

Innovation in the European Statistical System: Recent achievements and challenges ahead

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Abstract. The National Statistical Institutes (NSIs) of the European Statistical System (ESS) have constantly strived to innovate products, processes and methods. Recent developments in the past decade have shown how rapidly data ecosystems are evolving across our globalised and digitalised societies. The outbreak of the COVID-19 pandemic in 2020 represented a turning point for innovation in the ESS. The speed of change spiked: those NSIs that had established a solid ground for innovation managed to continue providing high quality statistics to society and policymakers, while exploiting the potential for innovation given by the availability of new data sources. Despite the pandemic slowly losing its grip, Europe has found itself in the middle of a new crisis with the Russian invasion of Ukraine. Therefore, NSIs now face the challenge of keeping up the innovative work and rolling out these innovations into production. This paper provides an overview of the work on innovation done at the ESS level in recent years and its contribution to the resilience of the statistical system to respond to recent crises. Furthermore, taking stock of recent experiences, it presents some of the main challenges and enablers which are needed to sustain ESS innovation in the years to come.

Keywords: Innovation, European Statistical System, COVID-19, Ukraine, war

*‘When the winds of change blow, some people build
walls and others build windmills’
– old Chinese proverb*

1. Introduction

The European Statistical System (ESS) is the partnership between the European Union (EU) statistical authority (Eurostat) on the one hand, and, on the other, the National Statistical Institutes (NSIs) and ‘Other National Authorities’ that are responsible for the development, production and dissemination of European statistics in each EU Member State. This partnership also includes the European Free Trade Association (EFTA) countries. The primary objective of the ESS is to ensure the production of the European statistics that are compiled in all of the Member States of the EU, and to guarantee that they are comparable, reliable, relevant and usable. Eurostat has a central function in this co-

operation and it coordinates the work to develop statistics across national borders and ensure the availability of harmonised European statistics of a high quality. In its role, Eurostat is the authority providing the official statistics for the EU – European statistics – as a public good, vital for evidence-based decision-making in the EU.

The essential mission of official statistics is to provide information about societies, economies and the environment to citizens, policymakers, researchers and economic actors, enabling them to take decisions and form opinions based on facts and evidence [1]. Thus, official statistics have constantly evolved following the trajectory of the evolution of societies and economies. This enduring adaptability of official statistics involves both methods and statistical products and it is critical for the survival of statistical offices and for their relevance in modern societies. There is a growing debate on innovation and this trend has been accelerated by recent events that have demonstrated how quickly our societies can be disrupted by unforeseen and unprecedented shocks.

Recent crises – from the financial crisis to the COVID-19 pandemic, and now the Russian invasion of

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Ukraine – have shown that there is no room for complacency. In our rapidly changing and increasingly data-driven society, there is a growing demand for better, more up-to-date and more detailed statistics. Providers of official statistics must therefore innovate and equip open societies with the tools needed to respond to an increasingly uncertain environment and the many associated challenges and opportunities. NextGenerationEU, the European Green Deal and other flagship EU policy programmes involve ambitious changes such as the twin (i.e. green and digital) transitions. They call for an augmented portfolio of European statistics that is more granular, more accessible and timelier. Radical advances must be made in data supply and use, together with major investments in data production, data quality and metadata. The widening gap between what is expected from official statistics and what is currently delivered in practice requires vision, energy and urgent action. The world of official statistics is therefore undergoing profound transformation at the national, European and global levels.

The main goal of this paper is to look back and provide an overview of how innovation has developed in the ESS in recent years, with a special focus on the response to recent global crises and a glimpse into future plans. Section 2 introduces the scope and challenges of innovation in official statistics. Section 3 summarises the main innovation investments in the last decade that have allowed the ESS to build the foundations of a more resilient system. Section 4 focuses on how the ESS reacted during the pandemic and on some key enablers for innovation that emerged during this period (i.e. experimentation, collaboration and skills), while Section 5 gives an overview of the main plans at the ESS level to pursue innovation in official statistics. Finally, we draw some conclusions on the importance of innovation in the context of official statistics in today's world.

2. Defining innovation

Innovation is usually recognised as a wide term that indicates the process of implementing new ideas for the creation of new or improved products, processes or services. The Oslo Manual [2] defines innovation to be 'a new or improved product or process (or combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process)'.

When applied to the work carried out by the ESS, this definition entails the following categories:

- new and improved statistical products, aimed at closing information gaps, measuring new phenomena, and providing additional insights;
- new and more agile processes for producing more timely and responsive statistics based, for example, on advanced data integration and data exchange capabilities.

The innovations described above drive each statistical domain. They are sustained and usually incremental in nature. In parallel to them, there could be breakthrough (disruptive) innovations that drive the system into the next generation of official statistics. This type of innovation normally involves multiple domains/functions at the same time and often requires a considerable change in current practices – resulting in a 'leap forward'. Breakthrough innovations are typically fewer and larger, and require more resources, than incremental innovation actions, and they often encompass multiple aspects of innovation. For instance, the actions related to the Trusted Smart Statistics initiative [3] will:

- lead to altogether new *processes* for the incorporation of new data sources;
- involve new *organisational methods* (e.g. strengthened collaboration and distributed processes for the use and integration of privately held data);
- and result in a range of new *products* based on new data sources being rolled out.

In addition, the Oslo Manual refers to innovation capabilities as those organisational capabilities that support innovation. These enablers or horizontal capabilities are becoming essential to accelerate, streamline and sustain innovation in statistical offices.

We do not focus here on specific innovation areas as it would be impossible to treat them all in one paper, but we propose a general reflection on innovation and innovation management building on the ESS experience as a federated system. The concept of innovation can be easily summarised by the desire to do something different or something new. At the basis of innovation stands the 'culture of change' supported by a firm rejection of the common refrain 'we have always done it that way'. This paper aims to highlight how this culture of change has evolved over the last decade in the member organisations of the ESS and how the ESS is preparing for challenges ahead.

3. Innovation in the European Statistical System – The 'digital era'

Ever since official statistics have been compiled, they have adapted to economic, political, societal and en-

vironmental events in order to remain relevant. This process of evolution continues today, and now at an accelerating pace [4].

Certain points in history can be identified when innovation became disruptive for official statistics. Survey methodologies that moved official statistics away from censuses are an example of these disruptive innovations. The digitalisation of society, which has accelerated enormously during the past decade, signifies a period of deep transformation for statistical offices. After the financial crisis of 2008–2009, the economic recovery of the globalised world supported by the increasing uptake of digital technologies came with the onset of the so-called ‘data deluge’. Pervasive digital technologies and the process of datafication have rapidly and fundamentally transformed societies and economies.

MacFeely [4] identifies three main drivers for innovation in statistical offices during those years: globalisation, sustainable development and big data. These same drivers, among others, motivated the launch of the *ESS Vision 2020*. As a major modernisation programme of the European Statistical System, it ran from 2015 until the end of 2020, yielding numerous high-quality results which will continue to influence the production of European statistics for years to come. At the ESS level, under a centralised and collaborative setup, the programme specifically addressed four key challenges: the data revolutions (i.e. digital transformation and so-called big data sources), new metrics (e.g. globalisation), the price of statistics (e.g. reduced budgets and the trade-off between quality and resources), and the future of Europe [5].

These intense collaborative activities yielded numerous high-quality results which have durably impacted the production of European statistics by building future-proof statistical capabilities. Detailed descriptions of outputs can be found in the final reports of the various projects that were part of the *ESS Vision 2020* portfolio. These include:

- better identifying user needs by developing user analytics and user research, with achievements in this field being described in the in-depth user analysis report [6] and in the user profiling exercise report [7] of the DIGICOM (Digital Communication, User Analytics and Innovative Products) project;
- engaging with administrative data owners and other stakeholders, in particular addressing the cooperation with private data holders, as described in the ADMIN project final report [8];

- adapting the quality framework to the new paradigm to produce official statistics based on non-traditional data sources [9], in particular when dealing with multisource statistics and cross-border business registers [10];
- exploring new data sources, the so-called big data sources [11], and leading the development of experimental statistics in new domains, with tangible outputs of this project including some pilot studies on using new methods and data sources, such as webscraping (e.g. online job advertisements and enterprise characteristics), smart meters and mobile phone data;
- improving the robustness and efficiency of statistical production, in particular regarding data validation [12] and confidential data exchange [13].
- improving the ESS product portfolio to include co-developed digital publications, public use files and experimental statistics:
 - * One of the most prominent digital publications is the series of products ‘The Life of Women and Men in Europe’ [14] running from 2017 to 2019, translated into all the official languages of the EU, plus Norwegian, by the ESS NSIs. ‘The European Economy since the Start of the Millennium’ [15] and ‘People on the Move – Statistics on Mobility in Europe’ [16] are other examples of flagship digital publications.
 - * New microdata (from the EU-LFS labour force survey and from the EU-SILC income and living conditions) and their corresponding metadata have been made public through a dedicated Eurostat webpage [17].
 - * Several experimental statistics were developed and published through dedicated websites [18, 19].
- improving statistical literacy through the development of targeted products and new forms of engagement for end users: the resulting statistical literacy product portfolio [20] features a wide variety of innovative solutions, ranging from educational videos to e-learning tools and virtual reality games.

Among the many outputs of the *ESS Vision 2020* programme, it is worth mentioning the concept of *experimental statistics* as a *first key innovation enabler*, which was developed and ultimately applied by a majority of the member organisations of the ESS. Experimental statistics are statistics in the research and development phase. Although they are produced in the robust

quality context of the ESS, they are not published as official statistics because of their lower level of maturity in terms of harmonisation, coverage or methodology. Their main purpose is to experiment, to seek user feedback, to learn from that and possibly improve the statistics. Experimental statistics are usually driven by policy needs, new sources and methods, successive data collections, or the development of a new indicator. As these statistics have not reached full maturity, they are always marked with a clearly visible logo, accompanied by detailed methodological notes, and published on a dedicated section of the Eurostat website [18]. While a handful of experimental statistics sites existed at a few ESS NSI websites also before 2016, the rollout of ESS experimental statistics on a major scale was, to a large extent, driven by the experimental statistics strand of the DIGICOM project [21]. A majority [17] of the ESS NSIs now have their national experimental statistics sites represented in the *ESS experimental statistics hub*, where interested users can find all the results of ongoing research and can contribute to their further development [19]. In the national context, ‘experimental statistics’ are sometimes referred as ‘beta versions’, ‘experimental data’ and ‘frontier outputs’. The concept of experimental statistics enables a stepwise approach for engaging with users to deliver new products and to respond to new and rapidly changing user needs.

The ESS Vision 2020 has also contributed to expanding the exploration of *Big Data* in the ESS. During the past decade, researchers and statisticians have demonstrated – in several case studies, research activities and pilot projects – the need for and potential benefits of innovation in exploiting new data sources. The ESS recognised new opportunities for the compilation of statistics based on the recent advancements in information and communication technologies, as well as the need to build methodological expertise for the processing and integration of non-traditional data sources. The importance of Big Data for official statistics has been discussed in the official statistics community at large [22,23] and formalised in the *Scheveningen memorandum*, which was adopted in 2013 [24].

The Big Data (BIGD) project [11], part of the portfolio of the ESS Vision 2020, explored the use of multiple data sources for official statistics and developed proofs-of-concept for the generation of outputs in response to user needs. Within BIGD, the collaborative work carried out by consortia of Member States in various constellations (such as the Big Data Task Force launched in 2014, and the first Big Data ESS Network in 2016, followed by a second one in 2018) [3] has been

essential in nudging official statistics towards this new paradigm. The BIGD project included ways of innovating that were new to the ESS, such as the Big Data Competition in 2016 and the Big Data Hackathons in 2017 and 2019 [25], as well as the creation of partnerships with data holders and dedicated data playground environments.

All these efforts contributed to the emergence of the concept of *Trusted Smart Statistics* (TSS) as the model for the future production of official statistics, building on non-conventional data sources and the most recent technological advances. It was formalised by the *Bucharest Memorandum* titled ‘Official Statistics in a Datafied Society’ [26]. This memorandum was a milestone in the progression of the discourse from ‘Big Data in Official Statistics’ to ‘Trusted Smart Statistics’. This transition represented a change of perspective on innovation in official statistics, from incremental augmentation towards a systemic paradigm change. New data sources are not just quantitatively (‘big’) different from legacy data, but qualitatively different and produced in a completely new data ecosystem. Moreover, new computing and processing technologies and societal expectations painted the picture of a changed context around the data [3].

Beyond the tangible results, the ESS Vision 2020 programme and the TSS initiative have achieved a systemic change in the way the ESS works together in pooling resources and co-creating to achieve commonly agreed objectives. They demonstrated that the members of the ESS could join forces to innovate and achieve structural transformation. They opened the way for more agile approaches and continuous monitoring and adaptation mechanisms at the ESS level. More fundamentally, they created an appetite for innovation and called for even more innovation for the period from 2021 to 2027.

4. The impact of the COVID-19 pandemic on innovation – Where are we now?

In a discussion that revolves around innovation, we cannot avoid mentioning the critical role that innovation in official statistics played during the COVID-19 pandemic. This global crisis initiated a *research and innovation agenda of unprecedented speed and volume*, hence becoming a catalyst for change in many domains of official statistics and putting all national statistical systems on a trajectory of change. Some of the developments that are discussed below are also presented in an extended reflection [27] of the discussion held at

the United Nations (UN) World Data Forum 2021 conference. This reflection covers a wide range of issues that the Dutch, Spanish, French, Italian, German and Finnish NSIs had to deal with.

NSIs had to quickly implement measures to face the pandemic crisis. These measures can be considered to fall into either of two different sets of actions: *response actions*, when quick and immediate actions (including remote-working procedures) were put into place to secure the business continuity of statistical production, and *recovery actions*, which included actions to evaluate the impact of the pandemic and support the recovery from it.

In the response phase, statistical systems had to resolve the issue of disrupted field data collection due to the sanitary restrictions. They had to adopt innovative ways of working and introduce new data collection methods. For example, the Dutch data collection strategy developed in 2017 followed a web-first computer-assisted web interviewing (CAWI) approach. New IT systems for data collection were almost complete by early 2021 and could quickly be moved into production. Thanks both to this and the limited use of computer-assisted telephone interviewing (CATI), there were no significant hiccups in primary data collection processes. Some questionnaires could also be adapted to include COVID-19-related questions. All ESS NSIs were faced with the same situation and implemented similar measures towards more *flexible and adaptable data collection methods*.

In the recovery phase, the newly created *Recovery Dashboard* initiated by Eurostat in close collaboration with the NSIs at the European level, and numerous similar initiatives at the national level, showed the ability for timely reactions and even proactive initiatives to preempt needs for statistical information that could monitor the way out of the shocks induced by the pandemic. These initiatives focused on timely and high-frequency data, new data sources and estimation models.

In this regard, the use of thematic dashboards by many NSIs proved to be successful for addressing the urgent needs of users who were looking for reliable information about the pandemic and its impact on societies. These innovative solutions were developed thanks to improved collaboration with other national authorities, research institutes and owners of privately held data. In this context, a common characteristic was that NSIs gained in terms of visibility as trustworthy providers of official statistics, by establishing important partnerships with other government services, research communities and private sector businesses.

Effective communication at the national and international levels, and the cross-border exchange of experiences, accelerated the adoption of good practices and proved the high value of broad international *co-operation*. This is nowadays a *second key enabler for innovation*.

Regarding the impact of COVID-19, De Broe et al. [28] underline the *availability of new data sources* during the pandemic and the importance of their use to produce official statistics. In particular, they argue that ‘when an NSI wants to produce a completely new statistic, the COVID-19 crisis has taught us that the most successful approach is to use a new, readily available, data source that provides the necessary information and calibrate this with an already existing (traditional) statistic that measures the same or a very similar concept. The latter is needed as we found that creating a new statistic from scratch is nearly impossible in a limited time frame. For new data, it just takes a lot of effort and time to understand the way the data are generated and the kind of errors they contain.’

The COVID-19 crisis has put a lot of additional pressure on official statisticians to produce new statistical information within a short-term period and with limited resources. At the same time, the crisis has brought along a new wealth of accessible datasets from different private and public sources which are valuable for statistics production. In this context, *experimental statistics* appear essential for disseminating these statistics which are highly relevant in times of crisis, despite their lower maturity in terms of coverage, data sources and harmonised definitions. A crisis (be it war, COVID-19 or another crisis) requires the rapid provision of information to underpin the societal response and ‘experimental statistics’ proved to be the adequate stream to respond to rapidly emerging phenomena. Importantly, the incorporation of such ‘urgent’ experimental statistics should be facilitated to the greatest extent possible by opening a fast-track procedure leveraging modular components built on a flexible infrastructure, so that pressing information needs can be met as fast as possible, and with as little overhead as possible. This experimental statistics fast-track pipeline would also allow the gathering of feedback from users, rendering it possible to improve the products. Previous investments and initiatives for exploring the potential of non-traditional data sources have proved themselves essential as they provided the building blocks for building an innovative response to crises. The possibility to leverage key assets and assemble them building on state-of-the-art integration methods and a wide range of *skills* to form a fast-track

pipeline for responding to new needs appears as a *third key enabler for innovation* in official statistics.

The recent opportunities for innovation during the COVID-19 pandemic would need to be considered within a longer perspective of intensively using digital technologies and new data sources in a systematic, sustainable and responsible way. Moreover, the use of new data sources within the context of innovation raises the need to refocus once more on existing statistical principles, for instance, transparency, public value, privacy and ethics. In addition, NSIs may further develop capacities on coordination and quality management and proactively provide assistance to other institutions that constitute sources of official information, as is the case in the field of health data in several Member States.

In conclusion, the COVID-19 crisis accelerated innovation in statistical production, steered complex processes of change towards the use of new data sources and privately held data for official statistics, and enhanced the adoption of new statistical methods as well as, consequently, the production of experimental statistics and dashboards [27]. The ESS now faces the challenge of embedding this impetus for innovation into its daily activities: NSIs should continue investing in innovation, collaborating, and establishing partnerships with the data providers and research communities that worked closely with them during the pandemic.

5. Future plans – Where do we want to go?

With the COVID-19 emergency slowly ending, the war in Ukraine challenges statistical offices to retain the innovative experiences that emerged during this period. The innovative ideas born in these tough times, combined with the rich output of the ESS Vision 2020 programme, are the foundation for ESS innovation that will continue to be developed in the years to come. There is also a need to increase the agility and speed of our deliveries to keep up with the pace of the changing ecosystems. Looking to the future, the ESS has the urgent need to deploy new data sources, investigate innovative approaches to collecting data, and develop the necessary frameworks for data definitions, data standards, methodologies and data quality. This is especially so for the cases in which the member organisations of the ESS are not the only data providers and collaboration with other stakeholders is needed.

Taking the lessons of crises (see for instance the Wiesbaden high-level meeting on ESS communication and governance in a time of crisis [29]), ESS NSIs agree

that innovation is more important than ever. NSIs want to maintain momentum on innovation and put in place the necessary enablers to sustain innovation to allow the entire ESS to reap its benefits. Innovation requires strategic direction and planning so that innovation and experimentation are effectively integrated into the regular ESS activities.

This process of consolidation should ensure that:

- *innovation encompasses the entire ESS*: innovation crosses organisational boundaries and encompasses various statistical domains; knowledge and best practices shall be shared across organisations to the greatest possible extent;
- *user information needs are the key innovation driver*: new phenomena, such as the digital economy, new forms of employment and the circular economy, are at the core of the political agenda and require the design of new statistical products and metrics; such policy needs, as well as the policy needs emerging from crises, shall drive the investments in innovation;
- *innovation results are integrated (deployed) in the statistical production*: innovation shall have a strong focus on implementation and deployment, with innovation results going ‘from the laboratory to the factory’;
- *participation in the innovation is flexible*: it should take full advantage of the strengths, individual experiences, and capacity of each ESS member;
- *failure is an option – in the short term*: for the ESS, a ‘fail often and fail fast’ approach would mean that many new innovative processes, products and methods are explored, with the objective of sifting out those few that appear most promising to the ESS, and rapidly terminating the development of the rest;
- *ESS innovation is participatory*: each organisation should be provided with the opportunity to take the lead or participate in an innovation project, based on the organisation’s capacity, experience and expertise, under the coordination and with the support of Eurostat.

Light mechanisms to pursue each type of innovation – involving ESS members on a voluntary basis and in an optimal way to get the best out of the system for the benefit of all – should be put in place. It should cover the end-to-end innovation process from ideation to deployment, and be guided by the above principles. That means that it should inter alia be agile, adaptive, driven by user information needs, and based on trans-

parency, with a focus on reusability allowing ESS-wide deployment.

Yet, innovation remains a challenge, despite the consensus on the need for it, as well as the business drivers and the support from top management. Innovation doesn't just happen; it needs a clear strategy to work. Many organisations usually struggle to roll out innovation results. They face a general lack of resources and skills. Sometimes the traditional operating model to deliver and scale innovation needs to be improved. The main challenges that need to be addressed are:

- building on incremental innovation while pursuing systemic innovation of the production model of official statistics production;
- scaling up existing innovation activities;
- maintaining the alignment of innovation with EU priorities;
- tracking the progress towards goals (making innovation measurable);
- securing proper funding for these innovation actions and entering a virtuous cycle whereby innovation frees resources that serve to launch new innovation activities.

Therefore, the ESS has recently decided to establish a dedicated task force of NSIs with the aim of defining the *ESS innovation agenda* and facilitating its implementation and deployment.

The scope of the innovation agenda is purposively broad. It covers new statistical products and processes but also pays the necessary attention to new data sources and their methodological, quality, and legal dimensions. Beyond identifying the domains in which innovation is needed and the key related methodological and technological capabilities required to support them, it is essential to strengthen the ESS innovation capabilities or enablers and to identify good practices for transferring innovation to production and deploying innovation across the whole of the ESS. This also requires considering developments outside the statistical system and their implications for ESS innovation.

The task force has opted for a bottom-up approach starting from existing innovation activities, striving to align business and user needs, continuously engaging with innovation stakeholders (such as the ESS Directors' Groups), and hence enabling the integration of NSI perspectives. It will act on the lessons and best practices for managing innovation in the ESS, including ways to further promote an innovation culture in the statistical organisations as well as effectively managing collaboration between statistical offices and partnerships with stakeholders. It will also reflect on current practices for

experimentation on innovative statistical products, the way to accelerate the transition towards mature statistical products, and the related communication and user engagement actions.

The focus is on facilitating innovation actions rather than establishing a monolithic innovation portfolio. The innovation agenda should create the conditions to promote innovative actions that are taking place at the national level, to reinforce cooperation among NSIs for the development and deployment of cross-cutting enablers, and to augment the impact of ESS innovation actions. In view of efficiency and limited resources, not all innovations should be embraced by the ESS innovation agenda, but only those that can benefit from accelerators and synergies beyond the limit of statistical domains and across organisations.

In this context, beyond identifying the domains in which innovation is necessary and needs to be prioritised, there is a broad consensus that the ESS innovation agenda should further develop the key enablers for innovation. This especially means the following, which experience has shown to be crucial.

5.1. Streamlining the path from innovation to production, including building on the concept of 'experimental statistics'

The ESS can modify the way that innovation is delivered in key areas by, for instance, adopting playgrounds for safe and rapid 'test and learn' approaches. These playgrounds could also serve to improve collaboration between statistical domains and IT and to keep track of less successful experiments for later reference. The ESS would also benefit from a process to include successful 'test and learn' results into existing production systems, so that experiments become (part of) reference solutions when they have proven their value. It would be useful for the ESS to further develop the concept of experimental statistics, to ensure a clear path for experiments, 'from the lab to the factory'. Furthermore, harmonising the concept and its definition could help in the adoption of a standard procedure to monitor the transition from the experimental status to the application in a production environment.

5.2. Achieving a cultural change and adapting the methods of working

The challenges ahead call for a gradual shift in the management of innovation in statistical offices. This shift also applies to the culture of our organisations

and our ways of working together. This will require active communication with staff. Ways to implement this change include setting up ‘communities of practices’ to foster people development and collaboration on innovation areas, peer learning, and agile governance. ‘Fusion teams’ can be set up to develop new products and building blocks for the future production architecture of the ESS.

5.3. *Sharing knowledge and strengthening cooperation with external stakeholders*

The ESS does not operate in isolation, and a wide array of external stakeholders – which can either support or promote innovation in statistics or benefit from it and use the outcomes – may be particularly relevant for innovation activities.

From an ESS perspective, relations with stakeholders depend on how they can benefit from, contribute to, support or govern ESS activities. Stakeholder relations may be straightforward or more complicated: a company may provide source data for statistics, use statistical outputs for its own goals, and collaborate in developing methods and processes. A public authority may use statistics, establish legislation, and provide financial resources. For regular statistics, the relations may be well established, but, especially for innovative work, they may be unclear. New relations may emerge, or existing relations could change.

5.4. *Upskilling and training staff*

One key factor in meeting the challenges ahead is the development of the necessary skills and competences for staff in statistical offices. Empirical evidence from the industrial field suggests that there are statistically significant complementarities between technical skills and innovation and that, without sufficient skills, firms benefit less from innovation, because they do not have the requisite complementary capabilities or absorptive capacity. Human capital can thus be seen as an enabling factor in profitable innovation [30]. The competences, skills and features that the next generation of statisticians will have are different from the traditional skill set of statisticians. New competences should gradually transform the role of statisticians towards a data scientist profile, with a more in-depth knowledge of IT, modern methods, and technologies. These changes in staff skills can be achieved through dedicated training in combination with the above-mentioned enablers, including a change in the working methods involving agile and multidisciplinary teams, the pursuit of experimentation, and the collaboration with stakeholders beyond the official statistics community.

6. Conclusions

Ever since official statistics have been produced, they have had to evolve constantly to reflect changes in society and to capitalise from evolving knowledge in methods and technology.

Around a decade ago, the pace of this change dramatically accelerated. The societies of our globalised world are rapidly moving towards full digitalisation, thanks to the rise of the internet, social networks, increased connectivity, and a decreasing cost of technologies. Nowadays, smart devices and connectivity are ubiquitous, generating exponentially increasing amounts of data on almost every aspect of our lives.

Statistical offices all over the world, including in Europe, have embarked on an innovation path to govern these changes, trying to stay ahead of new phenomena such as globalisation, while exploring the use of new and big data sources combined with new computational methods. In this paper, we have mentioned a few of these innovation efforts that proved to be crucial when the COVID-19 pandemic hit our societies in 2020. This was, without any doubt, a turning point for innovation in official statistics. For the first time in history, statistical offices, while struggling with reduced capacity, restrictions on field surveys, and new ways of working, had to respond to new and urgent data needs for society and policymakers. This was also possible thanks to the greater efforts put into innovation, which allowed the ESS to exploit the new data availabilities that emerged during the pandemic.

With the pandemic now slowly waning, the ESS is currently facing a new crisis, this time due to war, which will affect the work of statistical offices and generate new statistical needs. These tough times call for increased innovation efforts, as well as for the acknowledgement that taking stock of all the innovation potential realised during these challenging times can play a key role in the future of official statistics. Being prepared for the next crisis and learning the lessons from recent events are at the centre of the design process of the next ESS Innovation Agenda, which will lead the ESS through the main challenges from here until the end of the current EU multiannual financial framework in 2027.

Joining forces and developing expertise within the ESS has resulted in synergies and achievements that would not have been possible on the level of an individual organisation. Addressing global statistical challenges and opportunities in a digital world requires effective cooperation with the UN and other international statistical bodies, and partnerships with national, European and global stakeholders.

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