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The Future of National Statistical Organisations: The Longer-Term Role and Shape of NSOs

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The Future of National Statistics Offices

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Abstract

This paper explores a vision for the future of National Statistics Offices (NSOs). It analyses the history and role of NSOs before exploring current and future challenges and opportunities for NSOs, before finally outlining a future where NSOs become more agile, open, and collaborative while maintaining their high level of trust in the community, thereby allowing them to fulfil their new role as data stewards in a rapidly evolving data landscape.

Key Words: Standards; Artificial intelligence; Transformation; Challenges; Opportunities; Vision.

1. Executive Summary

This paper is the result of a strategic exercise conducted by a group of senior statisticians, data scientists and innovation lead from National Statistics Offices (NSOs) in 2024-25. It was led by Osama Rahman, Director, Data Science Campus, UK Office for National Statistics, as chief editor, and involved twenty staff from 12 different organisations who participated in online discussions, drafted and reviewed content, and edited and proof-read the final paper.

The exercise was carried out under the auspices of the United Nations Economic Commission for Europe (UNECE) High-Level Group for the Modernisation of Official Statistics to help inform statistical leaders of the ways in which NSOs may need to adapt to remain relevant in 10 to 20 years' time. The views expressed in this paper are solely those of the individual authors, and do not represent the official position of their organisations.

This version of the paper has been abridged to meet the submission requirements of the Statistics Canada Symposium Proceedings 2024. A longer version will be released later in 2025.

NSOs have long been trusted data and stats providers to the government and public, adapting to the challenges and opportunities of previous eras. The rise of mis-and-disinformation, alongside private sector competition, and declining survey response rates have created an existential crisis in NSOs and are pushing them to find and utilise alternative data sources. However, there are also major opportunities. NSOs can adopt the data steward role, and guide policy makers and the public through the evolving and expanding data and information ecosystem. Innovations such as open-source solutions and generative AI, can allow NSOs to be more transparent, increase their trustworthiness, and present opportunities for collaboration. However, NSOs will need to become more flexible and to enhance their internal capacity to achieve these goals. Following this path will enable NSOs to retain their central role in informing society long into the future.

¹ This paper was led by Osama Rahman of ONS and its contents were developed by a number of authors from several national and international statistics offices. Organisational assistance and general editing were provided by InKyoung Choi and Andrew Tait of UNECE, and Alison Baily and Jo Green of ONS.

2. History and role of official statistics

2.1 Professionalisation and institutionalisation of official statistics

Until the 19th century, national statistical systems were often highly fragmented. However, rising demand from policymakers led to increased professionalisation, institutionalisation and regulation of official statistics in the 20th century (Allen, 1970).

There is now wide recognition of the importance of the professional independence of official statisticians, and the need to reinforce the role of official statistics as a public good by ensuring objectivity and impartiality.

The institutionalisation of governance and quality frameworks has been underpinned by the codification of statistical laws and the development of fundamental principles and good practices. This has led to an increasingly robust oversight, regulation, and supervision of NSOs, introducing mechanisms to ensure accountability, transparency, and adherence to standards.

2.2 Methodological and technological progress

2.2.1 Sampling methodologies

The adoption of probability-based sampling marked a significant shift in the production of official statistics in the 20th century, when large-scale surveys addressing unemployment, housing, and public health demonstrated the method's efficiency and cost-effectiveness. In the post-war period, industrial applications of sampling for quality control further validated probability-based methods. This led to collaborative efforts between government agencies, academic institutions, and official statisticians, who refined these techniques and supported the widespread adoption of advanced stratified and systematic sampling frameworks in economic and social surveys. International bodies like the United Nations and the International Statistical Institute also played pivotal roles, advocating for the use of modern sampling methodologies, standardizing practices across countries, and helping integrate them into the core of modern official statistics (Stephan, 1948).

2.2.2 Development of statistical classifications and metadata standards

Official statistics have depended on standardised classifications and taxonomies to ensure consistent definitions and structures for measuring complex phenomena across time and borders. The primary goal has been to enable the aggregation and comparison of data at national, regional, and global levels (Hoffmann and Chamie, 2002). Over time, efforts to standardise and harmonise these classifications have intensified.

The evolution of standard statistical classifications has also paved the way for modern metadata standards. These frameworks have shaped advanced data processing and dissemination platforms, connecting a wide range of data providers with diverse user communities (United Nations, 2018).

2.2.3 Development of national accounts

Efforts to systematically measure economic activity began in the 1920s, leading to national industrial classifications, which initially were inconsistent across countries. Demand for international comparability resulted in the 1953 release of the System of National Accounts (SNA).² Since then, the SNA has undergone extensive revision. Additional

² The Material Product System (MPS) was developed as an alternative national accounting framework focused on the measurement of material goods in line with Marxist economic principles. It was formally adopted by Council for Mutual Economic Assistance (CMEA) countries in 1969 and emphasised the output of material goods while excluding many services from value-added calculations, reflecting the view that only tangible goods contributed to wealth creation. The transition of centrally-planned to market-oriented economies in the late 20th century led to

frameworks like the System of Environmental Economic Accounting (SEEA) have been developed to integrate environmental considerations into national accounts, reflecting the growing importance of sustainability in economic policy making.

2.2.4 Standardisation of demographic statistics

The first set of guidelines for the standardisation of demographic statistics was issued in 1958 at the request of the United Nations (UN) Statistical Commission. These initial recommendations aimed to establish international standards for census operations. Over time, the scope of these recommendations has expanded to address emerging national needs and reflect current practices in demographic data collection (United Nations, 2017).

2.2.5 Expansion of data sources

Over the past 30 years, data sources for statistics have shifted from statistical to administrative sources, and now to big data.³ This trend is driven by the development of national data infrastructures for data integration, including population, business, and property registers, (Wallgren, and Wallgren, 2014) and supported by data governance frameworks and institutional arrangements that allow for secure data access and fostering collaboration between NSOs and administrative authorities (United Nations, 2024).

2.2.6 Co-evolution of information technology and official statistics

Official statistics has always benefited from and driven innovation in information and data processing technologies, such as the punch card tabulating machine (Agar, 2006). NSOs transitioned from manual and mechanical tabulation to digital processing in the mid-20th century (United Nations, 1962), and the advent of the internet in the 1990s transformed how statistics were disseminated and accessed.

Today, official statistics continues to be at the forefront of Information Technology (IT) developments, with the use of big data sources, cloud computing and Artificial Intelligence (AI) enabling the refinement of methodologies and improving the timeliness and relevance of statistical outputs.

2.3 The emergence of a global statistical system

The emergence of a global statistical system has profoundly influenced the work of NSOs, dating back to the League of Nations, with the establishment of an International Statistical Commission in 1920 and the adoption of the International Convention on Economic Statistics in 1928. These early efforts laid the groundwork for international cooperation in the field of official statistics and set the precedent for harmonised practices that NSOs continue to build upon today (March, 1921 and Nichols, 1942).

Since its creation in 1946, the United Nations Statistical Commission has been the central coordinating body for the global statistical system. It has driven integration, supported capacity-building in developing countries, and established globally agreed statistical standards, including the SNA, recommendations for Housing and Population Censuses, and numerous other standards and recommendations designed to promote harmonised statistical practices through coordinated efforts of expert groups, task forces, and inter-agency collaborations (United Nations, 2025).

widespread adoption of the System of National Accounts (SNA) in former MPS countries. (See https://unstats.un.org/unsd/publication/SeriesF/SeriesF_66E.pdf)

³ In countries like the Nordic states and the Netherlands, census data derived from base statistical registers have demonstrated high quality and cost-effectiveness, often achieving efficiency improvements exceeding a factor of 10 compared to traditional, non-register-based censuses.

Today, the global statistical system⁴ continues to play a vital role, codifying key requirements into quality and ethics frameworks and codes of practice⁵ that are grounded in the Fundamental Principles of Official Statistics (UNFPOS) (United Nations, 2014). Ethical considerations have also gained prominence, particularly with the emergence of new data sources. Beyond privacy protection, ethics are embedded in quality frameworks and ethical guidelines. These frameworks support self-assessments and peer reviews that identify areas for improvement (UNECE, 2022).

3. External Challenges Facing NSOs

3.1 The changing relationship between NSOs and the public

A social contract of mutual obligations and expectations (Loewe et al., 2020) exists between the state and the public (Mwamadzingo et al., 2023). However, changes impacting this relationship between state and society are creating some of the most significant long-term challenges for NSOs.

In the context of official statistics, the public, citizens and businesses provide data to NSOs (i.e., contributing to the “common good”) and in return, NSOs provide essential information needed by society which is then used for decision making by policymakers, businesses and citizens. While in the past this agreement was more direct and explicit, it has become more indirect and subtle as NSOs increasingly engage with data from third parties rather than traditional survey methods. Consequently, garnering social acceptability for sourcing data from these new sources is a new and crucial task for NSOs.

Society should be able to trust NSOs with their data and understand that high-quality official statistics are an indispensable service for society. NSOs should be able to provide high-quality services and demonstrate that they are worthy of the public trust. Therefore, one of the central long-term *challenges* for NSOs comes from *changes* that reduce the quality of official statistics and the trustworthiness of NSOs.

3.2 Changes in our society

The following are key significant changes that pose challenges (but also opportunities) for NSOs.

Societal and political changes

1. Decreasing social cohesion
2. Decline of face-to-face activities
3. Shifting demographics
4. Heightened sense of privacy
5. Growing political polarisation

Economical, technical and environmental changes

1. Growing presence of private companies in the data business
2. Expansion of multinational corporations and their influence
3. Worsening climate change
4. Rapid advancements in AI

⁴ In addition to the United Nations Statistical Commission, the global statistical system includes the members of the Committee of Coordination of Statistical Activities (CCSA), and in particular regional bodies such as the Statistical Commission for Africa (SCA), the Conference of European Statisticians (CES), the Committee on Statistics of the Economic and Social Commission for Asia and the Pacific (ESCAP), the Statistical Conference of the Americas (SCA), and the Statistical Committee of the United Nations Economic and Social Commission for Western Asia (ESCWA).

⁵ Examples of quality frameworks for official statistics include the UN National Quality Assurance Framework (2019), the European Statistics Code of Practice (2017), the OECD Recommendations on Good Statistical Practice (2019), and the IMF Data Quality Assessment Framework (2012).

3.3 Challenges for NSOs

NSOs must provide quality statistics and insights while demonstrating that NSOs are trustworthy. We group the challenges that NSOs face into the three following aspects:

3.3.1 Measurement Challenges

The task of measuring relevant phenomena of interest to society is becoming increasingly difficult, and requires work on concepts, development of measurement, and agreement on new standards. Moreover, the complexity of modern economies and societies demands a shift from single-dimensional metrics to multidimensional ones.

Measuring societal phenomena accurately in today's fast-paced world requires precision and agility. Policy life cycles are becoming faster, and traditional statistical measures often lag behind real-time events, rendering them less relevant for immediate policy decisions. While alternative sources of data may be available, integrating such can be quite challenging, given that it is often generated for purposes other than statistical production.

Technology giants and private firms can often deliver data insights more quickly and tailored to specific needs, while NSOs must adhere to strict frameworks when measuring complex phenomena to ensure transparency, consistency, and international standards. NSOs must find ways to accelerate production while upholding methodological rigor to deliver high quality statistical data products.

3.3.2 Operational Challenges

The use of big data and transitioning processes to the cloud requires a significant overhaul of existing IT infrastructures. NSOs are pushed to become agile organisations, capable of rapid adaptation to new technology., and must hire new talent and upskill their existing staff (NITRD, 2019). AI is increasingly powering the tools that the public use to discover data. Consequently, NSOs are challenged to make official statistical data available in an "AI ready" way. This is all the while NSO budgets are often declining (Auerbach et al. 2024).

With the growing need for more timely statistics, multidomain and multidimensional insights on complex policy issues and response to emergencies, NSOs will be challenged to ingest, store, process and integrate all sources of administrative, privately, acquired, and publicly available data and harness such linked data to rapidly develop multidomain official statistics data products.

The operational challenges for NSOs are beyond technological. Traditional survey collection is becoming more difficult, resulting in plummeting response rates (Auerbach et al. 2024), and convincing individuals to continue to participate in surveys requires innovative engagement strategies.

3.3.3 Ethical Challenges

With heightened privacy concerns in society, NSOs must not only implement robust data protection measures but also actively communicate their commitment to data ethics to ensure trust. Transparency in data collection processes, clear communication of data usage policies, and stringent adherence to data privacy laws are essential components of such.

The ethical use of new data sources and emerging technologies presents a new layer of challenges. NSOs must adopt responsible and ethical frameworks to respond to such challenges in a way that ensures fairness, accountability, and transparency.

4. Opportunities for NSOs

4.1 Data stewardship

NSOs have traditionally acted as data custodians, managing the collection, storage and retrieval of data, and ensuring its quality at a technical level. Their comparative advantage in the provision of trustworthy information to society is a result of their origin and governance under legislation and codes of practice. Additionally, NSOs have a tried-and-tested reputation in providing reliable data and statistics to decision-makers and the public, who have used said data and statistics to navigate an ever-expanding data and information ecosystem.

Many NSOs are now moving to becoming **data stewards**,^{6,7} given the increase in new forms of data going beyond survey and government administrative data. A data steward assesses and promotes data use, identifies data needs and proposes mechanisms to fill any gaps. In order to best fulfil their role as data stewards, NSOs should adhere to and promote clear principles, such as the [Fundamental Principles of Official Statistics \(UNFPOS\)](#), which have been pillars of official statistics and statisticians more generally since 1994. This focus of NSOs in acting for the public good distinguishes them from data providers who may have commercial or partisan objectives.

4.2 Collaboration

An increasing proportion of the IT infrastructure of NSO, such as cloud storage and computing, or specialised data provision, belongs to a handful of private sector companies. Such technology can offer substantial savings in operational costs. Increased dependence on these providers could be problematic for *impartiality* and *equal access*. However, the use of such technology is not a problematic in-and-of-itself, as long as NSOs maintain their commitment to *relevance, impartiality, and equal access*, as well as *privacy* and *confidentiality*.

4.3 New data sources

Non-probabilistic sampling, crowd-sourced data, and targeted non-response follow-up are emerging as potential solutions to survey sampling issues. Not only is there potential to harness technology to improve data collection, analysis and production with such methods, but also to enhance NSO productivity (Molladavoudi and Bedard, 2023). However, new data sources from the private sector are typically produced for their own purposes, and so may have been collected in different ways to data collected by NSOs. This may also mean variations in the type of ownership of the data and the analytical output. However, there is an opportunity for the official statistics community to develop a framework for the responsible ingestion of new data sources into statistical production.

An important consideration when evaluating new data sources is that data collection should preserve privacy. Given the introduction of alternative data sources and methods of collection and production, it must be stressed that this principle needs to align also with privacy considerations. This is essential not only for statistical confidentiality, but also to reduce cyber risks.

4.4 New approaches to data outputs

There are rapid changes in the production of official statistics due to the incorporation of machine learning (ML), AI, and synthetic data. NSOs are best placed to utilise ML and deep learning models and algorithms to tackle a variety of complex tasks due to the statistical rigour and deep methodological expertise that NSOs possess. Additionally, NSOs are also well placed to assess the quality and trustworthiness of these models, which is important because to effectively

⁶ As defined by the United Nations: [UNSD — Working Group on Data Stewardship](#)

⁷ For instance, see New Zealand: [Statistics Act 1975 No 1 \(as at 01 September 2022\)](#), [Public Act 14 Duties of Government Statistician – New Zealand Legislation](#) and Singapore: [Ministry of Digital Development and Information](#).

apply these models to real-world prediction problems, the uncertainty of the model's predictions must be quantified (Molladavoudi and Yung, 2023).

While offering great potential, there are concerns around bias in large language models (LLMs) and other models that harness AI to produce outputs mostly from text. The bias can be in the form of potential over-representation or under-representation of specific populations, as well as the exclusion of those whose data is not in a machine-readable format. NSOs should consider the benefits of LLMs, but need to incorporate appropriate checks and balances when doing so.

Advanced technological tools also present the opportunity for improved technical communication, with improved visualisations and infographics, which make information more accessible.

5. A Vision for NSOs

5.1 NSOs need to adapt to the changing environment, becoming increasingly flexible through rapid evolution

NSOs need to become increasingly flexible through rapid evolution. At a fundamental level, the very nature of what is considered to be an official statistic also needs to change with a similar speed.

Rather than be concerned by competition, NSOs should act to ensure that statistics, including more timely, high frequency, and more granular statistics are produced, whether by themselves or by others, in compliance with the principles that guide NSOs. Private companies, ministries, academia, and non-governmental organizations can serve as both data and technology users as well as providers (e.g., financial transaction data, mobile phone data, administrative data and cloud platform providers). However, they can also act as champions and advocates for the mission of NSOs, by being intermediaries who repackage the data of NSOs, and providers of essential services that NSOs require. As more data emerges from alternative sources and NSOs expand their range of data products and services, establishing strong partnerships becomes critical. These partnerships should go beyond the traditional roles of data providers-users, but to form a collaboration where NSOs work with partners to fill information gaps and complement each other's strengths, providing high-quality information for the broad data and information ecosystem. To achieve this, NSOs should assess existing and potential partners, clearly define their own capabilities and offerings, adopt a systematic approach to partnerships, and allocate resources dedicated to nurturing these partnerships. Equal treatment of partners is a requirement, both in terms of how NSOs see organisations in different sectors, particularly the private sector, and also how NSOs work with different organisations in the same sector. There is also a question as to how NSOs may place themselves in debates about data sovereignty, and their role in the data and information ecosystem, as the value of data can lead to owners of data preferring to restrict access even to NSOs.

Analytical products, beyond those used for traditional statistics, are likely to play increasing prominence in the outputs of NSOs. New data sources open a wealth of opportunities for new data products and services. Demand for timelier statistics and use of new data sources will lead to the increase of experimental statistics as well as the use of modelling in statistics, with nowcasting as the point of culmination. Analytical products will gain prominence in the regular output of NSOs.

5.2 NSOs need to reaffirm and strengthen their role with all citizens and users

NSOs will need to continue to ensure that key information, analysis, data products and statistics remain available freely to society. They should be of high quality and comply with the UNFPOS, quality frameworks and other relevant guidance.

In addition to building constructive partnerships with other organisations, NSOs should strive to share data with analysts and researchers as early as possible to allow them to produce further value-added outputs and analyses beyond those produced by NSOs themselves. Any data shared must be protected to meet privacy and confidentiality requirements through mechanisms such as research data centers, public use micro-data files and Privacy Enhancing Technologies (PET).

NSOs need to adapt to non-human entities as significant data users. Search engine optimisation has already become a crucial factor when releasing official statistics as search engines serve as an important broker between human users and NSO data. NSOs must facilitate access to their data by AI models and tools (e.g., LLMs) while acting to retain the integrity and quality of such provided data, i.e. the data must be AI ready.

Due to the expanding data and information ecosystem and increasing provision of information, data, analysis, and statistics by others, the way NSOs disseminate data and statistics will need to be more responsive to how citizens and users are in this moment accessing data and statistics. NSOs will need to develop more digital data, analysis, and statistics dissemination platforms, thereby allowing users to access data, analysis, and statistics at different levels of aggregation across multiple dimensions including geographies, socio-economic characteristics, and other dimensions.

While not directly responsible for the collective data knowledge of a country, NSOs have a responsibility to do their best to increase data literacy. With increasing use of data to spread mis-information and dis-information, the efforts of NSOs in improving data literacy may help citizens to identify incorrect information. However, responding to mis/disinformation while safeguarding the neutrality of NSOs will be critical to maintaining credibility and reinforcing their role as impartial providers of trustworthy and reliable statistics.

Trustworthiness has to remain a cornerstone of NSO relations with others. NSOs have an important role in ensuring privacy, confidentiality, and data security, and that role will grow in importance as they move away from paper, PDF, and HTML dissemination to more dynamic digital forms of dissemination of data, analysis, and statistics. Citizens trust NSOs to handle their data responsibly and produce high-quality, rigorous data, analytical, and statistical products, while NSOs maintain high standards of service and demonstrate their commitment to privacy and data protection.

5.3 NSOs need to accelerate modernisation of their internal operations

Delivering more granular and more regular data products, analysis and statistics using multi-source data for multi-purpose production will require changes to the internal operations of NSOs. They will need to go beyond the use of automation but also use AI, including generative AI, and other tools in both production and dissemination. They will need more flexible IT infrastructures, making greater use of open source and, preferably, cloud-based options. They will also require evolving skill sets and areas of expertise, including methodological expertise, in their staff beyond those that are already traditionally found in NSOs.

The skill sets required will need to include new skills such as design thinking, data engineering, delivery and product management. As NSOs become increasingly digital, they will need to have within their workforces the full set of digital skills. Developing an agile culture through the establishment of robust production foundations (e.g., flexible infrastructure) is essential to foster an organisational culture that supports reacting swiftly and effectively to urgent information needs during any crises.

Growing emphasis on open research and open science has heightened user expectations for openness and transparency. As NSOs expand their products to complex analytical products, thereby shortening the time-to-market for their data and services in the future, it will become ever more important that the process and quality implications are shared in a transparent way, so as to maintain the public trust. Transitioning to open source and reproducible pipelines may be a major IT infrastructure issue for some NSOs. Making it part of standard practice and behaviour in NSOs requires significant cultural change at all levels of organisations.

To offer new products, it is not enough to improve efficiency of operations. On occasion, products that no longer meet user needs must be modified or discontinued to free up resources. While identifying user needs and producing statistics accordingly has been part of the standard production process, quality reviews and flexible adjustment, reviewing and actively monitoring existing products, measuring impacts and adjusting accordingly, and in particular discontinuing some of them, has traditionally been challenging in public offices, where inertia can be a significant barrier to change. Use of a robust monitoring system is recommended to help to avoid overlap of similar products and optimise resource allocation.

5.4 The role of standards in a rapidly changing world

The modernisation of NSOs also requires the modernisation of procedures, people, and organisations. The success and adoption of specific statistical standards are influenced by both technical factors such as maturity and ease of use, and also social factors such as community engagement, trust and collaboration.

The choice of technologies in accordance with specific standards should not be the primary concern. Delivery teams should be able to (within reason) choose the technology that works best for the purpose at hand and change things to address problems if they arise. Rather than prescribing the use of approaches, methods or technologies, a standard arises and becomes de facto in the official statistics community when statisticians use the same tools because of their proven effectiveness and widespread acceptance. This organic development of standards allows for a healthy balance between consistency and flexibility.

Common frameworks for statistical production are essential for effective collaboration and operational efficiency. The standardisation of statistical production systems and processes allows statistical organisations to respond to emerging risks and challenges and to leverage new opportunities by facilitating the reuse and sharing of solutions and services. However, it is important that standardisation efforts keep in mind the need for modularity, flexibility, and evolvability, avoiding a rigid approach, which is essential in a rapidly changing data and technology landscape.

Innovation and evolution of statistical standards is crucial to continuously incorporate new technologies and methodologies as they emerge, ensuring that statistical practices remain up-to-date and innovative.

Emerging data sources and types, such as **big data** and **Internet of Things** data, will require updates to standards to accommodate these new forms. Concurrently, growing concerns over data privacy and security necessitate periodic revisions to address new regulations and ethical considerations.

Standards are effective only with the ongoing support and endorsement of a user community and the public, therefore NSOs must ensure the demonstrable implementation of standards so users and the public are confident in the trustworthiness of NSOs. However, standards need to be regularly refreshed, as outdated standards can undermine trust. Nor should standards be too rigid, as current statistical methods are not necessarily the only way for NSOs to serve the public.

The modernisation of official statistics involves not just the adoption of new technologies and tools, but also the modernisation of procedures, people, and organisations. To be effective, technical standards need to be supported and adopted by a community of users. The success and adoption of specific statistical standards are influenced by both technical factors such as maturity and ease of use, as well as social factors such as community engagement, trust, and collaboration.

The pace of external change means that NSOs and international bodies will have to work hard to ensure that at any point, the set of standards to which NSOs demonstrably adhere are appropriate for the current environment, flexible enough to adapt to new challenges and opportunities, and do not stifle innovation.

5.5 Conclusion

In a world with a rapidly changing data and information environment, NSOs as trusted independent data and statistics providers are well placed to steward governments and the public through these uncharted waters. In order to do so, NSOs must look both inward and outward. NSOs must acquire new types of data and connect with the public. This is essential for ensuring that data and statistics are understood and easily usable. However, in the modern AI and open source age this means that NSOs should be producing outputs that are not only readable to human eyes, but are also machine-friendly. By meeting these challenges and opportunities in an open, transparent, and agile way, NSOs can ensure their trusted place in society and make new advances in the provision of accurate and timely data and statistics.

References

- Agar, J. (2006), “What Difference Did Computers Make?”, *Social Studies of Science*, 36(6), pp. 869–907. <https://www.jstor.org/stable/25474487>.
- Allen, R. (1970), “On Official Statistics and Official Statisticians”, *Journal of the Royal Statistical Society. Series A (General)*, 133(4), pp. 509–530. <https://www.jstor.org/stable/2344297>.
- Auerbach, J., McKay Bowen, C., Citro, C., Pierson, S., Potok, N., and Seeskin, Z. (2024), The Nation's Data at Risk - Meeting American's Information Needs for the 21st Century; <https://www.amstat.org/policy-and-advocacy/the-nation-s-data-at-risk-meeting-american-s-information-needs-for-the-21st-century>.
- Hoffmann, E., and Chamie, M. (2002), Standard statistical classifications: Basic principles. *Statistical Journal of the United Nations Economic Commission for Europe*, 19, pp. 223-241. https://unstats.un.org/unsd/classifications/bestpractices/basicprinciples_1999.pdf.
- Loewe, M., Zintl, T. and Houdret, A. (2020), The social contract as a tool of analysis: Introduction to the special issue on “Framing the evolution of new social contracts in Middle Eastern and North African countries” <https://www.sciencedirect.com/science/article/pii/S0305750X2030108X>.
- March, L. (1921), “International Statistics and the League of Nations”, *Quarterly Publications of the American Statistical Association*, 17(133), pp. 629–635. <http://www.jstor.org/stable/2965323>.
- Mwamadzingo, M., Koyi, G., Watt, M. and Waziri, K.M. (2023), The world of work and the new social contract; <https://www.ilo.org/publications/world-work-and-new-social-contract>.
- Molladavoudi, S. and Bedard, M.E. (2023), [Pivoting Government through Digital Transformation](#). J. Liebowitz (Ed.), *Data Science and Technology Trends for Official Statistics: Opportunities and Challenges*, pp. 129–146. Auerbach Publications.
- Molladavoudi, S. and Yung, W. (2023), [Exploring Quality Dimensions in Trustworthy Machine Learning: Explainability and Uncertainty Quantification](#). *AStA Wirtschafts-und Sozialstatistisches Archiv* 17(3), pp. 223-252.
- Nichols, C. K. (1942), “The Statistical Work of the League of Nations in Economic, Financial and Related Fields”, *Journal of the American Statistical Association*, 37(219), pp. 336–342. <https://www.jstor.org/stable/2279001>.
- NITRD (2019), *Networking and Information Technology Research and Development*, Executive Office of the President, [2016–2019 Progress Report: Advancing Artificial Intelligence R&D](#), p. 33.
- Stephan, F. F. (1948), “History of the Uses of Modern Sampling Procedures”, *Journal of the American Statistical Association*, 43(241), pp. 12–39. <https://www.jstor.org/stable/2280064>.
- United Nations (1962), *The International Compilation of External Trade Statistics by Computer: Report by the Secretary-General*. E/CN.3/300. <https://unstats.un.org/unsd/statcom/12th-session/documents/1962-300-ExternalTrade-E.pdf>.
- United Nations (2014), *Fundamental Principles of official Statistics*. Resolution adopted by the General Assembly on 29 January 2014. <https://unstats.un.org/unsd/dnss/gp/FP-New-E.pdf>.
- United Nations (2017), *Principles and Recommendations for Population and Housing Censuses, Revision 3*. United Nations. https://unstats.un.org/unsd/demographic-social/Standards-and-Methods/files/Principles_and_Recommendations/Population-and-Housing-Censuses/Series_M67rev3-E.pdf.

United Nations (2018), Data Interoperability: A Practitioner's Guide to Joining Up Data in the Development Sector,
<https://unstats.un.org/wiki/display/InteropGuide>.

United Nations (2024), Guidelines on Statistical Business Registers (Studies in Methods, Series F No. 122).
Department of Economic and Social Affairs, Statistics Division. United Nations: New York

United Nations (2025), Department of Economic and Social Affairs, Statistics.
<https://unstats.un.org/UNSDWebsite/statcom/>