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CHALLENGES IN ADJUSTING STATISTICAL SYSTEMS TO SUPPORT ANALYSIS OF CLIMATE CHANGE

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I. INTRODUCTION

1. This paper will address the types of adaptations needed in the current statistical systems to improve their ability to respond to the new information needs of climate analysis.

2. The wide range of environmental, social and economic information offered by national statistical offices could be better utilized for climate change analysis. The national statistical offices provide an information infrastructure for monitoring development and identifying driving forces that contribute to the observed changes in the society –these important changes include the changes in climate. Large part of the necessary data for analysing climate change is already available in the statistical systems. In many cases, these data need to be developed further to fit the needs of climate analysis since they were not originally designed for that purpose. Therefore, we need to identify where improvements to the statistical system are required and how the different pieces of information need to be re-shaped in order to try to bring them together in a better way.

3. It takes time to make changes to the statistical systems, especially to depict cross-cutting issues such as climate change, so we need to start as soon as possible. Nevertheless, statistical systems are constantly adapted to new information needs and changes in statistical standards and methods. Adaptations are being made, for example to meet the policy needs of sustainable development and to track progress towards meeting the Millennium Development Goals. Something analogous could be expected for improving usefulness of official statistics for climate change analysis.

4. Identifying the development needs in the current practices of national statistical systems is a major challenge. This requires an understanding of both current and future information needs as well as an analysis of the strengths and weaknesses of statistical systems in their ability to measure climate issues.

II. CURRENT STATE OF CLIMATE DATA IN STATISTICAL SYSTEMS

5. National statistical systems comprise the ensemble of statistical organisations and units within a country that jointly collect, process and disseminate official statistics on behalf of national government. One agency often has the coordination role of the system, usually the

national statistical office. This coordination reaches all producers of official statistics in the country. The organization of the statistical system differs among countries. For example, the responsibility for various environment statistics can be in different institutions, partly in the statistical office, Ministries and/or specialised agencies.

6. To explore the extent to which statistical offices are involved in producing climate change related statistics, UNECE carried out a survey of statistical offices in the member countries of UNECE and OECD in 2011. Of the 48 offices that replied, 37 reported involvement in work related to greenhouse gas emission inventories and 18 produced other statistics related to climate change.

7. The role most statistical offices currently play in the area of greenhouse gas emission inventories is the provision of basic data on economic activity. These data include energy statistics, industrial commodity statistics, agriculture statistics, forestry, transport, international trade, land use and land cover, wastewater and waste etc. About one quarter of statistical offices take part in the inventory calculations in addition to providing source data.

8. Recently, the focus of official statistics on environmental and climate issues has broadened with many offices offering data on natural resource assets, energy, waste, water and air emissions as well as environmental protection expenditures. The available statistics, however, often lack a particular focus on climate change and vary a great deal across countries. Furthermore, the existing climate relevant information is scattered across different statistical datasets and is not always directly accessible from statistical releases and from publicly available statistical tables.

9. Measurement of the state of climate and the direct impact of climate change is largely based on sources outside the official statistical system. Furthermore, analysing the causes and effects of climate change is not considered to be the task of the statistical system. Instead, official statistics should provide existing data in a suitable form so that users could analyse the causality of developments and relation to climate change or to other causes.

10. Regardless the availability of relevant data in the statistical systems, climate change related statistics are a new area for most statistical offices. Producing climate change related statistics requires cutting across many statistical areas and linking between the relevant social, economic and environmental data. Statistical offices could make better use of the existing data in the statistical systems and fill in gaps in some areas where they already have knowledge and good practices in place. This may call for changes in the current statistical infrastructure.

III. CHALLENGES IN ADJUSTING THE STATISTICAL INFRASTRUCTURE

11. Statistical infrastructure can be understood as a system within and between the organizations involved in climate change related statistics. It includes everything, but not the statistics themselves. This paper analyses the parts of the infrastructure that are weakest or missing with regard to the requirements of climate change related statistics.

12. The Australian Bureau of Statistics (ABS) defines statistical infrastructure as tools that support the operation of a statistical system. These tools can help to organise the statistical system, improve efficiency, add value, create new outputs or simply perform tasks within the system. Examples of statistical infrastructure include computer systems, metadata

repositories, legislation, standards and classifications, frameworks and information development plans.

13. Some of these categories of statistical infrastructure, i.e. metadata repositories and information development plans, do not have specific relevance for climate change related statistics. In addition, the organizational structure and resources, quality assurance and guidelines as well as cooperation networks have a great influence on statistical work. The following chapter looks at the readiness of statistical systems for producing climate change related statistics in the following subcategories: legislation, standards and classifications, frameworks and integration, statistical methods and computer systems, organizational structures and production resources, quality assurance and guidelines and cooperation networks.

A. Legislation

14. Obligations governing the collection and release of statistics are outlined through legislation and other government policy and guideline initiatives. These obligations seek to strike a balance between the need to collect and use demographic and sensitive information and the need to protect respondent and provider identity.

15. As the data needs related to climate change are very detailed, for example the need for regional or geo-referenced data, confidentiality poses a particular challenge. Agencies involved in the collection of data have a responsibility to ensure that procedures are implemented to ensure confidentiality of data and privacy of respondents who provided the data. The primary goal is to ensure that there is no risk that an individual or organisation is identifiable from the output released by a statistical collection agency.

16. Confidentiality and privacy is usually achieved by ensuring that identifiable information about individuals, households and businesses is not released outside the collection agency, is available inside the agency on needs to know basis only and cannot be derived from released data. Statistical systems have good practices in place for protecting confidentiality. The methods and technologies to manage confidentiality have significantly improved and more countries allow some form of access to microdata. Yet, confidentiality protection remains a constant challenge.

17. Climate research requires sometimes access to microdata in addition to the detailed geo-referenced statistics. The growing availability of microdata from official statistics can increase the risk of disclosure and puts more pressure to developing new safe methods to access the needed data. Climate research is particularly challenging for data confidentiality due to the need to link data across several datasets and statistical topics, which may result in higher risks of disclosure. Some sensitive topics also require research, such as the health impacts of climate change.

B. Standards and classifications

18. Standards refer to a comprehensive set of statistical and methodological concepts and definitions used to achieve uniform treatment of statistical issues across time and space. The statistical system has the responsibility for definitions, classifications, nomenclatures, methodologies, certified measurements, accounting standards and data quality of official statistics. These tools assist in maximising the effectiveness of statistical outputs and the

efficiency of the production process in terms of comparability (over time, space, industry, etc) and coherence (i.e. the capacity for integration) of the statistics.

19. While comparability and coherence are important for any dataset, they are particularly important where data are obtained from multiple sources and have to be combined or where outputs are used in a wide variety of contexts. The ability to combine multiple data sources is a precondition for compiling climate change related statistics. For many indicators, samples should be geographically representative which could be difficult to achieve without combining the data with administrative registers or observation data sets that provide more detail.

20. Statistical classifications facilitate the accurate and systematic arrangement of data into categories based on shared and common properties. The use of standard classifications aids in the production of consistent and comparable statistics over time, regions and across different collections. The classifications currently used in the national statistical systems do not fully incorporate the requirements of producing climate change related statistics. There are also differences in the classifications used in the greenhouse gas emission inventories and those used by national statistical offices. Bridging of the different classifications used in the environmental accounts and the inventories could improve availability of source data from the national statistical system for the inventory producers.

21. The source statistics offered by statistical systems should be in accordance with statistical standards for emission inventories. The statistical system is set up to enable changes to be included into the system. All of the related classifications (such as ISIC, CPC, SITC, COFOG, COICOP, etc.), definitions, and nomenclature and quality criteria are possible to adapt to include new aspects. The statistical system has a structure for periodic reviews of its various sub-systems, which can be used to examine this new user need. For example, the classification for different industries, known as the International Standard Industrial Classification of All Economic Activities (ISIC), was revised the last time to include more detail in the services sector due to the increasing importance of service activities. The same type of review could be undertaken for this and other classification systems with respect to aspects related to climate change.

22. Considering the global nature of climate change, it could be important to note that the statistical systems have in place routines for developing statistics and indicators that are internationally comparable. Statistical offices approach new phenomena to be measured by first ensuring that common definitions can be agreed upon and then designing recommendations for data collection and compilation, including adjustments to standards and classifications where needed.

C. Frameworks and integration

23. Frameworks exist for integrating and presenting data in many fields. The use of standards and classifications in frameworks greatly reduces the effort required for integration and reconciliation of data. As an example, statistical business registers could be useful for the purposes of producing climate change related statistics if developed by taking into account the specific requirements of spatial statistics. Similar benefits could be identified for between other existing statistical frameworks.

24. A framework is a set of assumptions, concepts, principles values and practices that underpin statistical collections in particular areas of interest. Frameworks provide a context and guidance especially in the planning phase. Frameworks can be simple, developed for a narrow subject of interest or can be highly complex and encompass entire subject matter area.

25. Examples of statistical frameworks that are linked to climate change related statistics include *the System of Environmental-Economic Accounts (SEEA)* [1] *and the UN Framework for the development of environment statistics (FDES)* [2]. SEEA contains the internationally agreed standards for producing environment accounts and linking them with economic statistics, and FDES provides an organizing structure to guide the production of environment statistics bringing together data from various subject areas and sources. The new version of FDES now considers the links between data needed for monitoring climate change and existing environmental statistics. Similar developments would be needed for improving linkage of climate change information with social and economic data, such as with the System of National Accounts (SNA). SNA takes account of emission trading schemes, but we should review whether the treatment requires modifications.

26. The UNFCCC and IPCC reporting guidelines form an information framework for the greenhouse gas emission inventory data. The quality of source data for emission inventories could benefit from statisticians having a better understanding of the concepts and methods used in inventory compilation. This would help ensure that statistics are established in such a way that they can be easily used for emission inventories.

D. Statistical methods and computer systems

27. Comparison of statistics across different geographical regions or demographic groups is an important focus for many administrative and statistical collections. Spatial statistics often require highly complicated and sophisticated methods, for instance spatial interpolation. Therefore, climate change related statistics might require adoption or development of new statistical models or methods not used in the national statistical system otherwise. On the other hand, many consider that any modelling approaches which are based on hypothetical assumptions should be left outside the border of official statistics. The official statistics would then provide the basic data for such modelling exercises.

28. To measure the impacts of and vulnerability to climate change, different types of data from very different sources needs to be brought together. This places major requirements for the capacity and inter-functionality of IT systems and requires wide access to different data sets thus underlying the importance of statistical systems to be involved.

29. Geographic information systems (GIS) are computer systems needed for capturing, managing, analysing and presenting geographic data, such as data related to climate change. Much of climate change related statistics is very closely related to spatial information e.g. meteorological data and population in danger of floods. Many statistical offices already have capacity to use GIS-technology, but probably much more experience will be needed for measuring climate change. One of the challenges of the statistical systems is that many statistics are based on sample surveys which do not allow detailed regional analysis for example of the regional impacts of extreme weather events.

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[1] http://unstats.un.org/unsd/envaccounting/seea.asp

[2] http://unstats.un.org/unsd/environment/fdes/Global%20Consultation/Draft%20FDES%20Global%20Consultation.pdf

30. Currently, internationally recommended methodology exists for part of climate change related statistics only. Statisticians apply well-developed methodology to make measures comparable over time and adjust them, for example, for seasonal variation, changes in prices/inflation, temperature, etc. These adjustments that eliminate the effect of some known source of influence and leave only the changes caused by unknown sources of influence and natural variation could be useful for measuring climate change related phenomena.

E. Organizational structures and production resources

31. Changes in environment, equipment and expertise create new needs, which may dictate changes in the organizational structure of statistical offices. The organizational structure determines how the roles and responsibilities are delegated, and it influences the information flows in the organization. In general, an organization is often structured by one of the following principles: area of knowledge, work process, business function, output, client, time or place.

32. Although there are many different ways to organize a statistical office, in practice there is some similarity in their organization across the world. In practice, most statistical offices have been traditionally organized according to either 'subject matter' (where economic statistics could be one of the units) or 'function' (where data collection could be one of the units), or is a mix of the two.

33. Production resources of new areas of statistics are naturally relatively small compared with the more traditional areas of statistics. Standardisation of production processes could enable some re-allocation of resources to new areas, such as for improving environmental and climate change related statistics. Partly, however, existing data could be re-sorted to match many of the new data needs with limited additional costs. This requires better awareness of the data needs of climate change mitigation and adaptation and the needs of greenhouse gas emission inventory compilers for source data.

34. According to the vision of the High-level Group for Strategic Developments in Business Architecture in Statistics (HLG-BAS), "the challenge for statistical organizations is to be sufficiently flexible and agile to provide statistics according to user needs, at an acceptable cost." They state that "in some specific statistical domains, only cross border data make sense, for example globalisation, enterprise groups and climate change." Cross-sectional statistics, such as climate change related statistics, may pose challenges to the structure and functioning of statistical organizations. Thus, producing climate change related statistics may be easier to undertake in an organization focused on serving the needs of different user categories and producing outputs by re-sorting and combining the collected data to match the user needs.

F. Quality assurance and guidelines

35. Different quality criteria and reviewing procedures guide the production of climate related statistics and research. The criteria for official statistics is set in the Fundamental Principles of Official Statistics, developed and adopted by the Conference of European Statisticians in 1991. The United Nations Statistical Commission (UNSC) adopted these Principles in 1994 at the world level. In addition, Shared Professional Values and a set of Ethical Principles to be followed in statistical production are included in the International Statistical Institute's Declaration on Professional Ethics, updated in 2010. Furthermore, in

2012, UNSC endorsed a template for a generic national quality assurance framework and the related guidelines.

36. The European Statistics Code of Practice provides practical quality assurance guidelines. The code was adopted by the Statistical Programme Committee in 2005 and revised by the European Statistical System Committee in 2011. The code is based on 15 Principles covering the institutional environment, the statistical production processes and the output of statistics. A set of indicators of good practice for each of the Principles provides a reference for reviewing the implementation of the Code. The quality criteria for European Statistics are defined in European Statistical Law.

37. According to the Eurostat Quality Assurance Framework, the definition of quality, with regard to official statistics, includes relevance, accuracy, timeliness and punctuality, accessibility and clarity, comparability, and coherence.

38. Greenhouse gas emission (GHG) inventories, on the other hand, follow specific quality criteria defined by UNFCCC and IPCC. The UNFCCC reporting guidelines (FCCC/SBSTA/2006/9 and FCCC/CP/1999/7) and the IPCC guidelines for national greenhouse gas emission inventories lay down the instructions for producers. Furthermore, the IPCC Good Practice Guidance (GPG) and Uncertainty Management in National GHG Inventories provide guidelines regarding quality assurance. The IPCC also provides good practice guidance for land use, land-use change and forestry (LULUCF).

39. A process of peer reviews is carried out before publishing the results of GHG inventories. This differs from the practice in producing official statistics where results are not shared with third parties before they become public to everyone. The reviews are guided by the UNFCCC guidelines for the technical review of greenhouse gas inventories (FCCC/CP/2002/8).

40. There are many similarities in the quality criteria used for emission inventories and other climate information when compared to the Fundamental Principles of Official Statistics and the European Code of Practice. Statistical systems should further explore the differences in the quality assurance methods for climate related information and take them into account in providing source data for inventories and producing climate change related statistics.

G. Knowledge

41. Given that the statistical system includes economic, social and environmental data, the statistical offices have acquired knowledge for measuring varying societal issues. However, climate change involves complex interactions between systems, is multi-disciplinary in nature and anchored largely in the natural sciences. Furthermore, spatial statistics often use highly sophisticated methods. To this end, measuring climate change requires specific knowledge, and many statistical offices currently lack the qualifications necessary to do good work in this area.

42. The substantive knowledge in climate issues is spread around many different agencies, ministries and research institutes that produce and use climate change related data. Climate observations are collected usually outside the statistical system by meteorological and atmospheric monitoring networks. Scientific research has a predominant role in providing

climate information. At the moment, most statistical offices do not mention climate change as one of the statistical topics they work with.

43. Statisticians would need training to start measuring climate related issues. The knowledge gaps should also be taken into account so as to recruit staff with the appropriate professional training and experience. Most potential employees, however, might not have the combination of statistical work experience and the required substance knowledge. It is more likely that training on the job is needed.

44. Building credibility as a player in the field of science-based climate analysis is a challenge, because statistical offices are relative newcomers to climate issues and do not have large teams of professionals dedicated to this area of work.

H. Cooperation networks

45. The information needed for analysing the causes and impacts of climate change is scattered across a variety of national and international organisations. The global nature of climate change calls for good cooperation among these organisations to find ways to better respond to the growing information needs. No statistical agency can function effectively without systematic cooperation with outside contacts (see Handbook of Statistical Organization. p. 175-176).

46. With regard to cross-sectional data, such as climate change related statistics, close cooperation and networking with other organizations are a necessity. Coordination of joint work of different organizations is also important for ensuring efficient use of resources and division of work.

47. Meeting the data needs of emission inventories requires cooperation throughout the statistical system and other producers of climate information as well as strong engagement with users. For example, the role of statistical offices in the compilation of air emissions inventories is not always clearly defined yet it can be important for the activity data needed for emission inventories. Greater interaction between statistical offices and environmental and energy agencies needs to be established in order to boost synergies and cooperation. The same applies for the cooperation amongst international organizations active in measuring or analysing climate change related phenomena.

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