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Statistical Capacity Building for Sustainable Development:

Developing the fundamental pillars necessary for modern national statistical systems

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Abstract

This article argues that to prioritise the data requirements of the Sustainable Development Goal (SDG) monitoring framework, requiring 230 global indicators and spanning the full spectrum of development issues, over the development of national statistical systems would be a mistake. Rather, countries and international organisations should prioritise the development of efficient national statistical systems that are sufficiently flexible, responsive

and affordable to satisfy the enormous appetite of the SDG monitoring framework but also national and regional information requirements. The growing recognition of the importance of good quality, independent official statistics to support development and progress, provides a unique opportunity to make a real and long-lasting investment to improve national statistical systems. But this will require coordinated investment and political support from countries, donors and international organisations. The three core pillars necessary for a modern statistical system are detailed: a robust legal framework; functioning institutional coordination; and a logical data infrastructure. Without these pillars countries will not be able to build statistical systems appropriate to a data driven world. Nor will they be able to meet existing and future demands for information, including the SDG monitoring framework.

Keywords: Legal framework, institutional environment, data infrastructure, SDGs

Statistical Capacity Building for Sustainable Development:

Developing the fundamental pillars necessary for modern national statistical systems[1]

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1. Introduction

In 2015, the United Nations (UN) Millennium Development Goals (MDGs) came to the end of their 15 year lifecycle and were replaced by the considerably more ambitious UN Agenda 2030 for Sustainable Development and the Sustainable Development Goals (SDGs). From a statistical perspective the implications of Agenda 2030 for the accompanying monitoring framework are enormous, as not only have the number of goals and targets increased considerably (The MDGs had 8 Goals, 21 targets and 60 indicators whereas the SDGs have 17 Goals and 169 targets and 232 indicators) but so also has the complexity of these targets. The scope of Agenda 2030 is also far wider than their predecessor, attempting to span the full spectrum of development issues, including not only aspects of society, economy and the environment but also institutional coordination. This massive increase in scope and scale raises real questions regarding the capacity of national and international statistical systems or

[1] All views expressed are those of the authors and do not reflect the views of the United Nations Conference on Trade and Development, University College Cork or Manouba University.

what others have described as 'data ecosystems' [1] to implement such an enormous monitoring framework. The complexity and ambition of this challenge led Mogens Lykketoft, President of the UN General Assembly to describe it as an *'unprecedented statistical challenge'* [2].

1.1 Costs and Benefits

The sheer scale of the SDG monitoring framework raises questions of cost-benefit. For example, the Sustainable Development Solutions Network estimate that $1 billion per annum *'will be required to enable 77 of the world's lower-income countries to catch-up and put in place statistical systems capable of supporting and measuring the SDGs'* [3, p.10]. Paris 21 [4, p.11] estimated that *'funding for statistics needs to be increased from current commitments of between US$300 million and 500 million to between US$1 billion and 1.25 billion by 2020'*. Danish economist Bjorn Lomborg estimates that the SDG monitoring framework could cost as much as $1.5 billion per target, meaning that measurement would account for 12.5% of total development aid [5]. While clearly the cost estimates vary, there is some consensus that populating the SDG monitoring framework will be expensive.

The danger of such a costly exercise is that it may divert scarce statistical resources from where they might be elsewhere used and perhaps with more relevance at a national level. The result is that the development of other nationally important statistics might be retarded or stopped altogether. The OECD [6, p.20] put it well *'A concerted effort from the international community over the next 15 years will be needed to ensure that SDG monitoring does not impose inordinate costs on developing countries or divert resources from achieving national statistical development strategies'*. This prompts the question as to whether it is worth populating SDG indicators at the expense of others. And this is a pertinent question, as many of the SDG indicators have proven unsatisfactory or even controversial. In part, this

dissatisfaction arises as several of the SDG targets themselves are very complex and would in truth require several indicators to do them justice. Other targets are ambiguous leaving many unclear as to what precisely is meant. So how much resource should be dedicated to fulfilling SDG data requirements as opposed to developing economically sustainable and efficient national statistical systems (NSSs)? It is a difficult question to answer as the two objectives are not necessarily mutually exclusive. But developing a NSS will potentially address at least some of the SDG requirements by default. It is not clear that the converse is true however. For countries that do not yet have a NSS, too much emphasis on the SDG indicators, however important or well intentioned, may be a distraction and ultimately counter-productive.

Furthermore, it is important to understand that the 230 SDG indicators are only performance metrics and the data required to populate them are only a fraction of the data required to implement the SDGs. Policy formulation requires more complex and nuanced data that allows several factors to weighed-up before informed decisions can be made. So we must draw a distinction between the output data required to populate selective performance metrics and the input data required to formulate policy that will help to implement the SDGs. A balance must be found whereby NSSs can be developed in parallel with the systems required to generate both the input data required to support policy formulation and the output data required to populate the SDG indicators (or at least a prioritised set for individual countries).

1.2 Change is constant

The challenge is how to weigh the demands of Agenda 2030 with the multitude of other national data priorities that exist. As countries progress along the development spectrum or find themselves on different slopes of the business cycle, their data and

information requirements, will be different and will change. Agenda 2030, like the MDGs before it, has a 15 year lifespan. In the context of history, 15 years is the blink of an eye. Nevertheless we can safely predict that, for many individual countries in various parts of the world, during the next 15 years, many unanticipated events will unfold and some of these will have a dramatic and profound impact on national priorities and development plans. Murphy's Law applies: *'what can happen, will happen'*. Natural disasters, such as, tsunami, earthquakes and famines; Political or economic events, such as, wars, the unravelling or creation of political unions, the emergence of new countries or new financial or economic crises may all play their part in shifting international or national priorities. The sudden migration crisis in Europe triggered by the conflict in Syria is a perfect example. Thus we can reasonably anticipate that national and global priorities will differ and change over the next 15 years. The challenge for countries, and for the international community, is how to build affordable statistical systems that are sufficiently flexible and responsive to these evolving priorities but can at the same time satisfy the enormous appetite of the SDG monitoring framework. This poses a dilemma - in designing statistical capacity building programmes, how can a global indicator and monitoring framework (with urgent data demands) be designed so that it does not suffocate or overwhelm national and regional priorities (with current and long term data needs) but rather feeds off them? While pondering this dilemma, it is worth recalling that capacity building is most effective when it is home-grown, long-term in perspective and managed collectively by those who stand to benefit [1]. It is also worth considering the impact on international organisations, many of whom will be faced with the problem of how to avoid destabilising existing frameworks and programmes that have taken years to fund and develop.

1.3 Interlinkages and interdependencies

Another important discriminating factor between the ambitions of the SDGs compared with that of the MDGs is the desire to reflect the interconnectedness of the social, economic, environmental and institutional pillars. Thus the SDG monitoring framework must be integrated in a way that is capable of illustrating and highlighting interlinkages across statistical domains. This raises another question - how can countries be helped to develop NSSs that are capable of measuring and explaining inter-linkages or interdependencies between the various strands of Agenda 2030 and between their own national and regional activities? While it is tempting to focus capacity building programmes and resources towards specific targets, such a narrow and short-term approach will not address this challenge and will come at the cost of developing wider and more flexible statistical systems. We argue that the balance should be tipped in favour of developing of strong, sustainable NSSs. Statistical systems take time to develop and mature but putting in place strong NSSs will yield more long lasting results for developing countries. Investing in a sound foundation, albeit generic in scope, will ultimately contribute more to the availability of information in the longer term than focusing on a set of specific contemporary targets. A properly functioning system will be better able to contribute to all statistics and not just the specific set chosen for the SDG monitoring framework.

1.4 Organisation of the article

The remainder of this article is presented in six sections. Section two provides definitions of a NSS and administrative data. It also briefly explains why each of the fundamental pillars is core to a NSS. The following three sections (3, 4 and 5) outline each of the pillars: legal framework; institutional environment; and national data infrastructure in turn. Section six makes the link between capacity building and NSSs and in particular

stresses the need for close coordination across international organisations. The seventh and final section concludes the paper.

2. National Statistical Systems

A NSS can be defined as the group of organisations or agencies (or specialist statistical units within those organisations or agencies) who together collect, process and disseminate official statistics on behalf of the government of a country. Or more comprehensively, organisations or agencies producing any of the steps identified in the Generic Statistical Business Process Model [7] on behalf of the government of a country. The United Nations Statistics Division has long championed the importance of NSSs in their Handbook of Statistical Organisation, the latest version [8] being no exception. Paris21 too has advocated this cause, developing guidelines for NSSs back in 2004 - the 'National Strategies for the Development of Statistics' [9]. More recently the Sustainable Development Solutions Network [ibid] has stressed the importance of NSSs for the production of official statistics. So too has the Addis Ababa Action Agenda of the Third International Conference on Financing for Development in July 2015, noting *'National statistical systems have a central role in generating, disseminating and administering data'* [10, p.58].

Statistical systems can be described as either centralised or decentralised depending on the extent to which responsibility for compiling official statistics rests with the central institution (usually the NSO). Statistical systems are said to be centralised when all, or most, of the products of the statistical system are compiled and disseminated by the central organisation. A decentralised system may have statistical units embedded in a number and variety of Government ministries and agencies spread across a public service. While there are strengths and weaknesses to both approaches, centralised statistical systems are typically independent and impartial but sometimes struggle with relevancy, owing to their remoteness from policy

debate. In contrast, the reverse is often true of decentralised statistical units located in Government ministries, as their work is highly relevant but is more susceptible to political interference and pressure to present statistics relating to Ministerial policies and outcomes in a favourable light, thus compromising the credibility of the data [11].

Before going any further, it is also useful to explain what we mean by administrative and secondary data. Administrative data or public sector data can be defined as data that are collected primarily for administrative or management purposes. National public administrations typically collect, maintain and update sizeable volumes of data as a matter of routine for the purposes of registration, transaction, and record keeping associated with the delivery of a service. These data pertain to the wide range of administrative functions in which states are involved, ranging from individual and enterprise tax payments to social welfare claims, education participation and grants, farming subsidies or individual health records. Typically these administrative records are collected and maintained at the lowest level of aggregation i.e. transaction or interactions by individual taxpayer/applicant/recipient with the state, making these data very rich from an analytical perspective. Secondary data is a broader concept that includes any data that have already been collected or available from other sources. Secondary data is not limited to administrative data and can also include non-government, commercial and research data. Secondary data may sometimes be cheaper and occasionally more quickly obtainable than primary data (assuming legal protocols and mechanisms to facilitate institutional cooperation are in place) and often will have very extensive population coverage.

2.1 Three fundamental pillars

While there are many diverse aspects required of a NSS, such as finance, governance and oversight, we argue there are three fundamental pillars that are absolutely core to a modern NSS (see Figure 1). First, and perhaps most importantly, a robust legal framework must exist. The compilation of official statistics must be governed by national legislation that ensures the professional independence of the statistical system and the head of that system in order to provide protection against political interference or politicisation. Legislation must also give the statistical system power to compel businesses and persons to provide information for statistical purposes. As a quid pro quo, the confidentiality of information provided under the auspices of statistical law must be protected. Finally a modern statistical system must have right of access to administrative and secondary data sources - without which, the system will not be able to meet the growing demands of users.

Figure 1 about here

Secondly, there must exist an environment where institutions of the statistical system can cooperate and coordinate their activities with other specialist and sub-national and international agencies and organisations. Sanga [12], discussing the situation in African countries, identified lack of statistical coordination within NSSs and between NSSs and international organizations as one of the factors that hindered the capacity of countries to measure MDG performance. Most likely it will be identified as a retarding factor for the SDG process in years to come, unless addressed now. NSSs in the future will require technical expertise and information held by organisations outside the statistical system. Availing of new opportunities arising from new data sources or meeting the challenges of greater demands for climate related data, geo-spatial information, better visualisation or improved explanations will require new strategic partnerships, both nationally and

internationally in order to get the mix of skills and experience necessary. As the volumes of data increase, owing to these new data sources, more thought and resources must be dedicated to the curation of data and this too may require external expertise, to ensure that comparable time series are preserved. International and supra-national organisations play an important role in collating official statistics on an internationally harmonised or comparable basis and facilitate the development of new concepts and production methods. It is vitally important that there are no impediments to NSSs and National Statistical Organisations (NSOs) cooperating fully with such organisations. Coordination between international organisations is also essential, to eliminate unnecessary duplication and to miminise the reporting burden imposed on NSSs, but this is outside the scope of this paper.

NSOs cannot possibly or efficiently deliver on the data demands facing them without building a supporting NSS. Landes [13, P.517], speaking about economics, reminded us that *'Economic analysis cherishes the illusion that one good reason should be enough, but the determinants of complex processes are invariably plural and inter-related. Mono causal explanations will not work'*. This is true of every subject, not just economics. To measure and illustrate the interconnectedness or interdependence of the various aspects of life, to identify multi casual explanations, requires that data from all different aspects of life can be connected or joined. In other words *'data must be comparable across time and sufficiently well described so as to facilitate integration with other data'* [14, p.147], and to do this, data must be 'domesticated' i.e. the rituals and routines of collection and storage, of setting metadata standards must be established. Thus cooperation between specialist institutions and a common framework or infrastructure is absolutely necessary to facilitate data linking. If each compiler is proprietary of their data and will not share it (within obvious sensible limits and with appropriate legal and technical safeguards) the value of their data and everyone

else's is greatly diminished. To realise the potential of data, data must be organised in a way that facilitates cross-pollination through the linking of microdata.

The final pillar for a functioning and efficient NSS is the existence of a National Data Infrastructure (NDI) that facilitates data-sharing and linking between the various agencies in that system. A NDI is essential for the efficient compilation of official statistics and to avoid what has been described as 'stranded data' [15]. A NDI is probably the only realistic and affordable way of reaching the level of data granularity required to realise the ambition of 'no one gets left behind' [16], which has been translated for statisticians as 'leaving no one uncounted' [1]. But a NDI has much wider implications beyond improving the NSS. A NDI can also provide a platform to transform the way public administrations operate, facilitating not only improved public services and administrative efficiency but greatly improving the management information systems necessary to monitor and evaluate programmes. Central to the philosophy of an NDI is the ability to re-use and link public sector information. This is essential not only for the compilation of affordable statistics, but also the development of new dynamic indicators, small area and regional statistics. SDG Target 9.1, although presumably not drafted with data in mind, summarises the ambition of a NDI perfectly - *'Develop quality, reliable, sustainable and resilient infrastructure, including regional and trans-border infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all*' [16, p.20]. Essential to the implementation of a NDI is to cultivate an appreciation or recognition of data as an asset and an essential part of the infrastructure necessary to support a modern public administration.

3. Pillar 1 - Legal Framework

The first pillar required to support a modern NSS is a sound legal framework. The implementation guidelines for the United Nations Fundamental Principles of Official Statistics states [17, p.62] *'High quality legislation is critical to the effective performance of a national statistical system*'. Irrespective of whether a statistical system is highly centralised or decentralised, all agencies or institutions belonging to that system, should have their activities supported by clear national legislation.

Activities like collecting private personal information, commercially sensitive business data or accessing confidential administrative or secondary microdata cannot be left to the vagaries of personal understandings or ad-hoc solutions. Equally, there can be no ambiguity regarding the safeguarding of confidentiality or the professional independence and impartiality of official statistics. Guarantees regarding such activities must be enshrined in national law so that all stakeholders understand clearly their rights and their obligations vis-a-vis the statistical system.

3.1 Statistical legislation

Statistical legislation will typically set out the roles and responsibilities of the key actors in the statistical system. For example, it should identify the head of the statistical system and define clearly that role. This will be particularly important if the head of the statistical system is different from the head of the NSO. NSSs operate within a wider national administrative and legal framework. So for a statistical system to properly function, the roles and relationships with other bodies, such as government departments or the central bank should be defined in legislation. Equally, the relationship and delineation between the statistical law and other legislative acts, such as, data protection and freedom of information

should be clarified as together these legislative acts create an environment of public trust by protecting the information rights of individuals, upholding administrative transparency and permitting data to be collected and used for statistical purposes. Data protection legislation typically sets out law on the treatment, use and storage of personal data on identifiable living people. It is designed to protect individuals against possible misuse of information about them held by others. Freedom of Information legislation typically sets out law creating a full or partial public 'right of access' to previously unreleased information held by governments and public authorities. Thus statistics and public administration are to some extent intertwined and symbiotic, although statistical legislation has some clear and important distinctions and differences. These legislative acts should all be mutually supporting in so far as they should help to create an environment of public trust regarding the use of information.

While national statistical legislation should define and legislate for all aspects of a statistical system, there are, three absolutely necessary components: the professional independence of that system and in particular of the head of that system; The NSO and other statistical agencies of the NSS must be legally empowered to collect primary information for statistical purposes from persons, households, businesses and other institutions and have legal access to all appropriate administrative microdata held by national and regional public administrations for the purposes of compiling aggregate statistical information; and the safeguarding of confidentiality must be clearly set out in law.

3.2 Professional Independence and Impartiality

The professional independence and impartiality of a statistical system is vitally important to ensuring that the best data possible are compiled and disseminated without fear or favour.

This is reflected in the first and second principles of the updated United Nations Fundamental Principles of Official Statistics [18] which state:

> *Principle 1 - 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. To this end, official statistics that meet the test of practical utility are to be compiled and made available on an impartial basis by official statistical agencies to honour citizens' entitlement to public information.*
>
> *Principle 2 - 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.*

and principle 6 of the revised European Statistics Code of Practice [19] which states:

> *Principle 6 - Statistical authorities develop, produce and disseminate European Statistics respecting scientific independence and in an objective, professional and transparent manner in which all users are treated equitably.*

It is essential that data providers trust the statistical system to only use data supplied for the purposes of compiling official statistics, and not for any form of legal or regulatory enforcement. Furthermore, it is also essential that official statistics are clearly independent of the political system and government interference or manipulation. Credibility will only come from independence [20]. The United Nations Handbook of Statistical Organization is also

uncompromising in this respect as *'It enjoins the chief statistician and staff to allow no interference by interested parties in the way facts are assembled and combined into statistics, nor in the method and timing of their release to the public'* [ibid, p.2]. Independence must include secure and sustainable resourcing of the statistical system to avoid the risk of politicisation.

3.3 Mandate to collect primary and secondary data

Legally empowering a NSO and the statistical agencies of a statistical system to collect primary information for statistical purposes is essential, so that necessary but often sensitive information, such as, household income or company turnover can be collected. Legislation should also address how to deal with non-compliance where mandatory data are not supplied, including issuing penalties. Securing the legal right of access to all appropriate administrative microdata held by national and regional public administrations for the purposes of compiling aggregate statistical information is also vital, as many key statistics cannot be compiled without such access. Furthermore, in order to future-proof statistical legislation, consideration should be given to mandatory access to all appropriate secondary data. This is a broader concept than that of administrative data traditionally used in statistical legislation. Thus, for the purposes of compiling official statistics, access to administrative data should now become access to secondary data, where secondary data would be defined to include not only administrative or public sector data but also some important, commercially held data, such as for example, information on credit card transactions, information held by utilities or information regarding the movements of mobile phones. This change has of course profound implications for safeguarding confidentiality. The ability to link datasets brings new challenges for a problem thought to be solved in traditional statistics - anonymisation. But with the computing power available today, it is now clear that simply removing personal

identifiers and aggregating individual data is no longer sufficient. A paper by Ohm [21] in 2010 outlining the consequences of failing to adequately anonymise data graphically illustrates why there is no room for complacency.

Figure 2 about here

3.3 Confidentiality

Last but by no means least, a functioning statistical system must be allowed to protect the confidentiality of the persons and entities for which it holds individual data. Thus the final component of a legal framework must be to safeguard confidentiality i.e. a guarantee to protect the identities and information supplied by all persons, enterprises or other entities. The UN Handbook of Statistical Organization [ibid, p.2] *'underscores repeatedly the requirement that the information that statistical agencies collect should remain confidential and inviolate. The failure to treat individual information as a trust would prevent the statistical agency from functioning effectively'*. The importance of confidentiality is clear in principle 6 of the updated United Nations Fundamental Principles of Official Statistics [18] which state:

> ***Principle 6*** *- Individual data collected by statistical agencies for statistical compilation, whether they refer to natural or legal persons, are to be strictly confidential and used exclusively for statistical purposes.*

In short, everyone who supplies data for statistical purposes does so with the presumption that their confidentiality will be respected. It is essential that this presumption should be underpinned by legislation. In effect this means that only aggregate data can be published for general release by official statistical compilers and those aggregates will have been tested for

primary and secondary disclosure. Data that cannot be published due to the risk of statistical disclosure are referred to as confidential data. Primary confidentiality disclosure arises when dissemination of data provides direct identification of an individual person or entity. This usually arises when there are insufficient records in a cell to mask individuals or when one or two records are dominant and so their identity remains evident despite many records (this frequently arises in business statistics where 'hiding' the identity of large multinational enterprises can be difficult). Secondary disclosure may arise when data that have been protected for primary confidentiality disclosure nevertheless reveal individual information when cross-tabulated with other data. However, many NSOs also make anonymised microdata available for limited but legitimate research purposes. Statistical legislation should also address whether such access to anonymised microdata for research purposes is permitted, and if so, how confidentiality will be preserved in this more testing scenario. Although not usually found in statistical legislation per se, most statistical systems will also supplement legislation by publishing security protocols and procedures (e.g. how paper or electronic questionnaires will be destroyed after their useful shelf life has passed or how individual records will be stripped of unique official identifiers to safeguard protection) and in the interests of transparency will also publish inventories of who has accessed microdata and for what research purposes. Doing so aligns statistical practice with Data Protection best practice.

4. Pillar 2 - Institutional Coordination

The second pillar required to support a modern NSS is a functioning institutional environment that facilitates formal cooperation and collaboration between key institutions. NSOs cannot reasonably be expected to meet all of the statistical and informational needs of a modern state in isolation or properly measure complex or cross-cutting phenomena such as

globalisation or climate change without access to a wide range of data and subject matter expertise. Increasingly, modern statistics are reliant on administrative and other secondary data to supplement the primary data collected. This is a trend that is likely to continue and escalate, as the costs of surveys become more prohibitive and the difficulties with hard to reach regions or cohorts intensify. This is a key issue in the context of the UN Agenda 2030 promise to leave no-one behind. Demand for more complex multi-faceted analyses coupled with the growing appetite for dynamic rather than static indicators all point towards the need to link and integrate data. A coherent mechanism that facilitates the safe sharing or linking data between institutions is also necessary if statistical and administrative burden is to be minimised or reduced. A functioning statistical system must address these issues and ensure that statistical activities are coordinated across all relevant institutions but also ensure that other aspects, such as data infrastructure, classifications and legislation are also coordinated between institutions.

4.1 Formal coordination

Institutional coordination may mean different things, depending on the administrative structures, culture and legislation of a country. But the objective should be universal - to compile good quality statistics that are fit-for-purpose as efficiently as possible. An important step should be to formalise and institutionalise roles and responsibilities, which will not only provide clarity and transparency but will ensure that cooperation is not dependent on particular individuals. Ideally, these arrangements should be supported by published Memoranda of Understanding (MoUs). Several UN manuals offer some good advice in this regard - for example, the UN International Merchandise Trade Statistics Manual [22, p.59] states *'Effective institutional arrangements are usually characterised by (a) the designation of only one agency responsible for the dissemination of official […]*

statistics, (b) a clear definition of the rights and responsibilities of all agencies involved, and (c) the establishment of formalised working arrangements between agencies including agreements on holding inter-agency working meetings […] and on the access to micro-data that those agencies collect'. The importance of this last point cannot be over emphasised; clarity regarding access to micro-data is absolutely essential. Formal MoUs should be agreed to bring clarity by explicitly dealing with the storage, classification and access to micro-data.

4.2 The role of the NSO

Typically, the NSO will play the central role in the coordination of a NSS. There are good reasons for this, as the NSO should be the centre of excellence for official statistics in a country and will usually have sufficient mass to be the natural gravitational centre. The NSO is also the natural conduit through which international organisations liaise with the compilers of national statistics. They are also the natural focal point for coordination between agencies compiling statistics or with relevant expertise, be they, regional; national; and international. The head of the NSO may also be required to act as head of the NSS, although in some countries the head of the NSO and NSS are deliberately kept separate. There are good reasons for either approach and for the purposes of this paper, it doesn't matter which approach is adopted. What is important is that the roles are formally clarified in legislation and both (if separate) should have their independence enshrined in that legislation to ensure that discussions remain technical.

4.3 Three key components

For the purposes of this paper, three key components of institutional coordination are identified, namely: (1) Statistical (namely coordination between NSOs and decentralised or

other statistical agencies or offices embedded in Government policy departments); (2) Specialist (including coordination between specialist offices, such as, health, sports, banking, pensions, or environment with NSOs); and (3) Geographic (including coordination between international, national and regional statistical offices) - see Figure 3.

Figure 3 about here

NSOs cannot be expected to compile statistics to support the UN Agenda 2030 for Sustainable Development or other international and national initiatives without access to supplementary secondary data from other government information and registration systems. For example, access to registrations of life events such as births and deaths, numbers of children attending school or of persons in receipt of social protection benefits are essential to compiling timely economic and social statistics. Coordination between NSOs and key compiling agencies within other national institutions, such as, tax and customs authorities or central banks is also essential if good quality official statistics are to be compiled; for example, the maintenance of business registers or the compilation of trade and balance of payments statistics. Consequently coordination and cooperation between agencies is essential to the efficient functioning of a NSS as it will increasingly require specialist and context knowledge. In particular, specialist knowledge regarding the quality of the administrative data and the associated metadata. It is also important for the promotion of consistency between different datasets and for the reduction of statistical burden to households and businesses. Coordination is required across all sections of the public administrative system: education, health, energy, transport, environment, tourism and policing. It may also be required across elements of the semi-private or private sectors too, to ensure that key data sources are available to the NSS.

Formal coordination between the NSS and other national, regional and international institutions is essential. National and sub-national coordination is the key to efficiently compiling coherent regional and state level statistics. In a federal context, such as in Germany or the United States of America, this may require quite formal structures supported by special legislation. For other countries sub-national coordination may be less formal or hierarchical but no less complex for a variety of historical or cultural reasons. But irrespective of the complexity, it cannot be ignored. Today, as the importance of geography or space for properly understanding many social, environmental and economic phenomena is increasingly understood, institutional coordination is becoming more important. The marriage of statistics and space brings huge opportunities to analyse and disseminate statistics in new and interesting ways but it also requires careful coordination. It is surprising how few NSSs have formalised or capitalised on this relationship - but there are some notable exceptions, such as IBGE (Instituto Brasileiro de Geografia e Estatística) in Brazil or INEGI (Instituto Nacional de Estadística y Geografía) in Mexico. The compilation of many sub-national or regional statistics is completely dependent on the coordination and cooperation between regional institutions as in some cases large administrative data may be the only way that good quality local or sub-national data can be compiled, even though sometimes this involves a trade-off between data availability and adherence to existing statistical concepts [23]. As noted above, this combination also brings new challenges for the anonymisation of confidential cells, again highlighting the importance of sound legislation and protocols, particularly regarding the use of and access to microdata. The coordination and integration of traditional statistical systems, land and property registers, mapping and ordinance services and other geo-spatial information systems will be critical if the potential of geography and space is to be

capitalised on from an information perspective, especially to yield good quality sub-national or small area statistics.

Equally cooperation and coordination with international institutions such as the United Nations, or supra-national institutions such as the Organisation for Economic Cooperation and Development or the African Union, is increasingly important, particularly in the context of compilation of global indicators to support policy actions on climate change or measuring progress towards Agenda 2030. International statistical organisations collectively play an important role in helping to harmonise classifications and standards (e.g. the International Standard Industrial Classification for economic activity - ISIC or the Central Product Classification for goods and services - CPC), agree methodology (e.g. the international System of National Accounts), share technology (e.g. Statistical Data and Metadata Exchange - SDMX) and facilitate capacity building across countries. By collating data from around the world, international and supra-national institutes provide valuable data repositories and also help identify implementation problems, such as, trade asymmetries which probably would not be otherwise identified or confronted. From a country perspective, it is very important to coordinate national activities with international community programmes. But of course national coordination is a necessary prerequisite. Coordinating the timing of census taking or the adoption of the 6th edition of the Balance of Payments (BPM6) are good examples. If countries act unilaterally, it only serves to undermine the international comparability and value of their own data. Thus adopting internationally agreed standards and classifications is sensible. Furthermore adopting international standards can further safeguard national statistics against attempts to manipulate data and concepts for short-term national interests. Finally, institutional coordination facilitates information sharing and highlighting innovative or best practice.

5. Pillar 3 - National Data Infrastructure

The final pillar, essential for a modern, NSS is a well organised and coherent national data infrastructure (NDI). Use of the broader term 'data infrastructure' rather than the narrower 'statistical infrastructure' is deliberate. The term 'statistical infrastructure' is used by the OECD in their 2015 recommendations [24] for good statistical practice. While we fully support their argument, we take a wider perspective, as not only is such an infrastructure of paramount importance from a statistical perspective but it also critical for an efficient national administration. This specific point is outside the scope of this paper but has been well articulated by MacFeely and Dunne [25]. With the attention currently being placed on 'big data' and ideas of 'data revolution', there is a risk that insufficient attention is being given to properly designing the basic architecture required to support national data or information systems. Without helping countries to put in place the solid foundations of a properly designed data infrastructure, many statistical capacity building programmes may not achieve their full potential or may simply be wasteful.

The logic of a NDI is simply the rational or logical organisation of public or administrative data to maximise the potential value and interoperability of those data. Administrative data, if properly organised, are valuable assets and an essential part of the infrastructure necessary to efficiently run a modern state and fuel a modern statistical service. Holders of other secondary data, such as private or commercial data should also be encouraged to adopt the same standards although emphasis should focus first and foremost on administrative data.

5.1 Persons - Businesses - location

To develop a NDI three comprehensive databases or 'lists' are required: (1) a list of all persons in the state (with a unique ID attributed to each person), (2) a list of all businesses in the state (each with a unique ID) and (3) a list of all locations/buildings in the state (each with a unique ID and location co-ordinate). Furthermore, the inter-linkages between these lists are also required, so that the various interactions between them can be measured and understood e.g. where does a person live and work (see Figure 4). This is not an exhaustive list, other databases could be added, but these are the three core databases essential to an NDI. For example, Niels Ploug [26] of Statistics Denmark has presented a much more complex model, illustrating how a variety of different administrative data (including income, social benefits, health, education, employment and turnover data) can all be linked. Nor is this a new idea, as far back as the 1970's, Largs Thygesen, also of Statistics Denmark, promoted these ideas [27].

Building a NDI on unique, permanent official and commonly used identifiers will permit public sector data to be analysed in a way that facilitates the identification of longitudinal, latitudinal, spatial and relational linkages. These linkages allow movements in time and space to be properly understood. Thus an 'object' or unit (e.g. individuals, enterprises or buildings) can be tracked over time as can their 'attributes' or characteristics (e.g. spatial location) and their relations to other units (e.g. family, employer, school, car). Hence the importance of a NDI to both understanding geography and space but also for the development of dynamic indicators. The importance of permanent or 'persistent' official identifiers is central to this approach. This has also been emphasised by the Finch Report

[28] which was commissioned by the UK government to address the question of how to improve the transparency and openness of public data to improve public policy and research.

Figure 4 about here

[29]

5.2 Unlocking the potential of data

For a comprehensive NDI to properly function, it must facilitate data-sharing and linking. The importance of being able to re-use and match public sector information cannot be overstated both for the compilation of modern official statistics but also for the efficient running of a modern state. Quite obviously, if the data made available to the NSO can be shared across the wider statistical system it will have a profoundly positive impact on the quality and range of official statistics that can be made available.

It is vital that the underlying data generated or associated with these services are organised in a coordinated way using the permanent public service identifiers and the same internationally agreed classifications and codes. By better organising and coordinating the management of administrative data, the potential of that information can be unlocked. To extract maximum benefit from such an information system, the infrastructural design is crucial, and must involve using relevant permanent, official unique identifiers associated with each database or list. For those interacting with the state in any service or activity, use of these official identifiers should be mandatory. A move to such a universal design will 'de-silo' existing systems. Only with such a system can the interactions and inter-relationships between citizens/business and the state be measured and understood. Such an approach could make a profound contribution to achieving the ambition of 'no-one left uncounted' and supporting a human rights approach to sustainable development.

5.3 Dataveillance

If organised properly, a NDI is an incredibly powerful tool, and with such power comes the risk of abuse. Naturally a NDI may raise the dystopian spectre of a database state employing intrusive surveillance (or dataveillance) to control rather than serve citizens - what O'Neill has rather provocatively called the 'weaponisation' of data [30] . History has taught us that these are not irrational fears. But against this, governments obviously need information to run modern states. The question is, whether governments will access and use administrative and secondary data covertly or in an open and transparent way. Paradoxically, an NDI operating under proper open and transparent legislation and with robust data governance procedures and a sound ethical framework could arguably afford citizens more rather than less protection. Governance procedures that provide unambiguous audit logs will allow citizens to see who has used their data and for what purposes would bring greater transparency not less. But fundamentally, this is a matter of culture and trust. To what extent citizens trust their government to use their data sensibly or openly will vary. But every country must weigh up the pros and the cons and decide where they lie on the 'efficiency - privacy' spectrum. For countries, where sufficient trust exists, a NDI offers the potential to realise significant administrative efficiencies and a much richer suite of official statistics. In any case, the need for legislation, transparency and governance concerning what data are being linked, by whom, and for what purposes should be evident.

6. Coordinated capacity building

At the end of the MDG lifecycle in 2015, countries could populate, on average, only 68 percent of MDG indicators [31]. Compared with the 169 targets set out by the SDG programme [32], the MDGs requirements were modest, both in number (21 targets) and complexity [33]. Yet it is anticipated that most governments will agree to populate the 230 indicators demanded by this universal agenda while at the same time fulfill their existing obligations to provide data in support of national development plans and other international and supra-national programmes and agreements.

6.1 Resource Implications

As yet, neither the United Nations Economic and Social Council (ECOSOC) nor the General Assembly have formally endorsed or approved the 230 indicators proposed by the Inter-Agency and Expert Group on Sustainable Development Goal Indicators, so the actual number of indicators could still change. But saving a dramatic reduction in indicators, this will be a huge task for many countries, but in particular, least developed countries, land-locked developing countries and small-island developing states. A UN Joint Inspection Unit has highlighted this issue [34, p.9] remarking *'Given that member States found great difficulty in reporting on the much more limited Millennium Development Goals, reporting on the Sustainable Development Goals will require a step change in the quantity, quality and means of delivery of the support from the international community. Moreover, capturing dimensions of inequality, sustainability and governance will provide further challenges to national statistical systems in all member States, not just in developing countries*'. But as the UN Secretary General's Independent Expert Advisory Group on the Data Revolution noted in 2014, many NSSs are still beset by under-funding, low capacity and inadequate investment in administrative data [35]. Furthermore, the UN Statistics Division (UNSD) in 2016 estimated that less than half of the selected indicators for the SDG monitoring framework could be

classified as 'Tier 1' meaning that the indicator is conceptually clear with an established methodology and set of standards and that data are already, regularly produced by countries [36]. While UNSD note that this estimate is very preliminary, it nevertheless gives an indication of the magnitude of the task facing the global statistical community. As already noted, estimates of the resources required to support the poorest countries in implementing the SDG monitoring framework ranges between, US$1 and 1.25 billion per annum. But many other countries will also require assistance, meaning the investment required will most likely be far greater.

Reorganising or developing a NSS is a huge task. Most countries will not be able to develop a NSS on their own and will need considerable help and support. From an international organisation perspective, there arguably needs to be a less fragmented and more coordinated, holistic approach to statistical development and capacity building. Countries should be encouraged to prioritise the development of a functioning NSS and should be assisted in implementing such an undertaking. This would help countries to address both the new demands from Agenda 2030 but also meet their own existing and future national data requirements. National governments should be helped to understand the connection between shared and linked information and ‘seamless’ or ‘joined-up’ government to improve not just official statistics but also public services and government performance by increasing administrative efficiency, transparency and improving policy formulation and assessment.

6.2 Agenda 2030 - An opportunity

With the growing recognition of the need for good quality data, there has been a renewed push for improved data to support the UN Agenda 2030 programme and the Addis Ababa Action Agenda [ibid]. This momentum presents a real opportunity for international

organisations to actively promote and assist in the development of coordinated NSSs. While to some extent this is already being done, by programmes such as Paris21 and through various domain specific projects, there is no coordinated global programme that specifically targets the three mutually supporting and interconnecting fundamental pillars and components necessary for a modern NSS, namely: a sound legal framework, a functioning and coordinated institutional environment and a national data infrastructure (see Figure 5). It remains to be seen whether the recently formed 'Global Partnership for Sustainable Development Data' will be a help or a hindrance in this regard. Usefully they highlight the importance of data architecture, but run the risk as many do, of thinking that IT solutions can overcome deficits in data infrastructure. But as MacFeely and Dunne [ibid, p.99] note *'Technology can only provide solutions if the underlying data are properly structured and organized and populated with universal codes and classifications'*. It may of course be difficult to convince donors to commit to such a broad programme, which will take many, many years to deliver. However without a coordinated approach to capacity building, and one that targets the development of properly designed foundations or infrastructure, many existing statistical capacity building programmes may not achieve their full potential or may simply be wasteful.

Figure 5 about here

Coordinating statistical capacity building across UN and international organisations will not be easy or straight forward. Each has a different mandate. But from a statistics perspective, the development of a NSS is the rising tide that will lift all boats (or in this case statistical domains). Morrison [37] identifies the need for a clear 'road map' and also highlights the importance of 'phasing' for the improvement of statistical capacity building.

The pillars and components outlined above provide that road map, towards a sustainable NSS designed with the modern 'data age' in mind. We agree. Phasing or sequencing is critical. Hence we argue that Pillar 1 (legislation) should be addressed first, followed by Pillar 2 (institutional coordination). Only then can Pillar 3 (data infrastructure) be implemented. We recognize of course there is an element of 'chicken and egg' here, and that a good argument can be made for beginning with institutional coordination, we nevertheless believe Pillar 1 is the best place to start. It is important to recognize that developing a functioning NSS that includes a logical NDI is a long and difficult road; a road that may take decades to build. Certainly this has been the experience of those countries that have achieved sophisticated systems, such as those in the Nordic countries of Northern Europe. This further strengthens the argument for a longer term approach to coordinated capacity building. Jütting [ibid] has also argued that a new approach to statistical capacity building is required. We completely agree.

6.3 Where to begin?

Considering the likely obstacles to improved coordination, how can it be achieved? The establishment of the High-level Group for Partnership, Coordination and Capacity-Building for the 2030 Agenda in 2015 [38] may offer an opportunity to demand and facilitate a more coordinated approach. At the 47th session of the United Nations Statistical Commission (UNSC) in 2016, this group was tasked with, among other things, working with the High-level Group and the Inter-Agency and Expert Group on Sustainable Development Goal Indicators (IAEG - SDG) to address statistical capacity-building for the implementation of the global SDG indicators [39]. This group will report back to the UNSC in 2018 and this will be an opportunity to demand a more coordinated approach towards capacity building for NSSs.

7. Conclusion

The complexity and ambition of the SDG monitoring framework presents an unprecedented challenge for countries. The sheer scale of this framework has the potential to overwhelm existing national and regional statistical development strategies and programmes. The SDGs are part of a political process that will require results in the near future to assess progress towards Agenda 2030, and so, the data demands arising from this process must be addressed. But too much focus on short term results to feed that process, at the expense of longer term development will ultimately lead to wasted resources. In particular, for countries without a developed NSS, a balance must be found between feeding the SDG monitoring framework and reaching their sustainable long term statistical capacity.

It is clear from the various reports and statements cited above, that the central importance of NSSs is recognised. It is also clear there is a growing recognition of the importance of good quality, independent official statistics to support development and progress. This recognition should provide an opportunity to justify a substantial investment in what the United Nations Conference on Trade and Development [ibid] has termed the 'soft infrastructure' of countries. It is critical, that this investment is long-term and is done in a concerted and coordinated way, so that the development of NSSs is the key priority. To properly fulfil its mandate, a NSS will require a strong legal underpinning, institutional coordination and usage of common standards. A 2016 UN Joint Inspection Unit report [ibid, p.14] evaluating the contribution of the UN on the development of national statistical capacity found that *'The United Nations system has not always been able to address national statistical capacity development in a holistic manner, to address the national statistical system as a whole. In addition, it has not always been strategic and catalytic in leveraging its*

limited financial resources and promoting such broad holistic support where necessary'. These criticisms are not unique to the UN. Had the net been cast wider, such an evaluation would have undoubtedly reached the same conclusions of international organisations generally. To overcome these criticisms, a clear long-term vision is required to shape and direct a coordinated statistical capacity building programme. High level political support from, not only countries and donors, but from all international and supra-national organisations (not just UN agencies) will also be required. The role of donors will be especially important, as they must cast their gaze far beyond the immediate horizon, and consider how to invest in long-term capacity building.

We believe that the organisation of the data itself must form an integral part of this vision. Consequently, we have broadened the discussion surrounding NSSs to emphasise the importance of data infrastructure. While the importance of legislation and institutional coordination to the development of NSSs has been long understood, the organisation of the data itself is often less discussed. We stress the importance of data as an asset, an asset that must be supported by sound architectural design - a NDI. We also suggest that a modern NSS will require statistical legislation that anticipates access to secondary data (rather than the narrower concept of administrative data) such as data derived from social media, technological or financial services. This of course will raise many difficult legal and ethical questions regarding the appropriate governance and use of data and many technical challenges regarding anonymisation. But at some point these issues must be addressed if official statistics is to move with the times and remain useful as a tool for global reporting and relevant to the needs of civic societies, governments and business communities.

Without a rational architectural design and data infrastructure and without solid legislative and institutional foundations, many countries will not be able to build statistical

systems appropriate to a data driven world. Nor will they be able to meet existing and future demands for information, including the SDG monitoring framework. Such infrastructure has implications far beyond statistics - for example, the development of registers will play an important role in helping developing countries make the transition from informal to formal economies, with direct implications for their ability to mobilise domestic resources (SDG Goal 17.1).

Without appropriate legal safeguards, institutional coordination and data infrastructure, compilers of official statistics will not be able to safely and securely access and use administrative or secondary data or avail of opportunities to harness new data sources. In short, if the fundamental pillars required for a modern statistical system are not put in place, many opportunities will be squandered while the risks of abuse and manipulation of official statistics, the deterioration of public trust and inefficient institutions will remain.

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Figure 1 - Fundamental Pillars of a National Statistical System

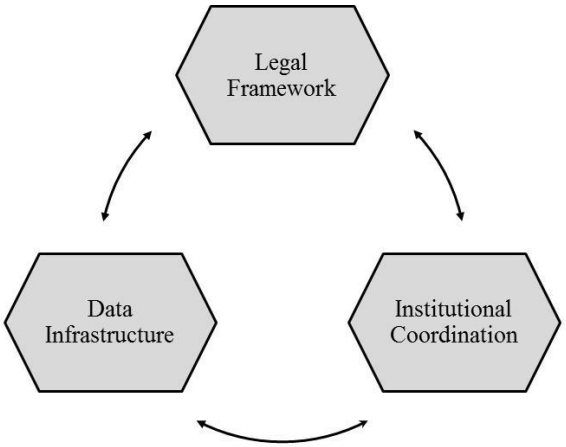


Figure 2 - Basic components of a Legal Framework

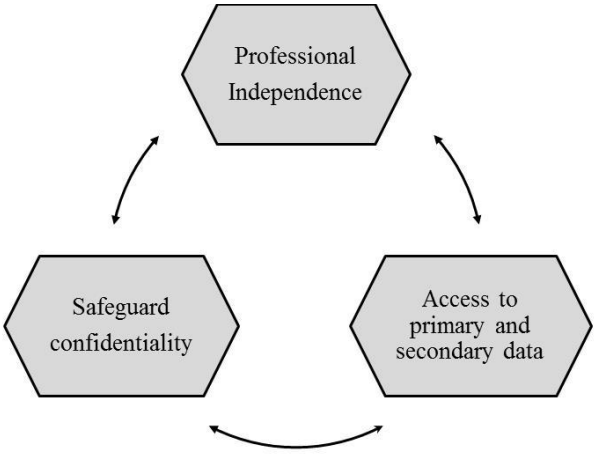


Figure 3 - Basic components of a functioning Institutional Environment

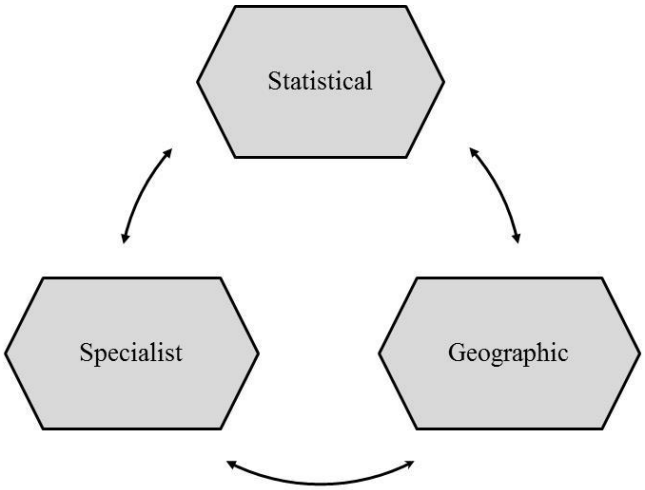
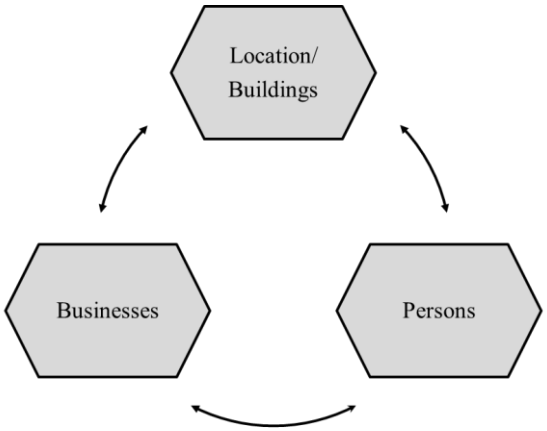


Figure 4 – Basic components of a National Data Infrastructure



Derived from: Thygesen 2010 [29]

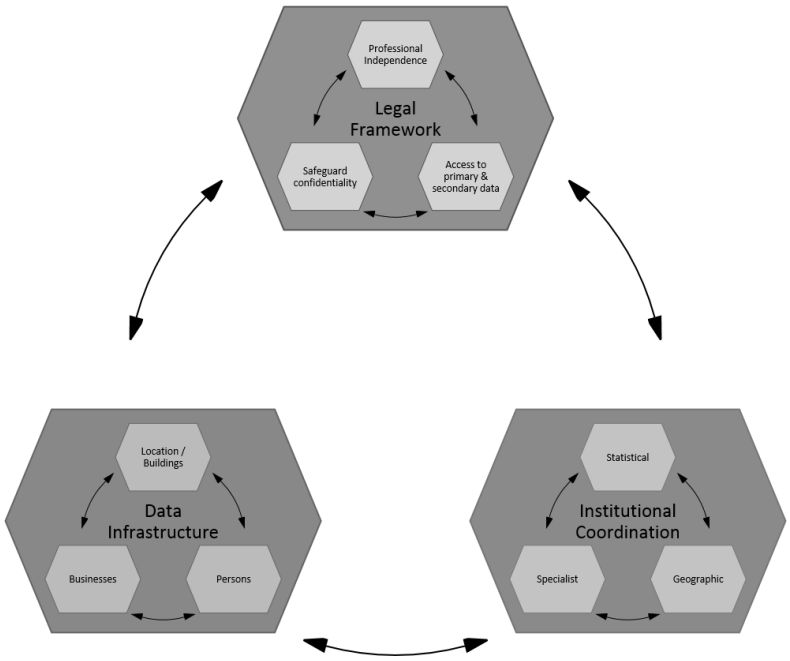



Figure 5 - The Fundamental Pillars and Components necessary for a Modern National Statistical Service