Statistics of a lifetime – and beyond?

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Abstract

Official statistics are part of the infrastructure of democratic societies. As societies have changed statistics have changed accordingly, not so much in content but in ways of production and dissemination. This paper describes important trends in official statistics over approximately the last 50 years, a period roughly corresponding to the author's professional experience in this area.

The trends considered comprise global trends affecting official statistics and the corresponding changes in these statistics and the way they are produced. The general quality revolution in the last century has affected official statistics. This includes the recognition of such statistics as a public good available for free for everyone, and the development of institutional quality frameworks for official statistics. The Internet caused a shift in the way statistics were spread, while more use of secondary (non-statistical) input data has changed the way of producing statistics.

Based on the history, some thoughts on the future development of official statistics and how to meet new challenges are addressed. Now the data era threatens to replace statistics. Major shifts are difficult to foresee, but there is no doubt that the development of artificial intelligence will affect both the way statistics are produced, and not least how statistics are understood and used in society. Quality frameworks for official statistics may be changed, but the main principles or core values of such statistics should remain. Cooperation and statistical literacy are keys. Official statistics must be associated with trusted institutions.

Aspects linked to the development of European and Norwegian statistics are briefly described. Examples referring to Statistics Norway are believed to be valid beyond the national level.

Keywords: Official statistics, Quality, Development trends

1. Introduction

In the discussion on the future of official statistics it is useful to consider how such statistics have developed in the past. This covers how statistics have adapted to or taken benefit from developments in user needs, technology, and other relevant conditions. The paper considers developments in or affecting official statistics over about 50 years.

The trends considered include the recognition of official statistics as a public good, systematic quality work in statistics and the development of Internet in addition to more use of secondary data and coordination of the statistical system. The most recent development affecting official statistics is linked to the so-called data era. Most of the trends originated 50 years or earlier as ideas, though materialised fully during the last 30 years.

Some thoughts on the future of official statistics are included in the paper. This regards further developments of the trends described but also new issues such as the use of artificial intelligence (AI).

2. Setting the table

Svein Nordbotten gave a speech at Q2012 in Athens, looking back and forward (Nordbotten, 2012). He started with the punched cards used for censuses at the end of the 19th century. Other main shifts comprised the use of sampling theory 100 years ago, and the introduction of electronic processing in the 1950s. He mentioned that automatic editing really took off in the 1990s when computers had become important tools for simulating the human brain by means of artificial neural networks. An example relevant before its time!

A former Director General of Statistics Norway, Petter Jakob Bjerve, wrote a paper on international trends in official statistics for a lecture presented to the Statistical Council of Portugal (Bjerve, 1980). He noted that the use of official statistics was expanding rapidly. On data collection he noticed the international trend in utilizing administrative data more and more.

Bjerve was concerned with quality before this became a pronounced focus for the National Statistical Institutes (NSIs). He also advocated analyses to satisfy user needs.

An interesting aspect of the period up to the late 1970s was according to Bjerve that more and more countries planned their economies, following the development of national accounts after the second world war. Related to this he advocated analyses based on official statistics including projections. Statistics Norway has since 1950 had a department of research. One example of the planning trend was the development of natural resource accounts within Statistics Norway around 1980, where use of natural resources was linked to the national accounts. However, the planning trend was broken during the 1980s, though national accounts are central in most countries. Today, the need to control emissions damaging the climate is central, and linking emissions and environment to the economy and more central planning is on the agenda.

Bjerve considered the need to coordinate production of official statistics. He mentioned that the NSIs have been given greater and greater professional independence.

3. Main trends in official statistics

Some of the trends described in the following are mentioned by Sæbø and Hoel (2023).

3.1 Official statistics as a public good

The understanding that official statistics are a public good, available for free for all users, is relatively new. The UN Fundamental Principles of Official Statistics (UNFPOS) first adopted by the Statistical Commission in 1994 and reaffirmed in 2014, state that “official statistics provide an indispensable element in the information system of a democratic society, serving the Government, the economy, and the public with data about the economic, demographic, social and environmental situation“ (UNFPOS, 2014).

UNFPOS is a basis for quality frameworks such as the European Statistics Code of Practice (ESCoP, 2017) and the UN National Quality Assurance Framework (UN NQAF, 2019). These frameworks elaborate how to secure official statistics as a public good. Official statistics as a public good is also included in new statistical legislation.

Official statistics available for everyone should in principle be free of charge. Free statistics contribute to goodwill and increased trust.

Production of some statistics may involve extra use of resources and costs beyond governmental grants. In this case most NSIs receive payment corresponding to marginal costs (in practice often average costs including necessary overhead linked to support, equipment, and offices). Statistics Norway's budget today is for example based on about 25 percent "market funding" of which most comes from public institutions such as ministries. Some such funding is useful to provide user feedback, too much might involve a risk of less professional independence. It could at least be perceived as such. However, this should not be a problem regarding official statistics as a common good. In Norway the results of all production of statistics or analyses are available for free simultaneously for all. This is part of all contracts with funding partners.

3.2 Professional independence

The recognition of the professional independence of the producers of official statistics has emerged in parallel with the understanding of these statistics as a public good. But what does professional independence mean? UNFPOS does not mention independence specifically, but states that "to retain trust in official statistics, the statistical agencies need to decide according to strictly professional considerations, including scientific principles and professional ethics, on the methods and procedures for the collection, processing, storage and presentation of statistical data".

The indicators in ESCoP mention the responsibility of the NSIs and Eurostat for ensuring that statistics are developed, produced and disseminated in an independent manner, in other words *how* statistics are produced and disseminated, but not *what* or *which statistics* should be produced. What statistics should describe depends on the user needs, both the needs of the decision makers and the public.

However, even if professional independence is recognised as a precondition for producing official statistics today, there are several examples where this principle is not followed. Some of these are mentioned by Sæbø and Holmberg (2019) who discuss how professional independence may be challenged by other principles.

3.3 Quality

A quality revolution took place worldwide during the last half of the 20th century. This had great impact on the production of statistics. This revolution is often associated with professor W. Edwards Deming and his advisory activities in Japan from 1950 (Deming, 1975), which provided the basis for Total Quality Management (TQM). Important principles in TQM comprise customer or user orientation, understanding variation and its causes, teamwork, and continuous improvement. Statistical methodology was applied as a basis for improvements controlling processes.

Quality was not new to statistical organisations. However, at least until the end of the century the concept was almost solely associated with accuracy. Total quality thinking points at a wider content of the quality concept, covering the needs of different users for products, as well as requirements to the underlying production processes as the key to improvements.

In Europe, a milestone in the development of a systematic quality work within official statistics was the Leadership Expert Group (LEG) on Quality which published a comprehensive report on quality in the European Statistical System (Eurostat, 2002). The report is inspired by TQM philosophies. It refers to the quality definition given by the International Standardisation Organisation (ISO) which in its later version is: “Quality is the degree to which a set of inherent characteristics of an object fulfils requirements“ (ISO 9001: 2015). A simple version of this is "fit for use". Different users may have different needs that must be balanced to give the quality concept a concrete content.

The LEG report states that quality can be defined along several dimensions which constitute the product quality of statistics: Relevance, accuracy, timeliness and punctuality, accessibility and clarity, comparability, coherence and completeness. These dimensions are largely identical with the principles for quality of statistical output in the ESCoP that was originally adopted in 2005.

The LEG on quality developed a list of recommendations on quality work in the European Statistical System. One of them was to organise a biennial conference covering methodological and quality-related topics. The first such conference took place in Stockholm in 2001. The Q-conferences have been held regularly except for the pandemic year of 2020.

The UNFPOS has had a great impact on the work in statistical organisations worldwide. It was originally developed under the leadership of the United Nations Economic Commission for Europe (UNECE) following the need for a set of principles governing official statistics when countries in Eastern Europe began to change from centrally planned economies to market-oriented democracies. It was adopted by the UNECE in the Conference of European Statistics (CES) in 1992. Statisticians in other part of the world soon realised that the principles were of much wider global significance. Hence the process towards the UN Statistical Commission

adoption of UNFPOS in 1994 started. Its rather short and simple formulation structured as 10 commandments is one of its strengths. UNFPOS itself does not say much about how to live up to its principles. However, as mentioned it has been the basis for the more recent quality frameworks, the global UN NQAF (2019) and regional frameworks such as ESCoP (2017).

The IMF Data Quality Assessment Framework (2012) should also be mentioned. In fact, the IMF was one of the first organisations promoting official statistics as a common public good and the importance of equal and simultaneous access to such statistics for everyone.

In the EU and the European Economic Area including Norway, the ESCoP is the basis for the quality requirements for official statistics. These requirements are reflected in new statistical legislation.

In Norway, the requirements for official statistics are given in the new Statistics Act (2019). Professional independence and impartiality are pillars in this act.

A quality framework is not much worth if not used for improvements. It can be the basis for self-assessments, audit-like reviews and peer reviews identifying improvement points to be followed up. In Europe, peer reviews based on ES CoP have been carried out for the whole European Statistical System three times. All countries had to set up improvement plans which have been followed up by Eurostat annually.

After each round of European peer reviews the ESCoP has been revised. The current issue from 2017 was strengthened by including a principle on coordination and cooperation.

There has been a work in the international statistical community on core values for official statistics. The aim of selecting and communicating core values is to promote trust in official statistics. The Conference on European Statisticians session in 2022 endorsed a set of 6 core values for official statistics or their producers (CES, 2022).

Relevance of official statistics is the first core value. Other values *are impartiality, transparency, professional independence and protection of privacy* which are largely specific for official statistics. The last value is *collaborative* which points at the direction producers of official statistics should go. The core values can be looked upon as a superstructure over the UNFPOS, and hence over the main principles in the quality frameworks as well.

3.4 WWW

A major shift affecting official statistics came with the Internet. Several NSIs including Statistics Norway reacted quickly to the new possibilities and launched their first websites early in 1995. In the annual plan for Statistics Norway written during the autumn 1994 this was not foreseen. About 10 years later, the Internet was the main channel for disseminating statistics, such as news, tables and publications, in addition to databases where users could specify their own tables and download statistics.

Today, statistics can be transferred in different formats and by machine-to-machine transfer through the application programming interface (API). It has improved transfer of data between systems, and this has had great significance for statistics as open data. The NSIs' use of social media for spreading or referring to statistics is common.

Technology has also facilitated electronic data collection by the NSIs.

3.5 Use of secondary data

During the last 30 years there has also been a shift in data sources for statistics, first from statistical sources (data collected for the purpose of statistics) to administrative sources (data registers developed for public administration), then to other sources including what is denoted as new sources including big data. Sæbø (2016) notes that while the first Q conference in 2001 treated quality of administrative registers only in a session on business registers and macroeconomics, there were 5 sessions devoted to this in Q2014. Now most sessions treating data collection focus on utilising new data sources, in addition to administrative data. New data sources dominate the discussion on development in different working groups in the international statistical community, though this has not resulted in many official statistics yet.

Recently, several countries have renewed their statistical legislation with greater emphasis on access to privately held data on third parties.

In Norway, official statistics are largely based on administrative data systems. Statistics Norway has established a system for cooperation on quality with holders of administrative data to be used for official statistics. The system involves the signing of cooperation agreements. There are currently around 30 of such agreements. The agreement terms state that Statistics Norway is to produce yearly quality reports for each administrative data system, also for the use of the data holder to improve the data quality. There are about 100 such reports today.

3.6 From NSIs to statistical systems

NSIs are not sole producers of official statistics, but the NSIs normally have a coordination role that comprises quality assurance. The European Statistical System currently consists of Eurostat, 31 NSIs and 282 other national statistical authorities[1]. In the recent round of European peer reviews coordination has been a main issue.

According to the Norwegian Statistics Act (2019), Statistics Norway shall coordinate all development, production, and dissemination of official statistics in Norway, and produce an annual public report to the Ministry of Finance on the quality of official statistics. The Ministry has appointed a Committee for Official Statistics, led by Statistics Norway. The members

[1] According to Eurostat website https://ec.europa.eu/eurostat/web/european-statistical-system

mainly represent authorities who are responsible for official statistics or hold administrative data systems that are important for official statistics. The Committee shall contribute to the quality of official statistics and an effective national statistical system. Based on the Statistics Act, Norway has a national programme that defines and delimits official statistics. The programme is drawn up by Statistics Norway in consultation with the Committee for Official Statistics. The current programme covers the period 2024 – 2027 (Statistics Norway, 2024). Statistics Norway and 15 other public authorities have the responsibility for official statistics.

3.7 Data era replaces statistics

Data is not the same as statistics, though statistics are also data. Statistics based on aggregated data are normally closer to decisions than data. However, today the concept of data is widened and dominates the public discourse. The age of statistics is being replaced by the data era as expressed by Radermacher (2021).

Statisticians and data scientists cooperate and participate in the same international fora. In their communication, it is important to use a clear language to avoid misunderstandings. Open data are an advantage for use and reuse of data in the society. What is sometimes not communicated in their discussions is that official statistics as a public good today are open almost by definition.

The request for more open data may indicate a need for more relevant and disaggregated statistics. Access to source data used in the production of official statistics can normally not be open to all because of necessary confidentiality rules. They may be accessible, with specific restrictions, for research or other specified purposes. A lot of work is going on to improve access to more data by anonymization and advanced technical solutions.

Reister (2023) addresses the assurance of quality in the new data ecosystem and warns to mind the gap between data and statistics. One of his points is the need to distinguish between the quality of data for different purposes including the quality of source data used to produce statistics, and the quality of output statistics. Distinguishing data in general from statistics can help bring clarity to the discussion of the role of official statistics in the data ecosystem.

4. What now?

Many working groups or task forces are considering todays' challenges to official statistics and how to meet these. Challenges comprise competition from new producers of data and statistics, also by using artificial intelligence (AI), the difficulties for the public to differentiate the continuous data flow through the society from official statistics with specific quality requirements, access to privately held data and possible lack of funding because of easy access to data from other sources than the NSIs.

What from the past can contribute to new solutions? A few thoughts based on the trends considered above follow; new developments linked to data stewardship and AI are considered in separate chapters.

As a prerequisite for a democratic society, *official statistics as a public good must be promoted and defended*. Far from all countries in the world are democratic, and there is probably a way to go for all official statistics in practise to serve as a basis for a public debate. The work of international statistical organisations to promote quality frameworks based on UNFPOS is crucial since they contain principles and requirements supporting this and assuring the professional independence of producers of official statistics. The core values are also important in this context.

There is a discussion in the international statistical community about the quality of source data, in particular new, often denoted big data. Do we need to develop new quality frameworks for such data? Some of these discussions are based on misunderstandings about the difference between quality of produced statistics and quality of source data. The quality frameworks for statistics are geared towards the users of statistics, to ensure that statistics are fit for use. Statistics are based on source or input data that are fit to produce statistics, which in principle is different from requirements to output statistics for their users. This means that there may be different quality dimensions and requirements for such data, though some of the concepts used for characterizing the quality of statistics are suited for source data as well. What might be added in future revisions of quality frameworks for statistics is a requirement to systematic assessment of source data quality following checklists adapted to the type of data.

Gomez et al. (2023) address the overlap between ethical codes or assessment tools, legislation and the ESCoP. Discussions on new roles of official statistics and access to and use of new input data such as big data have triggered even more work on developing ethical and other principles and requirements for official statistics, possibly overlapping existing codes and frameworks. The paper argues that most of new proposals are already covered by existing codes/frameworks, and even statistical legislation. But what might be missing is highlighting and communicating what particularly applies to ethics in data collection.

There is a tendency of reinventing the wheel when developing frameworks, beyond what can be justified, e.g. to assure ownership. New data sources may imply a need for modifications and revisions of existing quality frameworks. However, that is different from developing new frameworks overlapping the existing.

5. Data stewardship?

There is a discussion in the international statistical community on the role of NSIs as data stewards. Several working groups and meetings have had this on the agenda.

In brief, data stewardship can be defined as the responsibility to manage a data ecosystem. The objective is to improve the use of data and statistics in society.

While few NSIs have the full responsibility for all public data as a national data steward, many hold this role for data used for official national statistics, including access to administrative data, sharing of data given privacy protection and coordination of the national statistical system. Almost all European NSIs collaborate extensively with other government bodies on issues related to data and information management processes. This may be prescribed in the statistical legislation, but it varies between countries.

This is in line with the experiences and plans for Statistics Norway, see Sæbø (2024). Statistics Norway has collaborated with other public authorities to develop solutions which have simplified the employers' communication with the different authorities, but which has also benefitted the production of official statistics.

To take a more active role in such collaboration, quality assurance, data sharing, teaching, and explaining statistical literacy in the society is natural for the NSIs. Most of these extensions of the role of an NSI are relevant regardless of the legislative basis.

Data stewardship roles may involve promotion of data exchange that go beyond the main NSI role of producing official statistics and sharing of microdata under specific conditions. This involves a risk of reducing trust, even if trust may also be an argument for extending the NSI role. An example is the efforts to utilise privately held data on third parties for official statistics in Statistics Norway, see Sæbø and Dimakos (2023). The statistics act authorizes such access. However, in a project to use bank transaction data linked to receipts from grocery stores as a basis for a new household budget survey, there has been protests both from data holders and the public. The Data Protection Agency has decided to forbid this because of possible privacy implications with reference to the Personal Data Act/GDPR. Statistics Norway decided to postpone the project while developing more methodology on data minimisation and offers a cooperation with the Data Protection Agency. It is a challenge to explain that data will only be used for official statistics describing groups and not individuals. The public debate focuses on surveillance.

The conflation of data and statistics is probably one of the reasons why it is challenging to explain that official statistics do not threaten privacy. An extended role for the NSI as national data steward might not make tasks like this easier.

6. Artificial intelligence

Artificial intelligence (AI) and machine learning (ML) are often mentioned in connection with new developments in data science and statistics. Statistics might be considered a core element of AI (Friedrich et al., 2022).

Use of AI is not new, and machines have taken over manual operations for centuries. But as normal applications follow some years after theory. From the beginning of the 1990s, AI has been developing with major breakthroughs and practical applications such as automatic face recognition, speech recognition, translation, autonomous driving, and games such as chess. This is partly linked to an explosion in available open data, code and in particular computing capabilities. Today, machines can learn from data and information in amounts far beyond what humans can manage, but they still depend on human teaching. The development of AI is expected to expand dramatically in the years to come. We might be witnessing a shift comparable with the development of Internet 30 years ago.

AI has already affected the production of official statistics. Examples comprise programming, automatic classifications and editing. However, many new activities within statistics in this area can mainly be classified as research and development. The most relevant areas for implementation in the first round seem to be further automatization of editing to improve effectiveness and timeliness. Dissemination including the development of chatbots is also a relevant area for new developments.

Challenges are linked to possible biases in the training material, necessary protection of privacy and false news also based on statistics. The results of using AI must be validated. Tools that can contribute to modify results in desirable directions are under development. One example is the so-called constitution, named after the legal constitutions. By comparing statistical results with given laws/regulations (such as GDPR) and guidelines, possibly also quality frameworks, they may be modified in a specific and ethical direction.

However, another side of the coin is how statistics are used and tools applied by our users. Will official statistics be recognized as trusted compared to an increasing amount of false and misused information also based on statistics? Promoting statistical literacy will be even more important for statistical institutions.

Recently, much attention has been devoted to chat robots such as ChatGPT and Copilot. An example particularly interesting for statisticians is Google's Data Commons, a system for presenting graphics including maps with data and statistics. These statistics are from open sources, mainly international organisations including UN and Eurostat but also from some NSIs. The sources are referred to, but there might still be a challenge regarding the visibility of official statistics compared to other statistics, and hence the quality of data in the system.

So far, the AI systems are a bit immature. They are very impressive when used for the purposes they are trained for, but other purposes humans take for granted like ethical principles may be missing. Validation and quality control are crucial.

7. Conclusions

Official statistics have developed greatly during the last 50 years. This has not so much applied to the content of such statistics, but to systematic quality work and the technological developments affecting their production and dissemination. Major developments are linked to the recognition of official statistics as a public good, available for free simultaneously for everyone in line with the development of quality frameworks for statistics, use of administrative and other data sources, the development of Internet and the following data revolution.

The last chapter in this development is probably the exploding use of artificial intelligence. This will affect both the production and use of official statistics positively, but it also represents a challenge for official statistics. Will such statistics be visible and perceived as relevant compared to the access to other data, including misuse of statistics and fake news? Availability of information of sources for statistics and data may not be granted.

Quality control and promotion of statistical literacy are important tasks for an NSI which may go beyond its own statistics.

Keeping and developing the statistical infrastructure in line with developments in the society and technology will be crucial also in the future. Reserving enough resources for research and development of new technical solutions and data to produce statistics is necessary. International cooperation is important in this context. A key concept linked to innovation is *curiosity,* an attitude that should pervade any statistical organization.

The NSIs should stick to the core values of official statistics, and extending their roles should not compromise this. Collaboration is probably the main answer to the discussion on extended roles. Official statistics must continue to be associated with trusted institutions.

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