contribution of social capital to skills formation, When considering human capital as a lifelong asset, the investment undertaken after completion of studies, notably in the labour market, should also be considered: this would entail including training activities but also estimating depreciation (e.g. due to long-term unemployment) or revalorization of human capital;
- Market output refers to the flow of economic benefits that stem from the skills and competencies embodied in each person that result from formal and informal learning process and that are sold on the market against compensation. While different methods exist for evaluating educational market outputs, the income-based approach for valuing the stock of human capital appears as the natural option. Differently from the input measures included in these accounts, measures of the flow of market output would need to be derived from estimates of the changes in the stock of human capital based on the income-based approach;
- Non-market output includes the non-monetary benefits delivered by human capital investment. These broader benefits accrue to individuals privately but also to society at a large. Private non-market benefits include better health status and higher longevity, civic awareness and participation, job quality and job satisfaction, social connections, subjective well-being and personal security. Public non-market benefits to society as a whole include higher productivity, lower social spending, higher public health and safety, and stronger social inclusion. Measuring this wider range of benefits is certainly much more challenging: while the evidence on the importance of the non-monetary benefits is robust, it comes in the form of estimates showing that, when controlling for a number of other factors, education has a positive impact on these various components of well-being, i.e. higher educated individuals have higher probability of experiencing a positive well-being outcome. This implies that well-being benefits to education are not quantified through a monetary metrics; it would hence be necessary to find appropriate prices for incorporating these benefits in a satellite account of human capital. Pricing methods for non-market outcomes exist (Abraham et al. 2005, and Schreyer 2010) but they are far from being consensual as they require many arbitrary assumptions as well as a relative large set of data.[22]

[22] One pricing method that could be considered is a more sophisticated version of the income-based method, based on the incremental earnings brought by higher well-being (e.g. the higher salary due to higher health status, higher job satisfaction, higher subjective well-being). Another possibility would be to estimate private and public returns to education by applying the standard internal rates of returns methodology to non-market benefits (e.g. considering the lower medical expenditures that an individual or society at large incurs in as a result of higher health status due to higher education).

VI. CONCLUSIONS AND RECOMMENDATIONS

94. In recent years, both individual researchers and organisations have developed experimental measures of the stock of human capital in monetary terms. Measures of this type allow comparing the stock of skills and competencies embedded in people with the stock of other types of assets, and to assess the relative contribution of a range of factors (demographic, education and labour market) to the evolution of human capital. While there is broad recognition that the benefit of human capital are much broader than the economic returns to individuals who have invested in it, there is also shared agreement that a gradual, step-by-step approach, which starts from these economic returns, is the only option for putting in place comprehensive accounts in this field. Even if limited in terms of the range of benefits considered, the policy implications of such accounts for the measurement of human capital are potentially large, as they imply that expenditures related to human capital formation should be considered as a form of investment rather than consumption.

95. While both the cost-based and the income-based approach have been used to derive monetary measures of the stock of human capital, most of the NSOs who answered the questionnaire undertaken to support this in-depth review expressed a preference for the latter. Recent international experience in this field also suggests the feasibility of producing this type of measures based on the information that is already available within the statistical system of CES countries, even if the scope for improvements in terms of consistency and comparability of the underlying data remain significant (Liu, 2011). More importantly, the two approaches to estimating monetary values of the human capital stock should not be seen as alternatives, but rather as complements within a more comprehensive information system. Such comprehensive system could be described through human capital (or educational) satellite accounts. Obviously, data requirements and methodological issues to be confronted in the construction of these satellite accounts become more challenging as the scope of these accounts increases.

96. On this background, the authors of the stock-taking report propose that:

- Studies be carried out to investigate in more detail the discrepancies between the estimates of the stock of human capital based on the cost and the income approach.
- Initiatives be undertaken to influence the type of data that are collected internationally, so as to allow improving the quality of these monetary estimates of the stock of human capital.
- A group of experts be established to construct experimental satellite accounts for human capital, based on common methodologies and common view on the ambition of such accounts.
- Work be pursued to estimate non-economic returns to human capital, with the objective of incorporating these estimates in more sophisticated types of satellites accounts in the future.

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ANNEX I. COUNTRY ANSWERS TO THE QUESTIONNAIRE PREPARED FOR THE STOCK-TAKING REPORT ON MEASURING HUMAN CAPITAL

97. The questionnaire was sent to members and regular observers of the OECD Committee on Statistics by the OECD Secretariat, in February 2012; and to the non-OECD CES members by the UNECE Secretariat, in March 2012. The CIS Statistics Committee provided the Russian translation of the questionnaire. The results from the questionnaire are summarised in two tables:

- Annex Table 1 gives information on whether or not National Statistical Offices from different countries responded to the questionnaire; for countries that answered the questionnaire, the table summarises their responses to general questions and their overall comments;
- Annex Table 2, describes the detailed answers provided by the 17 countries that provided richer information.

98. As of May 2012, out of the 35 members (34 countries plus European Union) and 5 regular observers of the OECD Committee on Statistics (CSTAT), 27 had provided replies to the questionnaire (25 responses from CSTAT members, and 2 from regular observers). Among these 27 countries, 11 (the Czech Republic, Estonia, Hungary, Japan, Portugal, Spain, Sweden, Switzerland, Turkey, the European Union, and Brazil) reported that they did not compile any estimate of the total stock of human capital, and had no plan to do it in the near future. Two countries (Germany and New Zealand) reported that they do not plan to undertake measures of human capital in the near future but they provided some information about their work in this field;

99. Lack of human and financial resources, and low priority due to lack of specific demands at both the domestic and international level were the main reasons mentioned by countries that do not undertake any measurement in this field. However, some of these countries reported that they recognised the importance of human capital measurement for economic and policy analysis, and indicated that they might address it in the longer term. As regards the specific factors accounting for the current resource constraint, many NSOs referred to the ongoing implementation of SNA 2008 and/or ESA 2010.

100. Overall, 15 members and regular observers of the OECD Committee on Statistics provided answers to the detailed questions in the questionnaire. These are Austria, Canada, Finland, France, Germany, Israel, Italy, the Netherlands, New Zealand, Norway, Poland, Slovenia, the United Kingdom and the United States), as well as Romania (regular observer). One NSO (Mexico) stated that they planned to incorporate human capital measurement into their work in the near future. When answering the question of whether there is any other government-sponsored group in your country makes/will make human capital estimates, six countries reported “No” and three countries “Yes”.

101. As of May 2012, the UNECE Secretariat had received replied from19 out of 30 non-OECD countries who are members of the CES. Among them, 2 countries (Bosnia and Herzegovina, Bulgaria) answered that they had no information to fill in the questionnaire; 10 countries (Croatia, Cyprus, Georgia, Latvia, Lithuania, Montenegro, Serbia, Armenia, the Russian Federation and Tajikistan) stated that they did not measure human capital, and had no plan to do it in the near future. The main reasons provided were lack of an agreed methodology, low priority and tight resources.

102. Another 6 countries (Albania, Azerbaijan, Belarus, Liechtenstein, Mongolia, and Ukraine) indicated that they plan to measure human capital in the future, and some of them have plans already in place. Among these, Ukraine stated that it is currently implementing human capital measures. Liechtenstein provided almost complete answers to the detailed questions, although these answers referred to general measurement of education, which is likely to measured also by other countries, including those who did not complete the questionnaire or answered that they did not measure human capital. The former Yugoslav Republic of Macedonia did not reply to the general questions, while providing some general comments and answers to part of detailed questions, while Ukraine indicated that a government-sponsored group in the country undertakes estimates of the human capital. Answers from Liechtenstein and Ukraine, who provided more complete answers to the detailed questions, are combined with those from the 15 CSTAT members and regular observers into Annex Table 2.

103. Some of the key findings from the responses presented in Table 3 are detailed below:

- *Purpose of measurement*. More countries report measuring human capital for the purpose of "measuring well-being and social progress" (7 countries) or of making "education related policies" (7 countries), than for either "growth accounting/productivity analysis" (4 countries), "national wealth accounting" (3 countries), "satellite account construction" (5 countries), or "sustainability assessment" (6 countries), though the differences between the numbers are minor. The majority of countries (11) indicated multiple purposes;
- *Concept of human capital*. There number of countries selecting each of the three concepts of human capital listed in the questionnaire was approximately the same (7 in the case of "skills and knowledge that people acquire"; 6 in the case of "the productive capacity embodied in individuals", and 7 in the case of "the knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being", Annex Table 1). Since the third definition of human capital includes more dimensions than the other two, countries choosing this concept are also those indicating "measuring well-being and social progress" or "sustainability assessment" as the main purposes for measuring human capital. Only 3 countries chose multiple concepts for different research topics;
- *Data availability*. Almost all countries (16) indicated that data required for human capital measurement are available within their institutions, and the most of them (12 countries) reported using multiple data sources;
- *Frequency of human capital measures*. Nine countries reported that they undertake human capital measures on a regular basis, most of them (7 countries) annually;
- *Status of the estimates*. Eight countries qualified their estimates of human capital as "research results only", although seven of these countries have included these estimates in their statistical publications; five countries qualified these estimates as "official statistics". Almost all countries (14) have references to their estimates;
- *Satellite Accounts*. Only a few countries reported planning to construct satellite accounts for human capital in general (3) and for educational sector in particular (4). Likewise, only 5 countries reported having assessed to some extent the possibility and impacts of incorporating human capital measures into the SNA;
- *Nature of human capital estimates*. Thirteen countries reported that they compile physical indicators of the quantity of education and skills, while 6 countries reported compiling physical indicators of the quality of education and skills. Conversely, twelve countries reported that they applying monetary measures. Overall, most countries (12) indicated that they applied multiple measures. However, among the five countries that reported using only one measure, four indicated that they rely on a monetary measure;

- *Physical indicators of the quantity of human capital*. The indicator "distribution of the population by educational attainment categories" was selected by all the (13) countries that reported compiling "physical indicators of the quantity of education and skills"; in addition, six countries reported that they compile measures of the "expected length of education for students currently enrolled", while seven countries indicated that they provide estimates of "average years of schooling";
- *Physical indicators of the quality of human capital.* Only two countries reported that they planned to use the results from PISA and PIAAC to complement their human capital estimates, while another two reported that they had other country-specific quality measures;
- *Monetary measures of human capital.* Among the (12) countries indicating that they compile such measures, eight reported using the income-based approach, three that they used a cost-based approach and two that they used a residual approach. Most countries (8) selected only one approach, while two countries reported using several types of monetary estimates, serving different purposes;
- *Reasons for choosing the cost-based approach*. The main reasons reported for choosing the cost-based approach are "availability of data", "applicability in the SNA core accounts", and "no imputations needed for uncertain future returns". Conversely, the main challenges faced when implementing this approach are issues related to data availability, although one country also mentions the concept issue as well. In terms of scope, two countries reported including in their cost-based estimates of the stock of human capital the expenditures undertaken by firms, one country included only the costs of formal education and another country included expenditures by private households. No country indicated having ever included non-market costs in these estimates;
- *Reasons for choosing the residual approach.* "Simplicity" is the main reason given by the few countries who reported relying on the residual approach. The main reported challenges with applying this approach were more issues related to data availability, though conceptual and methodological issues were also mentioned;
- *Reasons for choosing the income-based approach.* Many countries indicated as reasons for preferring this approach that regarded it as consistent with the economic theory, with the way that other assets (such as natural resources) are estimated in the SNA, that it is the well established and widely used, that it can be linked to productivity analysis, and that it can used for constructing human capital accounts with volumes, values and prices as basic elements. Some countries also mentioned data availability as one reason for choosing this approach. Conversely, most countries relying on this approach (8) reported as main challenges "methodological issues" (7), "data issues" (5 countries) and "conceptual issues" (2). Considering the scope of estimation, except one, all countries made estimates that were limited to people of working age and to market activities only;
- *Plans to use other approaches.* When asked whether they planned to use other approaches than the one that they had currently chosen, almost all countries (except one) reported either "No" or "Not clear".

Annex Table 1. Country responses to general questions

Country	Responded to the questionnaire?	PART A	PART B			PART C
		A. Does/Did your institution compile any estimate of the total stock of human capital?	B1. Does your institution plan to measure human capital in the future?	Reasons if No/Plans if Yes (to the question B1)	B2. Is there any other government-sponsored group in your country which most likely makes/will make estimates of human capital?	Comments and Suggestions
CSTAT Members and Regular Observers (collected by the OECD)						
CSTAT Members (35)						
Australia	No					
Austria	Yes	Yes				
Belgium	No					
Canada	Yes	Yes			Bank of Canada, Finance Canada, Human Resource and Skill Development Canada, Treasurey Board	
Chile	No					
Czech Republic	Yes	No	No	Lack of resources, none of our priorities		
Denmark	No					
Estonia	Yes	No	No	Lack of resources		
Finland	Yes	Yes	Yes	There is a possibility for continuing the work but it depends on possible funding of such work.		The assessment of human capital referred to here includes multiple approaches: The number of enrolled students each time is used as physical school attainment information, the volume of education expenditure attached with the cohorts enrolled at each point of time is used for quality adjusting the human capital in the number of enrolled in each type of education. Finally, in the labour productivity analysis the human capital (H) including the components mentioned of the working age population is attached with the labour input (H/L). This is used for quality adjusting the hours worked in the economy ([H/L] * L). This structure ([H/L]*L) is suggested for human capital in a number of modern economic growth theories (see e.g. Barro and Sala-i-Martin: Economic Growth, 1999.) In the proposed approach other monetary inputs for enhancing hours worked, e.g. health, social expenditures or expenditures by firms and households on education could of course be similarly taken into account. In the study referred to here, the aim was to carry out a long run analysis for the whole 20th century. Because of Yescomparability with the typical human capital proxies, the expenditures on formal education in Finland were used for the whole 20th century. Yet, the exponential growth of labour compensation could be explained by human capital by education together with hours worked.
France	Yes	Yes				The questionnaire is ill designed since it starts with a question (do you compile any estimate of the stock of human capital ?) and two modalities "yes" or "no". If "no" we are requested to go to Part B, without filling out Part A. Things are not as clearcut as that. To make it short, we do not compile "estimates of the total stock of human capital" as such, but we have carried out some background works related to part of the issues raised in the questionnaire.
Germany	Yes	No	No	Other priorities, especially changes to SNA 2008/ESA 2010	Institute for Employment Research, at least in the past (see A5)	Although German National Accounts is not engaged in measuring human capital we are interested in this topic. That's why we have filled in this questionnaire as far as possible.
Greece	No					
Hungary	Yes	No	No	Lack of human and financial resources. Neither domestic nor international specific demand on this issue.		Some data are available related to different aspects of human capital: questions A8, A9, A10
Iceland	No					
Ireland	No					

Country	Responded to the questionnaire?	PART A	PART B			PART C
		A. Does/Did your institution compile any estimate of the total stock of human capital?	B1. Does your institution plan to measure human capital in the future?	Reasons if No/Plans if Yes (to the question B1)	B2. Is there any other government-sponsored group in your country which most likely makes/will make estimates of human capital?	Comments and Suggestions
Israel	Yes	Yes	Yes	The measure will be used in satellite accounts, but the construction of these accounts are only planned to start in the coming year	No	
Italy	Yes	Yes				
Japan	Yes	No	No	We have many other issues to be tackled, such as introduction of the SNA08		N.A.
Korea	No					
Luxembourg	No					
Mexico	Yes	No	Yes	It is necessary to incorporate human capital measurement into well-being indicators. This action would take advantage of the results of source data instruments such as the National Poll of Employment, of Wages, of Technology, of Manufacturing Training, as well as the National Poll on Household Income and Expense, the National Poll on Expenditures, the National Poll on Use of Time and the National Poll on Occupation and Employment. Furthermore, in the middle term there is a interest on developing human capital indicators through a satellite account that may allow to integrate them into the central SNA framework.	The following government entities: Secretariat of Social Development, National Commission for Social Development Policies Assessment, National Council for Science and Technology, National Council for Population, and the Deputy Secretariat of Higher Education of the Secretariat of Public Education.	We consider of great importance the making of a technical document on the subject that allows strengthening the work on human capital indicators, on its methodological and practical issues. This technical document should allow a greater use of these indicators, in order to integrate them in the SNA, through satellite accounts of human capital and education.
Netherlands	Yes	Yes				I did not consult my colleague working with the residual approach; so if you want more information in these areas, I will consult him at your request.
New Zealand	Yes	Yes	No	Statistics NZ has the intention to develop measures/indicators related to human capital in the broader frame of sustainability and living standards. However, these measures are currently not in development and will not be ready during the next 5 years.	No	
Norway	Yes	Yes	Yes	We expect to continue the national wealth accounts, with human capital as a residual. Further work on human capital will depend on external funding.	No	
Poland	Yes	Yes	Yes	We are interested in using cost based aproach as well as income approach to estimate human capital stock. We have started to work on the methodology but we think that those work will be finished no sooner that in 2013.		
Portugal	Yes	No	No	Albeit the relevance of this issue for economic analysis and policy, the current workload, notably associated to the implementation of the new ESA, and the available resources do not allow assuming any commitment on this issue for the near future.		
Slovak Republic	No					
Slovenia	Yes	Yes				
Spain	Yes	No	No	We have not enough resources to devote to this task. In this time, to implement SNA-2008 (ESA-2010) is a priority. However, we will return to this issue in the future.		No

Country	Responded to the questionnaire?	PART A	PART B			PART C
		A. Does/Did your institution compile any estimate of the total stock of human capital?	B1. Does your institution plan to measure human capital in the future?	Reasons if No/Plans if Yes (to the question B1)	B2. Is there any other government-sponsored group in your country which most likely makes/will make estimates of human capital?	Comments and Suggestions
Sweden	Yes					Statistics Sweden does not presently have any activities to report in the area of human capital measurement.
Switzerland	Yes	No	No	There are no plans in this area in the Swiss statistical programm for the years 2011-2015 due to resource restrictions and the overall setting of priorites. The latter relies on inputs given mainly by national users.		
Turkey	Yes	No	No	In the short term, it is not planned to measure of human capital due to intensity of work plan.		Although there are many articles, publications and thesis about human capital estimates in Turkey, there is no any specific study relating to this subject in TURKSTAT. But most of the data needed for measuring human capital are available in our institution.
United Kingdom	Yes	Yes				
United States	Yes	Yes	Yes	Continued research in methods	No	
European Union	Yes	No	No			
Regular Observers (5)						
Brazil	Yes					Unfortunately the IBGE does not perform measurement on human capital and thus it will not be possible for us to answer the questionnaire forwarded.
India	No					
Romania	Yes	Yes	Yes	After the first stage of the project carried out by the international consortium has been concluded, INS Romania plans to construct satellite account for human capital in general.	No	To continue the development process of the second stage of the project carried out by the international consortium.
Russian Federation	No					
South Africa	No					
Non-OECD CES Members (30) (Collected by UNECE)						
Albania	Yes	No	Yes	In order to increase the efficiency of quality management, one of the main elements is to estimate the current professional capacity of INSTAT. In this aspect, the measurement of human capital is planned to be carried out in 2013.		
Bosnia and Herzegovina	Yes	No data to fill in the questionnaire				
Bulgaria	Yes	No data to fill in the questionnaire				
China	No					
Croatia	Yes	No	No			
Cyprus	Yes	No	No			
Georgia	Yes	No	No	There are difficulties in estimating quality of education obtained. This is related to a mismatch between a relatively large number of university graduates (formal diploma) with insufficient knowledge and demand for more qualified labour force with more specialized/subject-oriented skills.	No	
India	No					

Country	Responded to the questionnaire?	PART A	PART B			PART C
		A. Does/Did your institution compile any estimate of the total stock of human capital?	B1. Does your institution plan to measure human capital in the future?	Reasons if No/Plans if Yes (to the question B1)	B2. Is there any other government-sponsored group in your country which most likely makes/will make estimates of human capital?	Comments and Suggestions
Indonesia	No					
Latvia	Yes	No	No	Now in Latvia there is no worked out structure of human capital indicators. As experience of different countries is available then it would be useful to agree on comparable methodology among countries. We are planning to get acquainted with methodology of choosing indicators and calculation as well as with demands of data users.		
Liechtenstein	Yes	No	Yes	Details not defined yet.	No	
Lithuania	Yes	No	No			
Malta	No					
Monaco	No					
Mongolia	Yes	No	Yes	Now we don't measure the human capital. But it is very important issue for development indicators. We have a goal to measure it. But we need to create and collect some indicators that contribute to measure human capital. Furthermore, we need methodical and technical assistance for it.	No	We really interested in concepts and calculation of human capital. If possible, you can share more information about it.
Montenegro	Yes	No	No	Statistical office according to Program and Strategy for developing did not recognize this field as priority. After that it is necessary to improve our knowledge to understand belter methodology for measuring human capital.		
San Marino	No					
Serbia	Yes	No	No	Serbian Statistical Office wholly understands national and international needs for this kind of data. But due to very tight resource limits (including insufficient corporative knowledge on the subject) we can't positively answer, even on the question when we could start planning measurement of human capital. It doesn't mean that we do not collect some data in the framework of educational statistics. These are data from question A.8 (Physical indicators of the quantity of education and skills - Distribution of the population by educational attainment categories & Average years of schooling. Which are mainly census data.		Having in mind various uses of human capital data , from one side, and deficiency of needed resources to institute this kind of measurement (not just in Serbia, but in the whole region - Western Balkans), on the other side, we are prone to suggest some internationally sponsored regional project for instituting Human Capital statistics.
FYROM	Yes					Satellite accounts are under discussion for educational sector internally, from the viewpoint of exhaustiveness of NA
Armenia	Yes	No	No			
Azerbaijan	Yes	No	Yes	Within the next 3 years it is planned to study international experience in this field, to determine the indicators system and to provide the data base for calculations	No	
Belarus	Yes	No	Yes		No	
Kazakhstan	No					
Kyrgyzstan	No					
Republic of Moldova	No					
Russian Federation	Yes	No	No			after 2017

Country	Responded to the questionnaire?	PART A	PART B			PART C
		A. Does/Did your institution compile any estimate of the total stock of human capital?	B1. Does your institution plan to measure human capital in the future?	Reasons if No/Plans if Yes (to the question B1)	B2. Is there any other government-sponsored group in your country which most likely makes/will make estimates of human capital?	Comments and Suggestions
Tajikistan	Yes	No	No			
Turkmenistan	No					
Ukraine	Yes	Yes	Yes		Institute for Demography and Social Studies, National Academy of Sciences, Ukraine	
Uzbekistan	No					

Notes: 1. India and Russian Federation are both CSTAT Regular Observers and non-OECD CES member countries.

2. FYROM = Former Yugoslav Republic of Macedonia.

Annex Table 2. Country responses to detailed questions in Part A of the CES questionnaire

Countries answering that are either did in the past or are currently doing measurement work on human capital

Detailed Questions in PART A	AUT	CAN	FIN	FRA	DEU	ISR	ITA	NLD	NZL	NOR	POL	ROU	SVN	GBR	USA	LIE	UKR
A1. Purpose																	
Education related policies	Y			Y					Y		Y	Y	Y			Y	
Growth accounting/Productivity analysis		Y	Y	Y				Y									
National wealth accounting		Y						Y		Y							
Satellite account construction						Y	Y	Y				Y					Y
Sustainability assessment		Y					Y	Y	Y	Y						Y	
Measuring well-being and social progress							Y		Y		Y	Y	Y	Y		Y	
Other			Y												Y		
A2. Concept																	
Skills and knowledge that people acquire	Y	Y	Y		Y			Y					Y			Y	
The productive capacity embodied in individuals		Y	Y	Y				Y		Y					Y		
The knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being		Y					Y		Y		Y	Y		Y			Y
Other						Y						Y					
A3. Data																	
Available in your institution?	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
If Yes, are they																	
Survey data	Y	Y		Y			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Administrative data	Y	Y	Y			Y	Y	Y	Y	Y	Y	Y	Y			Y	Y
Census data	Y	Y		Y			Y		Y	Y		Y	Y			Y	Y
Other								Y		Y		Y					
A4. Frequency																	
Whether estimated on a regular basis?	Y	N	N	Y	N	N	N	Y	Y	Y	Y	N	Y	Y	N	Y	N
If Yes, how often?	AN			AN				AN	BN	AN	AN		AN			AN	
A5. Status of estimates																	
A5.1. Are the estimates																	
Research results only		Y	Y		Y	Y		Y		Y				Y	Y		
Results included in statistical publications	Y						Y	Y		Y	Y	Y					Y
Official statistics	Y			Y								Y	Y			Y	
Other								Y									
A5.2. Any references to the estimates?	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	N	Y	Y	Y	N
A6. Satellite accounts/Relation to SNA																	
Whether construct or plan to construct Human	N	N	N	N	N	Y	N	Y	N	N	N	Y	N	N	N	N	N

Detailed Questions in PART A	AUT	CAN	FIN	FRA	DEU	ISR	ITA	NLD	NZL	NOR	POL	ROU	SVN	GBR	USA	LIE	UKR
capital satellite accounts?																	
Whether construct or plan to construct Education satellite accounts?	N	N	N	N	N	N	Y	Y	N	N	Y	N	N	N	N	N	Y
Whether assess the possibility and impacts of incorporating human capital into SNA?	N	Y	Y	N	N	N	N	Y		N	N	N	N	N	Y	N	Y
A7. Nature of estimates																	
Physical indicators of the quantity of education and skills (then to A8)	Y	Y	Y	Y	Y		Y	Y	Y		Y	Y	Y			Y	Y
Physical indicators of the quality of education and skills (then to A9)		Y		Y					Y		Y		Y			Y	
Monetary measures of the stock of human capital (then to A10)		Y	Y		Y	Y	Y	Y		Y		Y	Y	Y	Y		Y
Other			Y					Y									
A8. Physical indicators (quantity)																	
Distribution of the population by educational attainment categories	Y	Y	Y	Y	Y		Y	Y	Y		Y	Y	Y			Y	Y
Expected length of education for students currently enrolled	Y			Y				Y			Y	Y	Y				
Average years of schooling	Y		Y					Y			Y	Y	Y			Y	
Other				Y				Y				Y					
A9. Physical indicators (quality)																	
Whether use or plan to use the results from PISA or PIAAC to complement the human capital estimates?	N	N	N	N					N		Y		Y			N	
Whether compile other country-specific quality measures	N	NC	N	Y					Y		N		N			N	
A10. Monetary measures																	
Cost-based approach (then to A10.1)			Y		Y												
Income-based approach (then to A10.2)		Y				Y	Y					Y		Y	Y		
Residual approach (then to A10.3)																	
Multiple approach (then to A10.4)								Y		Y							
Other			Y										Y				
A10.1. Cost-based approach																	
A10.1.1. Main challenges are related to																	
Concept					Y												
Methodology																	
Data			Y					Y									
Other																	
A10.1.2. Scope of estimation																	
Limited to costs by formal education			Y														
Including expenditures by firms					Y			Y									
Including expenditures by private households					Y												

Detailed Questions in PART A	AUT	CAN	FIN	FRA	DEU	ISR	ITA	NLD	NZL	NOR	POL	ROU	SVN	GBR	USA	LIE	UKR
Including non-market costs																	
A10.1.3. Plan to use other approaches?			NC		N			NC									
If Yes, please specify.																	
A10.2. Income-based approach																	
A10.2.1. Main challenges are related to																	
Concept										Y		Y					
Methodology		Y				Y	Y	Y		Y		Y			Y		
Data						Y	Y	Y				Y		Y			
Other															Y		
A10.2.2. Scope of estimation																	
Limited to people of working age		Y				Y		Y		Y		Y		Y	Y		
Covering the whole population							Y										
Limited to market activities		Y				Y		Y		Y				Y	Y		
Including non-market benefits							Y										
A10.2.3. Plan to use other approaches?		Y				N	NC	NC		NC		NC		N	NC		
If Yes, please specify.		A10.1															
A10.3. Residual approach																	
A10.3.1. Main challenges are related to																	
Concept										Y							
Methodology								Y									
Data								Y		Y							
Other																	
A10.3.2. Plan to use other approaches?								NC		NC							
If Yes, please specify.																	
A10.4. Multiple approach																	
Cost-based approach (then to A10.1)								Y									
Income-based approach (then to A10.2)								Y		Y							
Residual approach (then to A10.3)								Y		Y							

Notes: 1. Romania (ROU) is CSTAT Regular Observer, Liechtenstein (LIE) and Ukraine (UKR) are non-OECD CES member countries; all the others are CSTAT members.

2. Y = Yes; N = No; NC = Not Clear; AN = Annual; BN = Biennial.