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Productivity Ecosystems for Decent Work

Productivity measurement and analysis

A guidance note

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Productivity measurement and analysis: A guidance note

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International Labour Office

Contents

Acknowledgements **5**

Abbreviations **6**

Introduction **7**

1. Labour and multifactor productivity **9**

2. Constructing data series: Options and trade-offs **11**

Combining sources, harmonization, comparability 11
Sectors 12
Public administration and services 13
Informality 13

3. Key variables **14**

Labour quantity 14

Labour and production boundaries 14
Hours worked or persons employed 15

Labour quality (composition) 15

Categorizing the labour force 16
Computation of quality-adjusted labour input index 17
Informality 18
Skills utilization 19

Labour earnings 19

The self-employed and the labour share of income 19
Gender pay gaps 19

Capital and value addition 20

4. Some analytics **21**

Labour productivity and labour utilization 21

Decomposing labour utilisation and labour productivity 21

Within- and between-sector productivity gains 22

Decomposing within and between-sector productivity growth 22

Additional elements and a reporting framework 23

References **25**

Online resources **28**

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Abbreviations

GDP	Gross Domestic Product
ICLS	International Conference of Labour Statisticians
ISCO	International Standard Classification of Occupations
ISIC	International Standard Industrial Classification of All Economic Activities
MFP	Multifactor Productivity
NSO	National Statistical Office
OECD	Organisation for Economic Co-operation and Development
PPP	Purchasing Power Parity
QALI	Quality-adjusted Labour Input
SNA	System of National Accounts

Introduction

Productivity has come to be thought of as central to economic development and social progress. Countries can sustainably increase their economic output and living standards if and when they make more productive use of their labour, capital and other resources. When more products and services are produced using a given amount of resources, all boats can rise. As far as labour is concerned – the most important resource, especially in developing countries – earnings rise and working conditions improve if productivity increases, particularly where institutions are in place to balance the bargaining power of employers and workers. Important macro- and micro-level feedback takes place with rising incomes and improved working conditions in what may be described as a *virtuous spiral of productivity and decent work*. The alignment of wages with productivity ensures that aggregate demand spurs sustained investment, workers are more committed, and human capital gains can be achieved rapidly. More widely still, public revenues rise, improving the State's ability to address development challenges, and growth does not fracture social cohesion.

Productivity dynamics are important across macro-, sector-, labour market- and micro-level economics, and in social policy and tripartite dialogue on fair wages, working time or the retirement age. They are also very relevant to the environmental transition. Better productivity data are therefore essential for the work of the ILO's tripartite constituents (governments, employers and workers), and for a broader community of stakeholders seeking to advance decent work.

While high-income countries maintain detailed and regular productivity statistics, complying with international standards and guidance, the picture is patchier in developing countries. This is not usually for lack of data: employment and national account data are often sufficient to obtain key measures of labour and multifactor productivity at the aggregate and sectoral levels. The challenge lies, instead, in harmonizing, reconciling, and combining the various data threads from which productivity indicators are generated, in collaboration between different statistical departments and bringing together macroeconomics and statistical expertise.

The purpose of this guidance note is to assist national statisticians and economists in making the best use of available data to obtain detailed productivity measures, notably in developing countries. Guidance is provided on how to prepare labour and multifactor productivity measures, disaggregating by sector, with a particular emphasis on computing *labour inputs*. It builds on and complements international standards and guidelines issued by the United Nations and the Organisation for Economic Co-operation and Development (OECD).[1]

Productivity measures are especially sensitive to the way in which inputs are estimated. It is well established that not only changes in the quantity of inputs (capital and labour) but also changes in their *quality* need to be taken into account. This guidance note lays particular emphasis on how changes to the quality of labour inputs can be captured, summarizing the existing literature and statistical practice to date, and making additional contributions in that area. Quality-adjusted labour input (QALI) estimates are prescribed by international standards as they enable a *more accurate* valuation of labour inputs than quantity-only measures in multifactor productivity analysis. The QALI methodology is being used increasingly by national statistical offices, at least in high-income countries.

Beyond variations in the number of hours worked or the number of persons employed, the contribution of workers to output varies depending on: (a) their diverse productive capabilities at a given time; and (b) their ability to apply these capabilities, which is largely a function of the pool of available jobs. These compositional characteristics of the workers and of the nature of jobs evolve with time, affecting economic output positively or negatively. In its guidance on quality-adjusted measures of labour input, the *OECD Measuring Productivity Manual* refers to the literature available at the time on capturing changes in the skills of the workforce (OECD 2001). The present publication provides additional guidance on how to also take into account other compositional aspects that may be particularly relevant to developing countries, such as self-employment, informality, skills mismatches and the gender wage gap.

[1] In particular, *System of National Accounts 2008* (United Nations 2009) and the *OECD Measuring Productivity Manual* (OECD 2001).

These methodological considerations are relevant to policymaking and the narratives on productivity. They tie in with the long-standing efforts to "chip away" at the residual end of the multifactor productivity formula, where policy may be held to play a limited role. A more accurate valuation of labour's contribution to output growth reveals more clearly the importance of job gains and losses and of the evolving quality of labour.

The *causal* drivers of productivity growth are a highly contested field. This guidance note eschews causality analysis and keeps to measurement aspects. The most established and widely used methods for productivity measurement and decomposition are presented, with reference made to different theoretical traditions. This makes it possible to consider productivity from various angles and to form a better picture of productivity growth and its prospects. Labour and multifactor productivity measures, disaggregated to the extent allowed by the data and decomposed using various analytical lenses, shed valuable light on economic trends. The alignment of wages to productivity is a particular area of focus, as are the ways in which labour utilization, informality and gender wage gaps are interlinked with productivity dynamics.

The guidance note begins by reviewing common measures of productivity. This is followed by a discussion of important options and trade-offs that need to be addressed in the preparation of productivity statistics, especially in developing countries. The computation of data on labour, capital and value addition is then outlined, with specific guidance provided on assessing the contribution of labour inputs to multifactor productivity. The final section describes some analytical methods rooted in different theoretical traditions that can be used to explore the drivers of productivity growth and its prospects, together with the potential policy implications.

1. Labour and multifactor productivity

In its broadest definition, productivity (y) measures how efficiently *inputs* (X) are used to produce *outputs* (Y). It may be formulated as a ratio of outputs to inputs:

$$y = \frac{Y}{X}$$

Inputs can include labour, capital, land and the raw materials, energy and other intermediate goods and services used for production. Economic output is the gross domestic product (GDP) or a measure of real value added, as produced for national accounts statistics.

Labour productivity (y_L) focuses on how much labour is used in achieving the total output of the economy. It is the ratio of economic output to labour inputs (L):

$$y_L = \frac{Y}{L}$$

Given the simplicity of the formula and its parsimonious data requirements, labour productivity is the most widely used indicator of economic efficiency. Labour inputs are best estimated by counting the hours actually worked by all those employed, using national labour force surveys. Where the survey data do not allow one to count the hours worked, other more rounded measures are used, as described further on in this guidance note.

The other major input is capital, but capital productivity (Y/K) is rarely measured on its own. Capital is instead usually considered as part of multifactor productivity (MFP), also referred to as "total factor productivity" (TFP). In the "growth accounting" literature that defined MFP/TFP, economic output is the result of a particular combination of labour, capital and other intermediate inputs, as well as of an unmeasured (that is, residually obtained) factor. Most measures of MFP compute it only taking into account labour and capital as inputs, dispensing with a separate estimate of intermediate inputs.[2] The "residual" term captures changes in productivity that cannot be attributed to changes in the quantity and quality of labour and capital inputs. Over the short term, everything that influences output – from the weather to legislative and institutional reforms, or the social dialogue context – can be captured by the residual. With other factors evening out or diffusing over time, the residual is construed in the longer term as a measure of the effects of technical change or, more precisely, of "disembodied[3] technical change".

Multifactor productivity measures are highly sensitive to the way in which capital and labour inputs are taken account of. Indeed, the magnitude of the residual term has been progressively chipped away at since the initial framework proposed by Solow (1957), as theoretical and statistical work have corrected for data artefacts or imperfect observations.

Extensive guidance is available on the measurement of capital (see, in particular, OECD 2009). The present guidance note focuses on ways to compute compositional changes in the labour force as part of labour inputs. Educational attainment, occupational distribution and formalization need to be captured within the labour inputs segment of the MFP formula, ensuring that they do not end up in the residual for want of better measurement protocols. This is relevant to how policymakers and the public interpret productivity and growth. It is also important in clarifying how employment (and what is embedded in employment) contributes to growth and, conversely, in determining the extent to which employment losses affect a country's productive potential. Changes in the nature of capital and labour, and not just in their quantity, play a key role in growth and productivity.

[2] Measures of MFP using the "KLEMS" model include direct estimations of other inputs beyond capital (K) and labour (L), namely energy (E), materials (M) and services (S). Compared with capital–labour MFP, disaggregating five production factors at the aggregate and sectoral levels is exponentially more data-demanding. This approach also presupposes deep, competitive markets that set the right prices for each production factor within each industrial sector. KLEMS measures are rarely produced in developing countries. This guidance note focuses on the computation of robust capital–labour MFP measures.

[3] "Disembodied" refers to technical change that is *not* already taken into account as changes in the quality of capital and labour, and which is not therefore included in capital and labour inputs measures.

National statistical offices often produce *both* labour productivity and MFP measures, and this guidance note builds on that practice, since both types of measure are useful for policy or collective bargaining, and are used in further econometric and modelling research (see table 1).

▶ Table 1. Pros and cons of using labour productivity and multifactor productivity to measure economic performance

	Pros	Cons
Labour productivity	• Popular, for a good reason, as it is an easy-to-understand, widely available measure of economic efficiency; • It is available for most countries and in comparable international series.	• Only captures labour inputs; • Its apparent simplicity may lead to misinterpretations, e.g. that labour productivity is a measure of "workers' productivity".
Multifactor productivity	• Disentangles the contributions of labour, capital and other factors to productivity growth; • Has enabled progressively more accurate measures of labour, capital and other production inputs.	• More data-intensive and technically demanding; • Relies on some broad assumptions and a supply-side production function; • Different methods of measurement affect the results and their comparability.

The calculation of labour productivity requires only a few strands of data. MFP is quite different: it is a modelization, one that has evolved over time with the theory and with improvements in statistical observations. MFP is usually calculated through a neoclassical production function,4 the most common specification of which is the Cobb–Douglas version, as it dovetails best with growth accounting analyses.

Methodological standards are critical for comparability purposes and quality assurance. The essential standards on the measurement of productivity are laid down in the United Nations System of National Accounts (SNA), the latest version of which is the 2008 SNA (United Nations 2009); and in the OECD Measuring Productivity Manual (OECD 2001), which is referenced in the former. The international guidance provided in those two publications covers the main aspects of productivity measurement, but finer details have since been the object of further economic research and statistical development. This guidance note complements the 2008 SNA and the OECD Measuring Productivity Manual by reflecting recent advances in theory and practice. It also offers additional guidance, in particular on matters related to the valuation of labour inputs and how they contribute to MFP, with a focus on policy issues and the statistical context in developing countries.

[4] MFP is thus considered to be "theory-dependent" in the sense that it relies on a neoclassical framework.

2. Constructing data series: Options and trade-offs

National statistical offices (NSOs), perhaps most acutely in developing countries, have to address a multiplicity of evolving data needs with limited resources. The regular production of robust labour productivity and MFP measures is not a minor effort. Productivity measurement consists first and foremost in the construction and maintenance of consistent time series for output or value added and employment (and also for capital in the case of MFP). The longer the series, and the richer its sets of variables and disaggregations, the more valuable are the final measurements. A number of trade-offs and options come into play when one attempts to make best use of the available data and NSO capacity, while observing international standards and good practices.

Combining sources, harmonization, comparability

Data series stretching back two to three decades are desirable so that trends beyond business cycles can be detected, and also for robustness checks and testing that respect the minimal conditions for stochastic convergence. Ideally, a single homogeneous source of data would be available for all years for each desired variable and its disaggregations. Labour data should preferably be sourced from labour force surveys. Establishment surveys directly observing business output, capital and use of intermediate goods are preferred for series on capital and output. Reconciliation then needs to be carried out between the measures obtained from establishment and household surveys and from the national accounts.

In many developing countries, data on key variables may not be produced annually or at any regular interval. The question then arises whether to settle for fewer and more distant data points from a single, homogenous source, or to impute data by interpolating and combining different sources so as to construct a denser time series. In countries with considerable economic instability or experiencing rapid growth and structural transformation, a denser time series is arguably preferable.

Data for labour, capital, and output or value addition can be found in multiple sources, including (a) population and economic censuses, and (b) labour force, wage, consumption, income and establishment surveys. Each source uses different survey universes, sampling frames and strategies, concepts and definitions, questionnaires and time-reference periods. When combining different data sources it is necessary to take into consideration the respective strengths and weaknesses of each source. A clear understanding of what precisely is being measured within each survey is required. Administrative data on taxes or social security can be used to complement or adjust data from survey series.

The construction of long time series also implies the need to consider data harmonization within single sources. Survey instruments evolve, sometimes significantly over the years, in terms of their sampling methods, questionnaires or definitions. It is therefore important to re-estimate data collected over different periods, taking into account the "metadata" and international standards, which are likewise evolving.

As policy issues change and economies undergo transformation, additional facets of older concepts or new concepts are added to survey series. It is possible to "retroject" these variables into earlier periods, as long as it is clearly documented how these estimates have been obtained.

Productivity statistics are of considerably greater value when they allow cross-country comparison so that a country's performance can be benchmarked against that of its peers or competitors. Alignment with international standards – such as those pertaining to the SNA "production boundaries" or the International Conference of Labour Statisticians (ICLS) definition of employment – is essential in that regard.

Another key aspect is the comparability of the currency units in which variables are expressed. The most common method is to use purchasing power parities (PPPs).[5] The World Bank's International Comparison Program produces PPPs for all countries and these data can be used to derive aggregate variables for output and inputs. Preparing sector-level data in PPP terms is a particular challenge, since the prices of products and services in different sectors evolve at different paces.[6] The method combines data from national supply and use tables and product-level data from the International Comparison Program. The PPPs at the product level are aggregated to derive PPPs for gross output, intermediate inputs and value added at the industry level, using information from supply and use tables as weights.

Sectors

The level of sectoral disaggregation is a key early trade-off to be considered when developing productivity data. Sectoral heterogeneity matters a lot for productivity: some sectors and sub-sectors harbour great potential for productivity growth, while others may not be expected to yield much additional value per input. From a policy perspective, a further key aspect is the distinction between tradable and non-tradable sectors. The most common division of an economy into three broad sectors, namely agriculture, industry and services, fails to capture these two facets of heterogeneity, which are relevant to several important research and policy areas, including structural transformation, informality, gender and relative intensities of capital and labour. The finer the sectoral disaggregation, the more effective the analyses that can be performed, such as decompositions of productivity growth into within- and between-sector productivity gains.[7] On the other hand, sectoral disaggregation increases data requirements exponentially. The level of sectoral disaggregation of data on value addition and (often most critically) on capital tends to be the main constraint.[8]

A five- to nine-sector disaggregation may be recommended. An example with 8 sectors is provided in table 2.

▶ Table 2. A possible sectoral disaggregation

Sector[1]	Tradable	High potential for productivity growth
Agriculture[2]	Yes	Yes
Manufacturing[3]	Yes	Yes
Mining[3]	Yes	Yes
Utilities[3]	No	Yes
Construction	No	No
Services		
Trade, accommodation and food services, personal services	No	No
Information technology and communications, transportation, finance, real estate, business services	Yes	Yes
Government, education, health, social services and other non-market services (ISIC, Rev.4 sections O, P, Q, R, S, T and U)4	n/a	n/a

[5] Purchasing power parities "convert different currencies to a common currency and, in the process of conversion, equalize their purchasing power by controlling for differences in price levels between economies. They provide a measure of what an economy's local currency can buy in another economy. PPP-based comparisons of economic output differ from market exchange rate-based comparisons as the latter do not distinguish between the relative price levels of different items in economies. PPP-based comparisons are also less impacted by the potential volatility of market exchange rates." (World Bank, n.d.)

[6] Two important references on sectoral PPPs and on comparing the productivity of different industries are Jorgenson, Gollop and Fraumeni (1987) and Caves, Christensen and Diewert (1982).

[7] Disaggregation beyond the three broad sectors allows one to identify between-sector effects more clearly, since what appeared to be productivity growth within a large sector – say, industry – may in fact reflect a shift from, for example, construction to manufacturing.

[8] Where sectoral disaggregation of data on capital is particularly challenging, a choice will need to be made as to whether to fill in data gaps through imputation using data on other observed characteristics of sectors, businesses and households, or to limit the computation of MFP to broader sectors only and focus on labour productivity at a finer sectoral level. As part of its future data collection plans, the NSO may want to consider expanding the scope of establishment surveys.

n/a = not applicable
[1] Sectors defined according to the fourth revision of the International Standard Industrial Classification of all Economic Activities (ISIC, Rev.4).
[2] In many developing economies this sector includes both (a) higher-productivity tradable agriculture, fisheries and timber, and (b) subsistence or local-production agriculture that is not tradable or high-productivity. A further distinction between market-oriented and non-market agriculture may be useful where feasible.
[3] Manufacturing, mining and utilities are often combined into a single sector.
[4] See the following subsection on public administration and services.
Source: Authors based on United Nations (2008).

Public administration and services

Productivity measurements commonly exclude the non-market sector, where output is by definition equal to inputs, with no productivity growth assumed. In accordance with the 2008 SNA and the *OECD Measuring Productivity Manual*, non-market sectors include public administration, defence and compulsory social security, along with education, health and other social services (see table 2). Global guidance further recommends that, where possible, private social service activities be maintained within the production boundary. State-owned enterprises and mixed public–private enterprises that operate outside the non-market sectors should likewise be included within the production boundary.

Informality

It is important that measures of output, capital use and employment should all cover the whole economy and, therefore, also the activities of unregistered, informal enterprises and self-employed persons. Large segments of developing country economies are informal, and the informal economy is known to be associated with lower productivity. However, informal production and input use are – almost by definition – particularly challenging to measure.

Data on output and capital are normally collected in surveys that sample from official administrative records and business registries, and which therefore exclude informal establishments. Surveys of the informal sector (or, more specifically, informal microenterprises) that rely on other sampling methods are valuable sources of complementary data where available. Income and consumption surveys and economic or general census data can also be useful. Interpolation methods using labour force, income and consumption surveys or other sources may allow one to estimate informal sector output and capital, if only for the purpose of obtaining productivity measures. Data on informal employment, on the other hand, are usually available, as labour force surveys typically sample all households and capture informality by asking, for instance, about participation in a pension scheme or formal employment contracts. When measuring productivity in developing countries, it is important to take particular care to avoid a situation where informal labour inputs are well captured, while informal capital inputs and output are not, since that would distort the results.[9]

[9] This also applies to how self-employment and mixed income are captured – an important aspect for developing countries that is covered further on in this guidance note.

3. Key variables

The previous section covered the decisions that must be made early on when constructing a data set for the measurement of productivity. In this section we now turn to the key variables required for the computation of productivity indicators. These variables are listed in table 3 below and discussed in the subsections that follow.

Table 3. Key variables for the computation of productivity indicators

Variables	Definition	Disaggregation	
		Economic sectors[1]	Labour composition[2]
Value added (Y)	SNA	✓	
Stock of physical capital (K), investment, depreciation rates	SNA	✓	
Hours worked (LH) or other labour quantity proxies	SNA & ILO	✓	✓
Real labour earnings	SNA	✓	✓
Working age and active population, unemployment, underemployment, labour utilization	ILO		

SNA = System of National Accounts

[1] Agriculture; Manufacturing; Mining; Utilities; Construction; Trade, accommodation and food services, personal services; Information technology and communications, transportation, finance, real estate, business services; Government, education, health, social services and other non-market services (ISIC, Rev.4 sections O, P, Q, R, S, T, U).

[2] The socio-economic characteristics commonly used are educational attainment, gender and age. This guidance note also emphasizes occupational classification and markers of formality. See the subsection on labour quality further down for a discussion.

Source: Authors based on OECD (2001); Hulten (2009); and the ILOSTAT database.

Labour quantity

Labour force surveys are the most common source of labour input data. Estimates of labour inputs that combine labour force (household), establishment and administrative data tend to be more accurate.[10] The first step in computing labour inputs for productivity measurement is aligning the labour and production "boundaries".

Labour and production boundaries

For productivity measurement purposes, the definitional boundary of labour inputs should match that of value added or output. The most recent international statistical standard delimiting the boundaries of labour or employment is the resolution concerning statistics of work, employment and labour underutilization adopted by the 19th ICLS in 2013, which revised the previous standard from 1982. As shown in figure 1, "employment" is defined as work that is remunerated (wage employment) or performed for profit (self-employment). Other forms of work, such as own-use (non-market) production work and other unpaid work, which in the 1982 standard were within the employment boundary, were excluded from the scope of employment by the 19th ICLS resolution. The SNA production boundary is thus wider than the employment boundary, as it notably includes own-use production of goods.

[10] Since labour force surveys sample households, they may be less effective at detecting sectoral distributions of activity than enterprise surveys. The latter, however, may not cover the informal economy and so may result in skewed sectoral distributions. "Labour satellite accounts" that make use of different sources of information and are matched to national account aggregates make it possible to explicitly address such issues.

▶ **Figure 1. Forms of work and the 2008 System of National Accounts**

<table>
<tr><td>Intended destination of production</td><td colspan="2">For own final use</td><td colspan="5">For use by others</td></tr>
<tr><td rowspan="3">Forms of work</td><td colspan="2">Own-use production of work</td><td rowspan="3">Employment (Work for pay or profit)</td><td rowspan="3">Unpaid trainee work</td><td rowspan="3">Other work activities</td><td colspan="3">Volunteer work</td></tr>
<tr><td rowspan="2">Of services</td><td rowspan="2">Of goods</td><td rowspan="2">In market and non-market units</td><td colspan="2">In households producing</td></tr>
<tr><td>Goods</td><td>Services</td></tr>
<tr><td rowspan="2">Relation to 2008 SNA</td><td></td><td colspan="5">Activities within the SNA production boundary</td><td></td></tr>
<tr><td colspan="7">Activities inside the SNA General production boundary</td></tr>
</table>

Source: ILO (2023a, diagram 1).

The inclusion of non-market "*own-use*" production of goods in SNA production is particularly significant in the context of developing countries with a high level of subsistence activities. The ability to distinguish within labour force data whether workers are producing goods or providing services for own final use or for the market is, therefore, important to ensure alignment with the production boundary on the output side.

Hours worked or persons employed

The preferred measure of labour inputs is the number of *hours worked*, but other more rounded measures may be used where counting the hours is not possible. Four options can be distinguished:

- **Hours worked (LH)** are obtained from labour force surveys in which the questionnaires include questions on hours actually worked; absence from work due to sickness, injury or leave; reduced production; and other occurrences.
- **Estimated hours worked (ELH)** can be produced with questionnaires asking about hours actually worked but not about absence from work. Some data on absence from work can then be estimated from legal stipulations (concerning leave) or other information on average days of absence due to sickness and so on.
- **Full-time equivalent (FTE) employment** is an estimate that can be used where surveys do not measure hours worked but do distinguish between full- and part-time employment, in addition to possibly other measures of absence from work.
- **Employed persons (EP):** the last and least precise of the options is merely counting the people who are considered as employed, where no other detail is available. This measure can differ significantly from the number of hours actually worked, since a person is typically considered employed in standard labour force surveys if he or she has performed work for pay or profit in the reference week, *even if it was only for one hour*. Changes in the number of hours actually worked among those who are considered employed – for instance, as a result of increased or decreased economic activity – will not be detected by such a measure.

Labour quality (composition)

For MFP purposes, a precise measure of the *quantity* of labour input is still only a partial metric if the objective is to compute *the contribution of labour* to economic growth. Labour is not a homogenous input: for the same number of hours worked, different workers in different jobs will contribute differently to output and value addition, depending on their capabilities and how much they are able to apply these in their jobs. Workers' *capabilities* are a function of their training, work experience, age and health. Their *ability to apply* these

capabilities depends, in turn, on the jobs that they have and on the intensity, technical level and capital utilization of these jobs. Such *compositional characteristics of workers and jobs* change a lot over time.

United Nations and OECD guidance calls for quality-adjusted labour input (QALI) measures as more accurate estimations of the contributions of labour in MFP and growth accounting. Quality adjustment is carried out by *weighting* differently the amount of work contributed by different categories of workers. The shares in total compensation corresponding to the *earnings* of different categories of workers are used as weights. Such weighting relies on the assumption that wages reflect the marginal productivity of workers: the more productive a worker, the higher he or she is paid. This will be discussed in more detail further down, but the assumption is widely considered as more useful than not for the purpose of weighting labour inputs.

The *OECD Measuring Productivity Manual* refers to the available literature at the time (2001) on capturing changes in the skills of the workforce, using educational attainment or occupational groups as alternative proxies for skills endowment. Further research and the development of NSO practices since then have led to a broader understanding and application of the compositional characteristics that need to be captured for quality adjustments. Workers' job tenure, age and gender are now integrated into QALI procedures by many NSOs. As mentioned earlier, this guidance note suggests that the nature of jobs also needs to be captured, not just the characteristics of workers, which implies introducing occupation and formality as additional compositional variables. Gender wage gaps and their relevance to productivity measurement, too, are discussed further down.

▶ Box 1. Labour quality adjustment by the Asian Productivity Organization

The Asian Productivity Organization produces quality-adjusted labour input statistics for many Asian countries on the basis of modelled data series stretching back to the 1970s. The results for Viet Nam reproduced in the above table show how quality inputs become more important over the 1970–2020 period.

Growth rate of labour's quality and quantity in Viet Nam, 1970-2020 (percentage)

	1970-80	1980-90	1990-2000	2000-10	2010-20
Labour input growth	5.2	3.5	2.7	4.6	1.7
Labour quality growth	1.0	0.3	0.2	2.6	1.4
Hours worked growth	4.2	3.2	2.4	2.0	0.3

Source: APO (2022, p. 152).

Categorizing the labour force

The way in which the labour force is categorized is relevant to the way in which labour inputs are adjusted for quality. The more categories there are, the more the quality adjustment procedure will capture compositional effects. However, there are limits to how much disaggregation can be reached: as the number of categories increases, the confidence in each segment of the data decreases. The following categorization is suggested by way of general guidance.

▶ Table 4. Categorization of the workforce for quality adjustment of labour input

Educational attainment	1	Primary or lower
	2	Lower- or higher-secondary
	3	Tertiary
Occupational skill level (ISCO-08)	1	Managers; professionals; technicians and associate professionals (major groups 1–3: high skill level)
	2	Clerical support workers; services and sales workers; skilled agricultural, forestry and fishery workers; craft and related trades workers; plant and machine operators, and assemblers (major groups 4–8: medium skill level)
	3	Elementary occupations (major group 9: low skill level)
Industry (ISIC, Rev.4)	A	Agriculture, forestry and fishing
	B	Mining
	C+D+E	Manufacturing and utilities
	F	Construction
	G+H+I	Trade and transportation
	J+K+ M+N+L	Business, financial services and real estate activities
	O+P+Q +R+S+T+U	Government and other services
Gender	Female	Women
	Male	Men
Age	Age 15-24	15–24 years
	Age 24-99	24+ years
Formality	Form_	Participates in a pension scheme
	Inform_	Does not participate in a pension scheme

ISCO-08 = International Standard Classification of Occupations 2008

ISIC, Rev.4 = International Standard Industrial Classification of All Economic Activities, fourth revision

Note: The above listing distributes the employed population across 504 categories (3 × 3 × 7 × 2 × 2 × 2). This is more of an ideal than a practical suggestion, as it requires a fairly large survey sample. A consolidation of categories may be necessary. For example, industries may be re-aggregated from seven categories to five or three, and the age categories subsumed.

Computation of quality-adjusted labour input index

G categories of labour are distinguished in accordance with the above categorization. For each category g (where g = 1, ..., *G*), we have the number of hours worked h_{gt} during the period t. The total hours worked at time *t*, denoted H_t, is the sum of hours worked by all labour categories:

$$H_t = \sum_{g=1}^{G} h_{gt}$$

For each labour category *g* the average income earned per hour worked is denoted W_{gt}. The income share of labour category *g* in total labour income earned is denoted s_{gt}, which may be expressed as:

$$s_{gt} = \frac{h_{gt} * W_{gt}}{\sum_1^G h_{gt} * W_{gt}}$$

The growth rate of the QALI indicator from the end of the $(t-1)^{th}$ period to the end of the t^{th} period, denoted (Q_{t-1}^{t}), is assumed to be a geometric mean of the growth rates of hours worked (from $t-1$ to t) by each labour category weighted by their shares in total labour earnings, as is assumed in usual Törnqvist indices. We thus have:

$$Q_{t-1}^{t} = \prod_{1}^{G} \left(\frac{h_{gt}}{h_{gt-1}} \right)^{\left(\frac{S_{gt-1}+S_{gt}}{2} \right)}$$

For periods stretching from t = 0 to t = T, we will have a series of year-to-year weighted geometric growth rates of hours worked $Q_0^1, Q_1^{,2}, \ldots, and\ Q_{T-1}^{T}$. If the first year ($t$ = 0) is taken as the base year, in which the QALI index is by definition equal to 1, then for the t^{th} year we will have the following chained QALI index:

$$CHQALI_t = \prod_{0}^{t} Q_{p-1}^{p}$$

Let AHW denote the adjusted hours worked by the QALI index. For each year, AHW_t depends on hours worked in the base year H_0 and the chained QALI index:

$$AHW_t = H_0 \prod_{1}^{t} Q_{p-1}^{p}$$

The percentage growth rate of the adjusted hours worked, which is used in the growth accounting formula to measure MFP, is given by the following formula:

$$g_{AHW} = \sum_{1}^{G} \left(\frac{S_{gt-1}+S_{gt}}{2} \right) \left[\ln(h_{gt}) - \ln\left(h_{gt-1}\right) \right]$$

This growth rate of adjusted hours worked is used to create an index that describes how labour is evolving, with account taken of both its quantity (that is, hours worked) and its quality. If the growth rate of hours worked is g_H, then the growth rate of the quality of labour is computed as a residual as follows:

$$g_{Quality} = g_{AHW} - g_H$$

The steps involved in computing the QALI index include:

- Estimation of hours worked by each category of labour;
- Computation of the share of each labour category in total labour earnings;
- Computation of the geometric mean of the gross growth rate of hours worked between periods t − 1 and t as a Törnqvist index;
- Computation of the QALI index as a chained magnitude; and
- Computation of adjusted hours worked in each period.

Informality

The literature establishes a close relation between informality and productivity. As observed earlier, work in informal enterprises, and more widely informal employment, is less productive and paid less, on average. Conversely, the economic security and benefits attached to a formal job play a significant role in human capital accumulation and in a worker's commitment to his or her job and enterprise. Whether work is formal or informal determines how workers can apply their capabilities and develop them. This is particularly important in low- and middle-income countries, where 90 and 67 per cent of employment, respectively, is informal (ILO 2018a). Changes in the formality of employment across time impact, therefore, quality-adjusted labour and, therefore, productivity.

Two methods can be used to detect formal and informal employment on the basis of labour force surveys. The simpler and most frequently used one is to treat participation in a pension scheme as a proxy of formality. A more precise measure considers employment status, access to benefits and registration (ILO, 2023b). Informal employment according to this definition includes work for pay or profit by:

- self-employed workers (employers, own-account workers) who have not completed registration for taxation or social insurance; and
- employees and contributing family workers who do not work under a formal contracting arrangement or do not have access to a pension scheme.

Skills utilization

Education is the most commonly used proxy for skills utilization in QALI procedures – either the educational level or the number of years of schooling completed. Various studies have documented the limitations of education as a proxy for skills use. First, there are large skills "mismatches", particularly in developing countries (ILO 2019a). Educational attainment has risen significantly in many countries, but the demand for higher skills by employers in those countries has not grown at the same pace, leading to overeducation. The specializations provided by the educational system may result in skills shortages in some areas and oversupply in others, a form of mismatch that tends to grow with economic complexity. Secondly, educational credentials are not perfect indicators of the skills acquired: the quality of education may vary substantially over time, as well as across regions, educational institutions and levels, types and specialties of education. In many countries, a rise in coverage and attainment level has been accompanied by declines in quality (ILO 2019a).

Skills utilization in an economy is arguably better proxied by data on occupations.[11] Occupational employment data are widely available in labour force surveys. The underlying standard for occupational statistics, the International Standard Classification of Occupations (ISCO), is constructed so that major occupational groups (the broadest and most widely available measure) can be categorized as either high-, medium- or low-skill occupations. There are some issues related to coding errors and inconsistencies across countries or time at such a level of aggregation.

Labour earnings

The self-employed and the labour share of income

Treatment of the income earned by the self-employed is notoriously problematic in national account statistics because of the practical difficulty in distinguishing in their earnings the income from labour and the income from capital. This issue is especially relevant to developing economies, where self-employment tends to make up a large share of employment.

The 2008 SNA suggests equating the labour income of the self-employed to the wage earnings of employees for a given sector and occupation (United Nations 2009).[12] However, in developing countries the self-employed are found much more frequently than wage workers in informal, smaller and lower-capital establishments, serving lower-income segments of the market. They therefore often earn much less than wage workers in a given broad sector and occupational group.

An alternative method would be to treat different groups of self-employed workers differently. The earnings of the self-employed in lower-skill, more informal, less capitalized sectors may be treated as pure labour income (with capital income held to be negligible). Self-employed professionals, technicians and associate professionals (ISCO-08 major groups 2 and 3) may, on the other hand, be treated in accordance with the 2008 SNA guidance, equating their income to that of wage workers in the same sectors and occupations. These workers are much more likely to operate in the modern, formal, more capitalized segments of the economy, and their labour income can in principle be better estimated using the earnings of equivalent wage workers.[13]

Gender pay gaps

As noted above, a key assumption in MFP measurement is that labour earnings broadly correspond to the marginal productivity of work. Such a shortcut is as helpful as it is questionable. Wages are a function of a multitude of factors, including the business cycle and the tightness of the labour market, the relative bargaining power of employers and workers, and the labour institutions that provide the framework for collective

[11] For the literature and methods used on the subject, see CEDEFOP (2013). See also the O*NET database of the US Department of Labor, https://www.dol.gov/agencies/eta/onet; the ESCO (European Skills, Competences and Occupations) portal, https://esco.ec.europa.eu/en; the OECD Skills for Jobs database, https://www.oecdskillsforjobsdatabase.org; and the ILO Skills for Jobs database, https://www.ilo.org/shinyapps/skillsforjobs/

[12] Other methods have been suggested. Johnson (1954) imputes two thirds of self-employment income (mixed income) to labour, citing a regularity observed in developed countries whereby labour income represents around two thirds of the overall economy's income. Focusing on developing countries, Kravis (1959) proposes instead that capital earnings among the self-employed be considered as negligible.

[13] For further discussion of this, see ILO (2019b).

bargaining, hiring and firing, among other aspects. The marginal productivity assumption is particularly at odds with the prevalence and persistence of gender pay gaps. Globally, women's monthly earnings are 20 per cent less than men's, and gaps between the remuneration of men and women are still observed when controlling for educational attainment, job tenure, occupation, sector and other observable factors (see ILO 2018b, Chapter 9). While measurement issues and unobserved factors can play a role, the *unexplained* part of the gender wage gap may be largely attributable to some form of discrimination. In those cases, and unless one posits that men are overpaid, the wages paid to women under-represent their productivity. Female labour inputs may therefore be *corrected* to take discrimination into account.

A procedure for quantifying the unexplained part of the gender wage gap is outlined in the ILO *Global Wage Report 2018/19* (ILO 2018b, Appendix VI). Based on the approach suggested by Fortin, Lemieux and Firpo (2011), it involves estimating the wage distribution that would characterize women if they were paid the same returns for their labour market characteristics as men. Key characteristics that normally explain differences in wages between individuals include age, job tenure, education, occupation, sector, enterprise size and formality. The explained and unexplained parts of the gender wage gap are identified at each quantile of the pay distribution. Unconditional quantile regression is then applied to estimate the weight attached to each variable contributing to the gender pay gap.

Capital and value addition

Capital (K) refers to all reproducible tangible or intangible, public or private assets used over more than one year in the production of goods and provision of services. The most common procedure for constructing a K series is the *perpetual inventory* method. It relies on hypotheses about the lifespan and rate of depreciation of different classes of assets in the capital stock, and on how the quality of assets is evolving over time, to take into account changing *vintages* of the same type of asset.

The measurement of capital for productivity computations is in itself a large area of research and statistical development. It is extensively treated in international guidance, notably in the *OECD Measuring Productivity Manual* and the *OECD Measuring Capital Manual* (OECD 2001; 2009), to which we refer the reader.

Capital stock and capital formation may be particularly difficult to determine at the sectoral level. Capital formation is usually disaggregated by sector and asset type within an *investment matrix*. Direct and indirect methods are used to estimate information on asset-level investment. The indirect method relies on the flow of commodities, while the direct method relies on establishment censuses, agricultural censuses and other sources.

The measure of production most often used internationally is *real value added*, which is the value of output at basic prices less the value of intermediate consumption. It is equivalent to GDP plus all subsidies on products less all taxes on products. If gross value added or gross output are used in the national accounts, these measures need to be corrected for price effects when entered into the productivity formulae. Extensive guidance on this is provided in United Nations (2009) and OECD (2001).

4. Some analytics

The measurement of MFP through growth accounting involves *decomposing* GDP growth into its production factors. Additional decompositions of productivity are useful for an understanding of productivity dynamics. Short of more complex modelling exercises attempting to detect causality, these econometrics allow one to approach productivity from different viewpoints and theoretical traditions.

Labour productivity and labour utilization

Productivity measures take into account only *utilized* factors of production. It is useful to complement such measures by looking at labour utilization and underutilization. A high level of labour productivity coexisting with low levels of labour utilization points to a pattern of imbalanced growth that does not make sufficient use of labour resources.

It is important to note in this respect that unemployment,[14] particularly in developing countries, represents only a small fraction of labour underutilization.[15] Many developing countries have low levels of unemployment and high levels of *underemployment*, which can be time-related (people working less than full time and wanting to work more) or skills-related (people working below their skill level).[16] Moreover, among those categorized as "inactive" in labour force surveys there are "potentially active" people who are seeking work but not available for work at the time of the survey, or who are available for work but not actually seeking at the time of the survey (figure 2).[17]

Figure 2. Economic activity and inactivity as defined by the International Conference of Labour Statisticians

<table>
<tr><th colspan="2">Active population (labour force)</th><th colspan="2">Inactive population</th></tr>
<tr><td>Employed</td><td>Under-employed</td><td>Potentially active
Seeking and not available
Available and not seeking</td><td>Inactive
Not of working age
Unable to work
Not seeking nor available for work</td></tr>
<tr><td colspan="2">Unemployed</td><td colspan="2"></td></tr>
</table>

Decomposing labour utilisation and labour productivity

The procedure for decomposing GDP growth into changes in the extent of labour utilization and growth in labour productivity (OECD, n.d.) is provided below.

Let Y_t, N_t, and L_t be, respectively, the GDP, population and employment measured by the number of people employed in the economy during time (period) $_t$. Per capita GDP is equal to the product of labour productivity and the employment rate, that is:

[14] In line with international standards, NSOs normally define unemployment as comprising those of working age who have not worked during the reference week (not even for one hour), and who at the same time are actively seeking work and readily available to work.

[15] According to the formal ILO definition, labour underutilization covers the unemployed, those in time-related underemployment (working less than full time and wanting to work more) and the potential labour force (those not available but seeking work and those available but not seeking work).

[16] There is also income-related underemployment, which has been defined as comprising those who want to increase their income by "increasing the levels of organisation of work or productivity, improving tools and equipment and training or infrastructure" (ILO 2013). This measure is hard to operationalize and seldom produced.

[17] More loosely, one can also think of those who would be willing to work should various conditions be different, that is, availability of jobs with wages or working hours at a certain level, affordable and quality childcare and elderly care services, better working conditions or security and anti-harassment measures. Like income-related underemployment, such a measure is also hard to operationalize in statistical surveys.

$$\frac{Y_t}{N_t} = \frac{Y_t}{L_t}\frac{L_t}{N_t}$$

Consequently, the growth rate of per capita GDP is equal to the sum of the growth rates of productivity and of the employment rate:

$$g_{Y/N} = g_{Y/L} + g_{L/N}$$

We can further elaborate and take into consideration the broader demographic groups made up of the economically active population and the working-age population, resulting in:

$$\frac{Y_t}{N_t} = \frac{Y_t}{H_t}.\frac{H_t}{L_t}.\frac{L_t}{EAP_t}.\frac{EAP_t}{PAW_t}.\frac{PAW_t}{N_t}$$

where *H*, *EAP* and *WAP* are, respectively, total hours worked, the economically active population and the working-age population. This formula takes into account the productivity of an hour worked (*Y/H*), hours worked per employee (*H/L*), the rate of labour utilization (*L/EAP*), the rate of participation (*EAP/PAW*) and a demographic variable that can be thought of as the dependency ratio.

Within- and between-sector productivity gains

Economic growth can be understood as resulting from gains in efficiency within an enterprise or a sector, achieved through improvements in fixed capital, skills and/or management and work processes, or as resulting from structural transformation, when labour and capital *shift* from lower- to higher-productivity activities. Structural transformation has been shown to be particularly important for sustained growth in low- and middle-income countries.

Several specifications of shift-share decompositions have been proposed in the literature. From the point of view of comparability, we refer to a widely used method that is also applied by the OECD in its compendia of productivity indicators (see OECD 2018, box 1.1, on which the following text is based).

Decomposing within and between-sector productivity growth

Labour productivity in the total economy is expressed as the sum of labour productivity levels in each sector weighted by its employment share, as follows:

$$LP_t = \frac{Y_t}{L_t} = \sum_{i=1}^{n} \frac{Y_{it}}{L_{it}} * \frac{L_{it}}{L_t} = \sum_{i=1}^{n} LP_{it}S_{it}$$

where LP_t, Y_t and L_t represent, respectively, labour productivity, output and employment in the total economy in period *t*, LP_{it}, Y_{it} and L_{it} represent, respectively, labour productivity, output and employment in sector *i* (*i*=1,..., *n*) in period *t*, and *Sit* represents the employment share of sector *i* in the total economy in period *t*.

In a discrete time perspective, the difference in aggregate labour productivity levels between time 0 and time *T* can be written as follows:

$$LP_T - LP_0 = \sum_{i=1}^{n}(LP_{it} - LP_{i0})S_{io} + \sum_{i=1}^{n}(S_{it} - S_{io})LP_{io} + \sum_{i=1}^{n}(LP_{it} - LP_{i0})(S_{it} - S_{io})$$

We can divide both sides by the initial aggregate productivity to get a decomposition of the aggregate productivity growth rate. It follows that the aggregate labour productivity growth can be decomposed into an intra-sector labour productivity growth, represented by the first term on the right-hand side of the equation, and the effects of structural change in the economy, which consist of a static effect, represented by the second term, and a dynamic effect, represented by the third term.

Within-sector productivity growth effect: also known as intra-branch productivity effect, it captures the effect of productivity growth within the different industries;

Static shift effect also known as static structural change effect, it measures the contribution to aggregate labour productivity growth of a shift of employment towards other sectors or industries of the economy;

Dynamic shift effect: also known as the interaction effect or dynamic structural change effect, it measures the interaction of changes in labour productivity and employment across sectors. More specifically, it measures the extent to which positive/negative efficiency gains interact with the expansion/contraction of different industries. This term is positive if sectors with higher (lower) productivity increase (reduce) their share in total employment,

and negative when expanding sectors have below-average labour productivity growth or if sectors with higher productivity growth rates have declining shares in total employment.

The sum of the static and dynamic shift effects is often used as a measure of between-sector productivity gains – that is, of the structural transformation effects.

Additional elements and a reporting framework

Table 5 below provides a framework that may be useful in organizing the set of productivity indicators described in this guidance note as part of a national productivity report.

▶ Table 5. Framework for reporting on productivity indicators

1. Aggregate productivity	*Notes*
Key issues and questions. Overall pace of labour productivity and MFP growth trends: how do productivity growth trends compare with those of peers and higher performers in the same country income group? Is employment becoming more productive or is it concentrating in low-productivity activities? Capital and labour intensity of growth, quality-adjusted labour inputs, labour underutilization, formalization	
Aggregate labour productivity	*Level and growth*
Aggregate MFP, output growth by production inputs, with and without quality adjustment (QALI measures)	*QALI measures include changes in occupational employment, informality, education*
Labour productivity and labour utilization	*Including issues related to labour force participation, for women and young people. Demographics (dependency, ageing, youth bulges)*
Productive employment	*Changes in employment at wages above and below average labour productivity*
2. Productivity by economic sector	
What are the pace and direction of structural transformation? Is productivity accelerating in high potential sectors? Are there signals of early deindustrialization? In which sectors would productivity be expected to be higher/grow faster, compared with other countries? Are productivity and employment both growing in key sectors, or is one growing at the expense of the other?	
Sectoral productivity	*Labour productivity and MFP (labour productivity where capital data cannot be disaggregated by sector). Productivity in tradable and non-tradable sectors*
Agriculture	
Manufacturing	
Mining	
Utilities	
Construction	
Government, education, health, social services and other non-market services (ISIC, Rev. 4, sections O, P, Q, R, S, T and U)	
Market services	
Trade, accommodation and food services, personal services	
Information technology and communications, transportation, finance, real estate, business services	
Shift-share decompositions of productivity growth into within-sector and between-sector growth	*Decompose more than just the three broad sectors; triple shift-share method.*
Productivity and employment changes by sector	*Scatter plot of sectors showing productivity growth and employment growth*
3. Productivity, growth composition, and investment	
Is there robust investment (capital formation) in the economy compared with other countries? Is investment growing at a greater pace in more productive sectors?	

Composition of growth (private/public consumption, private/public investment, imports, and exports) and productivity	
Gross fixed capital formation (total, by sector, in productive capacities) and productivity	*Correlation between gross fixed capital formation and productivity*
Credit allocation and productivity	*Flow-of-funds analysis or other studies on credit allocation profile and its alignment with sectors' productivity profile*
4. Productivity, wages, working time	
Are labour earnings aligned with productivity? Overall, by sector, occupation, gender and formality.	
Real earnings and productivity: Overall, by sector, minimum wage (where applicable), occupation, gender, educational attainment and formality	*Is higher productivity in some sectors translating into higher wages there? Are some social groups being left behind?*
Productivity and the gender pay gap	*Correction for the "unexplained" part of the gender pay gap*
Labour share of income	*In comparison with peers; labour income by income deciles; demand-side constraints on growth.*
5. Other key topics	
Other key topics of interest may be explored, e.g. climate change, digitalization.	
6. Conclusions: The prospects for productivity, growth and employment	
General conclusions weaving together the different threads of analysis.	

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