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Article

INTERNATIONAL EXPERIENCE IN MEASURING THE DIGITAL ECONOMY

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INTERNATIONAL EXPERIENCE IN MEASURING THE DIGITAL ECONOMY

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Abstract: *The article discusses the importance and challenges of measuring the digital economy. It evaluates the overall benefits of the GDP framework and introduces new concepts to define the digital economy as an object of measurement. The concepts used to define the digital economy as an object of measurement are the following. In order to quantify the benefits associated with the digital economy, a new metric is introduced to formally link it to traditional GDP and the concept of gross income is used as the main indicator to assess its economic impact on the regional economy. The main methodological approaches for constructing relevant indicators are described. The methodology for measuring the digital economy and the prospects for improving the knowledge base are identified.*

Keywords: *Digital economy, measurement of economy, GDP, total incomes.*

INTRODUCTION

Digitalisation is "a general process beyond the industrial revolution that refers to the replacement of machines that depend upon humans and machines that do not depend upon humans by machines that can think for themselves, are intelligent and capable of working independently, participating in the production of sectors and causing fundamental changes in business life" (Yilmaz, 2020). The digital economy, meanwhile, is defined as "an economy that is extensively based on digital computer technologies" (Kalkınma Bakanlığı, 2018).

By renewing business processes in production, digitalisation supports the symbiosis of man and machine in working life in order to increase productivity and reduce production costs. However, the expected productivity gains are not keeping pace with the speed of the digitalisation process, despite the rapid pace of technological innovation and transformation. As any change in its own reality takes time to manifest its economic or social effects, these effects of digital transformation are expected to become more apparent over time. In particular, the adoption of digital by the public sector, the increase in the share of high-tech digital firms and the adaptation of business models to digital technologies should facilitate the adjustment of the productivity rate to the pace of digital transformation (OECD, 2021).

Measuring the Digital Economy

New Perspectives maps existing indicators across a range of domains, including education, innovation, entrepreneurship, and economic performance, against the current

policy challenges of the digital economy, as reflected in the OECD's Internet Policy Guidelines (2011).

The essence of the definitions is also influenced by the specifics of a particular historical period. The first definitions were based on contrasting earlier concepts such as the "information economy" and the related broader concept of the "information society". Don Tapscott (1996), for example, stated that the digital economy encompasses two types of economic activity. The first type, informational, involves basic tasks such as uploading static information to online resources; the second type, communication, includes activities made available by the Internet.

The definition of a concept reflects the times and current trends, especially in the field of technology. Early interpretations (Mesenbourg, 2001, Tapscott, 1996) focused on Internet technologies, which became a kind of technological mainstream of the 1990s, at least in the global North.

A number of works provide specific interpretations, but current approaches are generally simplified versions of the definition of the digital economy as a "digitally based economy" (EC, 2013).

The measurement of the digital economy is a priority, given the increase in the number of economic activities that are made possible by digital technologies and the consequent growth in their economic importance. But there are many challenges: High quality data is needed for good policy making, fiscal policy and resource allocation. At the moment, this component is lacking in the digital economy and, as a result, it is unlikely that public policies will be fully supportive of the development of the digital economy (House of Commons, 2016).

Challenges of the digital economy

There are several obstacles to measuring the digital economy:

- **Definitions/frameworks:** As the discussion above shows, definitions of the digital economy are very diverse and sometimes inconsistent. This does not in itself make it difficult to measure the digital economy, but it does make comparative analysis difficult. The same definitions that cannot draw a clear line between the traditional and the digital economy also make the initial measurement difficult (OECD, 2014).
- **Data quality problem:** Currently, especially in developing countries, there is a fundamental problem with the data being collected - it is either missing or unreliable. This is exacerbated by further innovation - data collection always lags behind technological progress.
- **The cost problem:** Moore's Law and similar phenomena - "my watch has more computing power than the computer that launched Apollo" - mean that the cost of the same amount of ICT power, storage capacity, etc. is constantly falling. Something similar can happen with types of ICT-related services, which also undergo qualitative changes that do not always affect their value; the emergence of free products (such as Wikipedia) that still add value is relevant (House of Commons, 2016, OECD 2016).

- Adjustments are needed to take this into account, but this is no longer relevant to science (OECD 2014, 2016). The virtuality of the digital economy: Many types of digital economic activity do not immediately produce a finished product. Some of these types of services may be intermediate at the business-to-business or consumer level; there may be difficulties in calculating value added; and digital services are delivered in virtual space and therefore may not be easily traceable, especially when there is cross-border e-commerce⁶ or the digital consumer-as-producer phenomenon (House of Commons, 2016, OECD, 2016, WEF, 2015).
- Some researchers argue that these obstacles make measuring the digital economy using traditional methods of economic analysis "not only incomprehensible, but unrecognisable" (Sheehy, 2016). At present, unresolved difficulties mean that the size of the digital economy is "substantially underestimated".

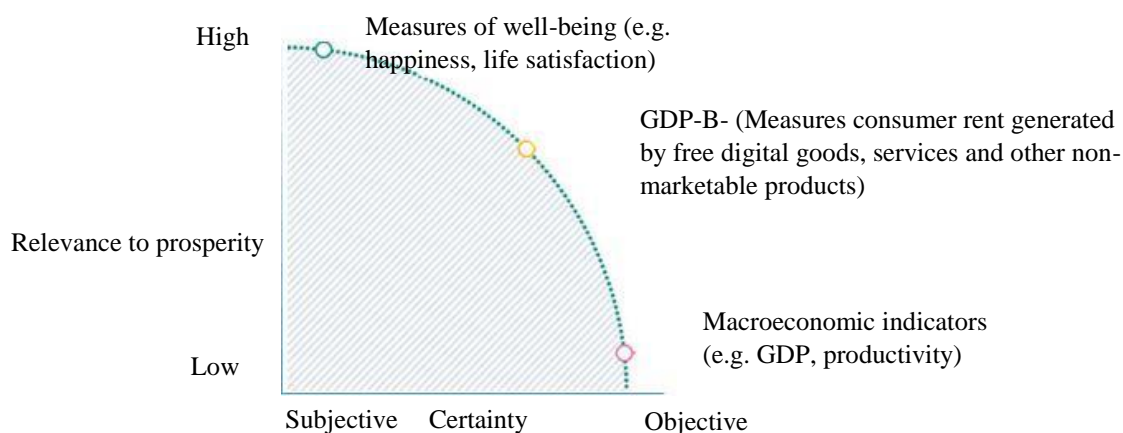
RESEARCH METHODOLOGY

Policymakers use GDP data to make decisions about everything from infrastructure to R&D, from education to cybersecurity. Regulators use this data to make policy decisions that affect technology companies and others. Because the benefits of digitalisation are dramatically overlooked, most of these policies remain divorced from reality. For example, a study by Felix Eggers of the University of Groningen found that Facebook has created \$225 billion in unrecognised value for consumers since 2004. If we start from the fact that digital products and services are growing at an incredible rate in our economy, we better understand the need to solve this problem as soon as possible.

The main reason why the digital economy is under-represented in GDP is that GDP is defined in terms of the price people pay for a product or service. Therefore, with few exceptions, if the price of a product or service is zero, its contribution to GDP is also zero. However, many of us use free digital applications such as search engines and online maps much more than we use their paper versions.

In order to measure these benefits related to the digital economy, a new measure was developed to map them onto traditional GDP in a formal way. This new measure is called GDP-B, due to its reliance on GDP to consider the advantages (instead of the cost) of new and free goods (Brynjolfsson, et al., 2019). GDP-B was developed by Erwin Diewert as a way to complement GDP in order to capture the welfare gains of new and free goods, together with Felix Eggers and Kevin Fox. It is recommended that policy makers and managers use this measure of GDP-B when focusing on the welfare of the consumption side of the economy, instead of the production side. They found that the average annual GDP-B growth in the US since Facebook's inception in 2004 would increase by between 0.05 and 0.11 per cent if Facebook's benefits were included. While our GDP-B estimates are not as precise as GDP measurements, they at least attempt to directly measure economic well-being, which in the digital age is not adequately captured by GDP. Our measure of GDP-B remains within the neoclassic framework, reflecting only the private economic benefits related to the digital revolution (Collis and Brynjolfsson, 2020, Brynjolfsson, et al., 2019).

Figure 1. Spectrum of well-being measures



Source: https://www.brookings.edu/wp-content/uploads/2020/01/WP57-Collis_Brynjolfsson_updated.pdf

Macroeconomic indicators are easy to measure, but they only tell part of the story, and well-being measures provide a more realistic picture of how consumers are faring, but they too may be subjective. By considering a combination of measures, including our proposed GDP-B, policymakers, regulators and managers would be better placed to make decisions (Figure 1).

To estimate the total income of digital economic activity, we use the following formula (Glinsky, et al., 2011):

$$M = M_T + M_1 \times \frac{1}{1-R} \text{ (Formula 1)}$$

where M - total income (direct and indirect, taking into account the multiplier effect) from digital activities in the region;

M_T - direct economic effect from digital activity (the amount of funds generated by the digital economy in the first round of circulation of funds, included in the GRP of the region) ;

M_1 - the part of the proceeds (income) of the digital economy that has an impact on GRP (the volume of GRP caused by orders of digital activities) ;

$$M_1 = \frac{Y \times Q_T \times (V_T - Z_{Ti})}{X} \text{ (Formula 2)}$$

V_T - volume of produced products and services of the digital economy in value terms (the value of goods and services of the digital economy);

Z_{Ti} - volume of expenditures for the purchase of goods and services for digital production from other enterprises (cost of goods and services of the digital economy);

Y - gross regional product;

X - gross domestic product;

R - coefficient reflecting the degree of closedness of the regional economy and reflecting the relationship between two consecutive circles of circulation of digital economy funds in the region;

Q_T - the share of digital economy costs remaining in the national (regional) economy (Lovelock, 2018, Katz, 2017).

RESULTS

The basis for the calculations is the estimation of MT - the amount of funds generated by digitalisation in the first round of circulation, included in the GRP of the region (direct economic effect from digital activity). As the main indicator for assessing the economic impact of digitalisation on the region's economy, this methodology is based on the concept of total income from the digital economy. The total income is understood as a set of annual benefits, both direct and indirect, received by the region as a result of digital activities and is expressed in value terms (Glinsky and Serga, 2021, Glinsky et al. 2011). This is a measure of how much money is spent by digital businesses, digital infrastructure businesses, information and communication businesses, and non-digital businesses on production, consumer goods, and services. Moreover, the indirect income for the region from digital activities is only the part of the expenditure (direct and overall cost) which stays within the region.

The following points should be taken into account when calculating total revenues from the digital economy (Glinsky and Serga, 2021):

1. The gross value added by the type of economic activity 'information and communication activities' (annual calculation of GRP) is the volume of funds generated by digitalisation in the first cycle of funds circulation.
2. Expenditure on the services of third parties used in the production of information and communication services is assumed to be equal to the volume of expenditure on the purchase of goods and services for digital activities from other enterprises (costs constituting the cost of the digital product).

Multiplier effects in monetary terms can be estimated using multipliers, especially on gross domestic product.

CONCLUSIONS

The study focuses on the methodological issues involved in assessing the contribution of digital economy activities to national and regional revenues, discusses possible methods for assessing the digital economy, and specifies the points to be taken into account when calculating total revenues.

In conclusion, the digital economy is a transforming power for the global economy and has considerable potential for revenue generation. However, there are a number of barriers to its development, the overcoming of which is essential for the full realisation of its benefits. Accurate definition and measuring their effects on GDP are essential for informed policy and economic analysis. Policy makers, regulators and managers can make better decision-making by evaluating a range of measures together, including the proposed GDP-B. Focus not only on price but also on the value created.

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