

## Guest Editorial

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### 1. Introduction

Already 12 months before the far-reaching consequences of the COVID-19 pandemic became apparent, the Statistical Commission at its 50<sup>th</sup> session in 2019<sup>1</sup> created the Friends of the Chair Group (FoC Group) on Economic Statistics to consider the future of economic statistics. In particular, the Statistical Commission provided the mandate to the FoC Group to assess the efficiency, effectiveness, and responsiveness of the current system of economic statistics, take stock of the governance arrangements of existing statistical groups and statistical initiatives, and provide recommendations on the working methods and the update of the system of economic statistics. Subsequent consultation activities and discussions with the representatives of the national and international statistical organizations and senior economists led to an acknowledgement that the current system of economic statistics needs to be more responsive and agile to meet the collective needs of users.

Fast forward, as we gather and review the lessons learned from the statistical response to the COVID pandemic of the national and international statistical offices, linking this review to the components of the statistical business model for the future system of economic statistics becomes more relevant than ever. Also, the publication of the Special Issue on the future of economic statistics has become timelier than ever with the opportunity to consult the statistical and academic community in shaping the future of economic statistics with the users.

In a series of global and regional meetings and a consultation with statistical groups, the FOC Group has taken the view that users demand an integrated and co-

herent set of macroeconomic and microeconomic statistics in support of the sustainable development. This set of statistics should be guided by a statistical framework that is multi-dimensional in nature covering the interrelationships between economy, society and environment and address the pressing global trends and underlying risks of inequality, climate change, technological change, demographic shift, and urbanization. These risks and impact of policies and decision making in the public and private sector should be monitored through both structural and short-term statistics and indicators taking into accounts the significant cross border movements of people, products, and finance.

Moreover, improving the overall agility of the framework, not only requires the development of concepts and methods, but also in its ability to deliver data products more responsively. Greater responsiveness of the statistical system can be achieved by allowing the statistical and institutional operations and supporting infrastructure greater experimentation, and increased collaboration and co-investment in the areas of data access, data sharing and exchange, new data solutions and technological resources. In a world of big data, there are economies of scale in undertaking multi-country data collection in partnership with the data owners in the private sector. For example, in the case of prices scraped from the web, a common multi-country database could be developed for all countries to draw upon. It is well recognized that appropriate risk management mechanisms have to be put in place to support more flexible and responsive ways of operating to maintain a balance between the often competing requirements of providing consistent, stable time series while also being responsive and innovative in the face of new needs or expectations.

An important theme that emerged in the discussion of the FOC Group is that of taking a capacity-building approach to international activities. In such an approach,

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<sup>1</sup><https://unstats.un.org/unsd/statcom/51st-session/documents/>.

international initiatives would not solely prioritize the development of international standards. Rather, they would recognize the value of global initiatives covering elements such as data access and acquisition, statistical methods for data innovation, collaboration on common information and communications technology infrastructure, and effective governance of statistical operations and infrastructure to fulfilling the mission of data stewardship of national statistical offices. Those initiatives would aim to increase collaboration, innovation and experimentation while delivering a return on investment for country involvement in global initiatives.

Another important theme identified is the growing demands for greater granularity in data provision (by region, demographic group, and at the unit level of households and enterprises) and the integration of statistical and geospatial information. These demands are a major challenge for national statistical offices and a major new opportunity to better meet the needs of policymakers and other users. Greater emphasis needs to be placed on supporting this challenge at the international level.

## 2. Emerging statistical business model from statistical response to the COVID-19 pandemic

At its last meeting in June 2020, the FoC Group<sup>2</sup> reached a convergence of views on an emerging new statistical business model from the statistical COVID-19 response comprising of four inter-related and mutually reinforcing building blocks: outreach and user consultation; statistical framework; institutional and statistical operations, and data stewardship; and statistical infrastructure and data solutions;

### 2.1. Outreach and user consultation for sustainable development

Users underline the need for a broad statistical framework for the future system of macroeconomic and microeconomic statistics for evidence-based policy and decision making. This framework is to inform the multidimensional and interrelated aspects of globalization and supply chains of Multinational Enterprise Groups (MNEs), digitalization and technological innovation, location and urbanization, climate change, demographic shift, and inequality.

<sup>2</sup>[https://unstats.un.org/unsd/statcom/groups/FOCG\\_Econ/Default.cshhtml](https://unstats.un.org/unsd/statcom/groups/FOCG_Econ/Default.cshhtml).

Given that the impact of the COVID-19 is likely to last for a prolonged period of time, the statistical response to the pandemic challenges the system of economic statistics in meeting the demand for a whole-of-system approach (“in networking the system”) featuring broad consultations and assessment with users (“in engaging the user”).

Under this approach, national statistical offices (NSOs) should adopt the role of a data steward in addition to being data producers and actively establish partnerships across the public and private sectors. Such networking partnership could include exploring new and innovative data solutions in the use of alternative data sources or conducting more frequent surveys to produce granular indicators beyond the traditional economic, social, financial and environment indicators for a rapid assessment of the impact of COVID-19.

The whole-of-system approach may also warrant closer collaboration between national, regional and international statistical agencies. In building responsive and resilient national statistical systems, the collaboration should promote co-investments in statistical infrastructure through shared technology cloud-based platforms, trusted data sharing and exchange arrangements, shared central global repository of big data from global agreements with private sector owners, shared method libraries of algorithms, and a global register of MNEs.

Given the multi-faceted impacts of COVID-19, the statistical response to COVID-19 should be framed in a holistic and integrated measurement framework for evidence-based policy making. Indeed, this multi-dimensional framing of the statistical response on our interrelated economies, societies and the environment is clearly demanded by users.

It is recognized that appropriate and possibly new communication mechanisms with the users should be put in place to enhance the statistical literacy when new methodologies, data sources, and collection techniques are developed and adopted for the release of experimental statistics and possibly traditional timeseries. These mechanisms should educate the user in the new ways of producing and releasing the new statistics and possibly explaining why traditional timeseries are discontinued. In addition, while there is wide recognition of the importance of innovating and developing experimental statistics for NSOs and International Organizations (IOs) in order to remain relevant and lean in a more competitive environment in the data space, this practice comes with the challenge of maintaining trust placed in statistical agencies by the public and decision-makers. Meeting this challenge, again requires adequate and continuous communication with the user community.

## 2.2. *Statistical framework for integrated economic statistics*

The user demand to inform the impact of the COVID-19 pandemic warrants a choice for the appropriate statistical framework in which to present the statistical and data products in an integrated and coherent manner. The national statistical responses to COVID-19 seem to merit a broader framework for the future of economic statistics, which goes beyond measuring GDP to measuring social, environmental and well-being (for example, health) dimensions, both at the macro and micro levels. Adopting this broader measurement framework would necessitate the need for collaboration with other both public and private sector partners to get timely access to microdata and statistical registers to produce the relevant granular indicators which would provide a more holistic picture of sustainable development.

## 2.3. *Institutional and statistical operations, and data stewardship*

Apart from data stewardship and whole-of system approach through new networking arrangements with public and private sector partners for access and use of technology, data, and methods, the institutional and statistical operations should increasingly adopt the compilation of iterative and experimental measures in a timely manner in addition to the traditional timeseries and indicators to meet the new user demands.

Facing the new demands, the statistical agencies face the challenge of balancing the various data quality aspects in the statistical production processes (for example, timeliness, accuracy and granularity). Moreover, while adopting and promoting a whole-of system-approach (for example, establishing increased collaboration within and between the national, regional and global levels) to become more resilient in institutional and statistical operations, the statistical agencies need to put in place appropriate new governance arrangements to set priorities and mobilize resources. These new governance arrangements should clarify the role of national statistical and international statistical agencies in the transformation of the institutional and statistical operations through co-investments.

With the arrival of the digital era and the related data deluge, the data ecosystem has fundamentally changed, which offers NSOs to rethink the way data is collected. Increasingly, it is acknowledged that primary data collection is less efficient with dropping response rates, less timely, and more costly. Actively, NSOs in col-

laboration with international statistical agencies could progress in accessing and using the vast amounts of digital data to source out traditional and new statistical products by supplementing existing data acquisition or replacing existing surveys. With the progress made in redesigning the data collection and compilation practices using the new data ecosystem, it is an appropriate time to share best practices in the design and implementation of integrated data collection practices that combine source data through micro data linking (MDL) and econometric techniques for household and business statistics to meet the new demand from users for timely and granular statistics. The emerging practices in integrated data collection design have demonstrated that these new practices do meet the new demands for the measurement of the environmental, social and governance aspects of business activity beyond the traditional measures of business activity.

## 2.4. *Statistical infrastructure and data solutions*

The statistical response to COVID-19 warranted a pivot to a new statistical infrastructure that is flexible in adoption innovative data solutions. These new statistical infrastructure and data solutions extend to applying new technologies for new data sources and new data collection methods, using alternative data sources, fostering network relationships with data providers (both administrative and private data), integrating high frequency data and structural information, and making decisions on when to discontinue the collection and compilation of traditional timeseries.

The value of the integration of geospatial and statistical information has become apparent during the COVID-19 crisis. Those national statistical agencies that had invested in this integration were able to assist government departments in identifying the vulnerable households by location assisting in targeting specific government interventions. Similarly, this capability allowed for locating enterprises that needed to provider essential goods and services in the various domestic supply chain. Therefore, the statistical community should consider investing in geospatial information systems and relationships with key providers of these systems.

Another area that warrants co-investment in statistical infrastructure and new data solutions will be in data sharing and exchange arrangements. These investments will facilitate the access to administrative and private sector data sources. These arrangements should also extend to exchange securely information on cross bor-

der transactions and company structures of MNEs for consistent recording of the information between countries of the role of the MNEs in the economy. Related co-invest is in Global Group Registers for MNEs

In this Special Issue of the Statistical Journal of the IAOS, we will take stock of the latest conceptual and practical developments in the various components of the newly emerged statistical business model. In the remainder of this Guest Editorial, the key features of these developments are briefly described by highlighting the main topics covered in the articles selected for this Special Issue. This brief overview is organized by the various components<sup>3</sup> of the statistical business model and demonstrates how the future of economic statistics is taking shape. It is expected that the accumulation of national practices from the COVID-19 statistical response will further accentuate the urgency to make our statistical system more relevant, responsive and resilient by taking collective action and making co-investment across the components of the statistical business model.

### 3. Articles on outreach and user consultation for sustainable development and statistical framework for integrated economic statistics

Inequality and environmental changes are among the most pressing policy challenges of our century and yet national accounting still largely fails to adequately measure these issues. Chancel (*'Towards Distributional National and Environmental Accounts.'*) presents current efforts to distribute National Income and National Wealth in a way that is fully consistent with the National Accounts framework. It also discusses options to extend distributional accounting to the domain of environmental accounts.

Smedes and Humphrys (*'Australian labour account: linking production to people and jobs.'*) describe how the Australian Labour Account supports macro-economic analysis of peoples' participation in employment and related production over time. Development of labour accounts have provided an opportunity to significantly improve the quality of aggregates such as the number of jobs occupied within each industry, measures of hours worked, and labour productivity growth. Finally, Smedes and Humphrys stress that labor accounts are an opportunity to further emphasize the household

experience within the system of economic accounts, linking from production activities to important demographic and socio-economic issues related to education, health, unpaid household work and ultimately the measurement of human capital.

Mehran and Ghahroodi (*'Labour accounts in Iran, Australia and Denmark.'*) complement the article of Smedes and Humphrys in providing a practical example of the compilation of the labour accounts for Iran for the year 1390 (March 2011–February 2012). The procedure is described in the first part of the paper. In the second part, comparative tables for Australia, Denmark and Iran are constructed on each of the three main elements (employment, hours of work and employment-related income). In the process of comparing the data, the differences in the underlying methodologies are reviewed and an assessment is made on the way forward. To date, very few countries have attempted to construct labour accounts. The three countries discussed in this article represent a diverse set of statistical systems, but have applied common concepts and definitions in line with the ILO international standards.

Obst, Alfieri and Kroese (*'Advancing environmental-economic accounting in the context of the system of economic statistics.'*) highlight the significant advances in accounting for the stocks and flows of natural capital that have taken place in the statistical community through the ongoing development and implementation of the System of Environmental-Economic Accounting (SEEA). Through description of the history and key components of the SEEA and through presentation of various examples of accounting from around the world, this paper demonstrates not only the theoretical advances but also the feasibility and relevance of SEEA based accounts to policy making. The increasing recognition of the threats of climate change and the importance of halting biodiversity loss and maintaining healthy ecosystems which provide essential contributions to people, make the implementation of the SEEA extremely timely and relevant in supporting policies that take into account the environment. There is now clear support from the official statistics community and a clear role for national statistical offices in using the SEEA to go "beyond GDP". They write that we can no longer afford to ignore our dependence on the environment, our natural capital. Accounting for it is part of the pathway forward.

Due the digital revolution from rapid technological breakthroughs, policy makers and analysts are increasingly interested in the size and growth of the digital economy. The BEA independently developed prelimi-

<sup>3</sup>The articles for the components of *outreach and user consultation for sustainable development and statistical framework for integrated economic statistics* are presented jointly as they are closely related.

nary digital economy statistics but has relied on consultation with other statistical organizations and participation in numerous international working groups aimed at advancing coordinated and internationally comparable digital economy measurement. Strassner and Nicholson (*'Measuring the Digital Economy in the United States.'*) describe BEA's digital economy measurement efforts to date including initial work towards a digital economy satellite account and related research on quantifying the value of "free" digital media, and the treatment and measurement of data. They also discuss BEA's efforts to improve price measures for high tech goods and services, notably internet and wireless services, cloud services, and ride-hailing services. Lastly, they provide an overview of BEA's measurement work related to international trade in digital services.

The System of National Accounts (SNA) has adapted, and will adapt, as economic, social and environmental conditions change. The revision process of the SNA2008, which is now underway, will take place in the context of developments such as globalization, digitalization, climate change, biodiversity loss, inequality as well as the COVID19-pandemic. The new SNA will have to make clear how the economy relates to concepts such as wellbeing, sustainability and equity and will also need to be linked to major global initiatives such as the Sustainable Development Goals (SDGs). As for the future framework for the SNA, Hoekstra (*'SNA and Beyond: towards a broader accounting framework that inks SNA, SDGs, and other global initiatives.'*) proposes a broad accounting framework for Wellbeing, Sustainability and Equity (WiSE). This provides a wider context for the System of National Accounts (SNA) and links to the other frameworks such as the Sustainable Development Goals, and other global initiatives such as the Better Life Initiative (OECD), Changing Wealth of Nations (World Bank) and the Inclusive Wealth Index (UN). The WiSE framework is not a new system, but rather a combination of existing accounting frameworks, which have been proposed in the last five decades. Hoekstra starts off by formulating principles to guide the work on the broader framework. Subsequently, seven accounts are proposed, which quantify the various dimensions of the economic, societal and environmental systems. This interdisciplinary accounting framework involves knowledge from many scientific disciplines and multiple units are used (mass, energy, people, time, money etc.). Hoekstra indicates that the most controversial part of any discussion about the future of the SNA is the valuation of non-market phenomena, such as unpaid household work or envi-

ronmental damages. He argues that the discussion on valuation of non-market measures is too focused on methods derived from welfare economics. Rather than on valuation, Hoekstra proposes to focus on evaluation methods from many scientific disciplines, which contributes to the assessment of progress towards wellbeing, sustainability and equity. He concludes that this interdisciplinary perspective should guide our thinking to select key indicators to replace GDP.

Samah, Kasim, and Arupin (*'Calculation of nominal FISIM for Islamic banking activity in Malaysia.'*) indicate that the application of the Financial intermediation services indirectly measured (FISIM) is a concept used in national accounts to value the conventional activity of banks as intermediaries between depositors and borrowers. Unlike conventional banking, Islamic banking declares the loans as financing of an equity participation in the financial account. Moreover, the interest payments and interest received on loans are declared as "profit distributed to depositors" and "income derived from investment" on financing of an equity participation. They note that change in the use of terms is important for their users as the proposed terms are compliant by the shariah law in Malaysia. They also describe the calculation of FISIM for Islamic banking in the context of the 2008 System of National Accounts. The calculation process is similar to the conventional banks methodology, but the measure uses the terms financing instead of loans in compliance with the Islamic Banking regulations.

Articles on Institutional and statistical operations and data stewardship

Salemink, Dufour and van der Steen (*'A Vision on Future Advanced Data Collection.'*) point out that society's demand for data-driven and fact-based information continues to increase. National statistical offices play a critical role in providing this demand-driven information to support evidence-based policy making in a new role as data stewards, which is expected to lead to their transition from suppliers of official statistics to providers of trusted "smart statistics". The digital transformation, data revolution and emergence of "big data" all influence the way NSOs collect data now available everywhere, generated by everything and everyone, and being stored in numerous locations and devices. This changing data ecosystem is bound to change the way a NSO collects and has access to data. Increasingly, it will be acknowledged that primary data collection is less timely, more costly and more burdensome to satisfy the increasing demand. Actively, NSOs in collaboration with international statistical agencies could progress in

accessing and using the vast amounts of digital data to source our traditional and new statistical products by supplementing existing data acquisition or replacing existing surveys. Convincingly, Salemink, Dufour and van de Steen argue that the use of new data sources, collection methods and collection processes require a redesign of existing collection and compilation practices. This redesign comes with consequences with respect to a revisit of existing methodology, technology, data quality, metadata and standards, and practices of confidentiality and privacy. Moreover, social acceptability needs to increase to maximize the benefit of these data sources to produce smart statistics for which appropriate communication strategies are required. The authors conclude by indicating that the sharing these data stewardship practices require active collaboration between NSOs and IOs.

The article by Menghinello, Pritchard, Ravindra, Blancas, Durand, Hermans, and Al-Kafri (*'A strategic and data production frameworks for the development of business statistics.'*) sets out the key characteristics of a strategic data production framework to enhance the relevance, accuracy and coverage of business statistics. The strategic framework aims to expand the traditional scope of official business statistics to include environmental, social, and governance issues. The article also demonstrates the relevance of an enterprise-centered approach for the design of an integrated and coherent data production framework for business statistics. The article points out that the Statistical Business Register (SBR) is the backbone of this data production framework and critical in ensuring the relevance and accuracy of business statistics.

Statistics Denmark (SD), as the responsible authority for national SDG reporting has worked closely with stakeholders in the business community, public authorities and NGO community in establishing a robust data reporting framework for the SDG indicators. SD has further extended the framework to report on business related indicators on environmental, social and governance (ESG) issues. The article of Olsen, Andersen, and Schiønning Andersen (*'New measures on contribution of corporations towards sustainability.'*) demonstrates how SDG-relevant information by type of industry can be collated and reported linking existing data sources. Emissions of CO<sub>2</sub> and energy efficiency are examples from the environmental economic accounts. Moreover, social and business statistics can be linked to provide statistics on occupational injuries, and employment and wages broken down by gender. The article also elaborates on a new survey covering the largest private Dan-

ish enterprises to enquire about the how the SDG framework is used in their business operations. The article is concluded by a discussion on the lessons learned so far and possible next steps are outlined to report on ESG issues of businesses.

Micro data linking (MDL) has become an important cornerstone in the production of new statistical insights. MDL is now widely acknowledged as a strategic activity to avoid increasing the respondent burden when meeting new user demands, such as on globalization. Luppés and Bøegh Nielsen (*'Micro Data Linking: Addressing new emerging topics without increasing the respondent burden.'*) point out that MDL allows for combining micro data from individual entities such as enterprises and people or in a combination of both (e.g. linked employer-employee data (LEED)). MDL is one of the most powerful methods to answer questions on emerging policy or research topics such as the interconnectedness of national economies and the impact of global supply chains on jobs, income, and growth. Not only for national purposes, where economic behavior and dynamics by enterprises can be expressed in terms of job dynamics, income and welfare for its citizens, but also from an international perspective where consistent and coherent indicators play an important role. Firstly, Luppés and Bøegh Nielsen address the central role of the Business Register for any MDL approach related to business statistics; secondly they describe current official statistics based on MDL such as Trade by Enterprise Characteristics (TEC). Thirdly, the most common use of MDL in terms of producing experimental statistics are described, including linked employer-employee data (LEED).

Bavdaž, Snijkers, Sakshaug, Brand, Haraldsen, Kurban, Saraiva, and Willimack (*'Business Data Collection Methodology: Current State and Future Outlook.'*) assert that collecting data from businesses faces ever-larger challenges, which have led to calls for an overhaul of underlying data collection methodology. The main challenges pertain to the motivation for participating being low; technology is shaping data collection processes; response processes within businesses are imperfectly understood, while alternative data sources originating from digitalization processes is pushing the response process (thus also response quality) further out of our sight. Their paper reviews these challenges, considers new developments in the field, and proposes directions for future research. Their review may help those that collect data from businesses (e.g. national statistical institutes, academia, and private statistical agencies) to reconsider their current approaches from the

lessons learned taking into account new developments in today's data ecosystem and to build their toolkit of business data collection methods.

In his article, Winardi (*'The Role of Inter-household Transfer in Mitigating the Impact of Economic Shocks on Income Distribution in Indonesia'*) explores the role of inter-household transfers in mitigating the impacts of the outbreak on Indonesian economy using a CGE model. With commodity prices dropping and social distancing measures impacting the economy negatively, the model demonstrates that the government response by lowering direct tax rates and increasing income transfers to households do not fully compensate the negative impacts from international trade and social distancing. However, the response by households by increasing inter-household transfers augments the government policy, particularly in reducing the decrease of households' income and consumption. The result indicates that inter-household transfer could be regarded as an effective instrument to improve income distribution and reduce poverty. Winardi demonstrates that the use of the econometric techniques for the generation of early estimates on the impact of the effectiveness of government policies in response to the COVID-19 pandemic could be considered a promising technique for national statistical offices to consider.

#### 4. Articles on Statistical infrastructure and data solutions

Statistical Business Registers (SBR) have historically underpinned the compilation of economic statistics by providing consistent unit structures and classifications for survey frame production and business demography data. To meet emerging data needs for both regular statistical production releases and for specific questions asked by policy makers, the SBR can also be used as a data integrating framework. Ryan, Thompson, and Jones in their article (*'A Statistical Business Register Spine as a new approach to support data integration and firm level data linking.'*) outline the "spine" model developed by the Australian Bureau of Statistics (ABS) to support more flexible integration and linking of firm-level data that will also expand the uses of the SBR. The spine is the minimum set of information required to identify an entity and act as the linking variable(s) to other datasets. Its application involves a new approach to management of input datasets and can be applied across statistical registers. This article provides (1) a description of the ABS spine proposal for statistical

registers; (2) the benefits of a spine approach for both regular statistical production and new data solutions; and (3) an overview of how the ABS BLADE (Business Longitudinal Analysis Data Environment) is used to integrate firm-level datasets to enable policy evaluation and statistical research by analysts from government and academia.

The importance of Multinational Enterprise Groups (MNEs) on the economy is ever-growing and at the same time, it becomes more complex to capture their activities and structures accurately in official national statistics. Demollin and Hermans (*'Advancing new collaborative mechanisms for the profiling of MNEs in national, regional and global group registers.'*) describe the increasing number of national practices in establishing Large Case Units and in introducing profiling of MNEs to capture the activities of MNEs and to ensure consistency between MNE statistics. At international level, the same challenges can be found. In Europe, the existence of the European Statistical System and accompanying legal frameworks make it possible to organize European collaboration, resulting in the EuroGroups Register, the European profiling, and the Early Warning System. The benefit from a Global Group Register (GGR) seems evident: providing unique identification of MNEs and insight in the structure of internationally operating MNEs helps to create valuable information for policymakers on many different economic themes. At a global level, legal facilities like those in the EU are not available, which makes it important to look for other solutions. An initial GGR must therefore be built using publicly available sources and sources from commercial data providers. Demollin and Hermans argue that the benefits of establishing a Global Group Register are multiple and work in this area should be pursued.

The professional discussion on *"The future of economic statistics"* has a practical driver: economic statistics, produced by national statistical offices, face severe difficulties in describing the national and global economic development in a relevant and coherent manner. Koskimäki and Peltola (*'Innovative ways to share and exchange data on the activities of MNEs.'*) point out that this statement is not only their perception as statisticians – there is a growing criticism towards traditional economic statistics among researchers, policymakers and other users. In their article, they reflect on the factors that have caused the current situation and propose solutions to improving the situation by data sharing. One aspect of the solution relates to the role of national statistical offices. Instead of being solely na-

tional institutions, dealing with national data only, they should exploit the possibilities of using statistical data, collected by statistical authorities of other countries, to produce better quality economic statistics. The other aspect of the solution is the sharing of innovative practices to understand and correctly record the activities of multinational enterprise groups (MNEs). The proposals they make in their article are not restricted to MNEs but are applicable to any type of economic activity with a cross-border dimension. Their observations are based on the work done when preparing the UNECE Guide to Sharing Economic Data.

Hancock writes in his article (*'The Use of Metadata Modelling for the Modernisation of Information Management of Statistical Classifications.'*) that as statistical data is becoming more accessible, available in bigger and more complex datasets and can be analysed and interpreted in so many ways, opportunities exist for modernising the development processes for statistical classifications and its responsiveness to emerging user demands. Metadata modelling along with the use of semantic software tools enables significant advances to be explored in the way that traditional statistical classifications are developed, maintained, updated and implemented. The system of economic statistics is one where there is overlap in concepts, definitions, classifications and metadata which often makes search and discovery by non-expert users challenging. New methodologies for managing and describing data, and the categories to which they are classified can benefit from a greater uptake of semantic web technology, such as Simple Knowledge Organisation Systems (SKOS), and Resource Description Frameworks (RDF). Hancock explores new approaches to statistical classifications and their role in the future of economic statistics through the use of metadata, conceptual and entity modelling rather than the traditional methodology of hierarchically structured, sequentially code based statistical classifications.

Classification of enterprises by main economic activity according to NACE codes is a challenging but important task for national statistical institutes. Since manual editing is time-consuming, Kühnemann, van Delden, and Windmeijer investigate in their article (*'Exploring a knowledge-based approach to predict NACE codes of enterprises based on web page texts.'*) automatic prediction from dedicated website texts using a knowledge-based approach. To that end, concept features were derived from a set of domain-specific keywords. Furthermore, they compared flat classification to a specific two-level hierarchy which was based on an approach

used by manual editors. They limit themselves in the article to Naïve Bayes and Support Vector Machines models and only use texts from the main web pages. As a first step, they train a filter model that classifies whether websites contain information about economic activity. The resulting filtered dataset is subsequently used to predict 111 NACE classes. They find that using concept features do not improve the model performance compared to a model with character n-grams, i.e. non-informative features. Neither do the two-level hierarchy improve the performance relative to a flat classification. Nonetheless, prediction of the best three NACE classes clearly improves the overall prediction performance compared to a top-one prediction. They conclude that more effort is needed in order to achieve good results with a knowledge-based approach and discuss ideas for improvement.

Grenier, Lantz, Soulard, and Wang (*'The use of combined Landsat and Radarsat data for urban ecosystem accounting in Canada.'*) describe a new data solution using Big Data sources by combining Landsat and Radarsat satellite images to generate national statistics for urban ecosystem accounting. These accounts will inform policy related to the development of mitigation measures for climatic and hydrologic events in Canada. Milton, Ontario was used as a test case for the development of an approach identifying urban ecosystem types and assessing change from 2001 to 2019. Methods included decomposition of Radarsat images into polarimetric parameters to test their usefulness in characterizing urban areas. Geographic object-based image analysis (GEOBIA) was used to identify urban ecosystem types following an existing classification of local climate zones. Three supervised classifiers: decision tree, random forest and support vector machine, were compared for their accuracy in mapping urban ecosystems. Ancillary geospatial datasets on roads, buildings, and Landsat-based vegetation were used to better characterize individual ecosystem assets. Change detection focused on the occurrence of changes that can impact ecosystem service supply – i.e., conversions from less to more built-up urban types. Results demonstrate that combining Radarsat polarimetric parameters with the Landsat images improved urban characterization using the GEOBIA random forest classifier. This approach for mapping urban ecosystem types provides a practical method for measuring and monitoring changes in urban areas.

## 5. Concluding remarks

This Special Issue on the future of economic statistics should be appreciated as another effort of the FOC Group on Economic Statistics to reach out and consult users on the future of economic statistics. The selected articles for this Special Issue should be considered a representative but not an exhaustive sample of the recent developments in articulating the new statistical business model for the future of economic statistics. I look forward to the forthcoming discussion on the future of economic statistics on the new online discussion platform of the SJIAOS, which will be the opportunity for anyone working or interested in official statistics to contribute to the global consultation on the future of economic statistics.

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