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Positioning Household Surveys for the Next Decade

Prepared by
the Inter-Secretariat Working Group
on Household Surveys

Contents

1. Introduction

1. As a key source of social and economic statistics, household surveys are a vital component of national statistical systems. Not only do they provide data that inform the design and evaluation of development policies, they are also a unique data source to gain knowledge on attitude and behavior that are difficult to obtain from other data sources. Household surveys are also critical for tracking progress towards national and international goals – household surveys are the source of more than a third of all 232 indicators for the Sustainable Development Goals (SDGs), cutting across 13 out of 17 SDGs.[1] They can be used to improve and complement administrative data sources, as well as to validate and calibrate remote-sensing models and machine learning applications that combine household surveys with non-traditional data sources, providing insights with accuracy and precision that cannot otherwise be achieved by using these data sources alone. Today, the need for household surveys is greater than ever, given the widespread socioeconomic and health impacts of the COVID-19 pandemic that have resulted in an increase in global poverty for the first time in two decades.[2] Survey data are key to understanding the distributional impacts on households and individuals of global shocks and crisis such as COVID-19, as well as climate change, natural disasters, and extreme weather events.

2. Despite their importance for development and substantial progress in the past decade, weaknesses persist in the availability, coverage, accuracy, timeliness, affordability, policy relevance, and usability of household surveys, particularly in the low-income countries that stand to benefit most from better survey data. Urbanization and higher income levels tend to reduce survey response rates; lengthy questionnaires bring about respondent fatigue with negative consequences for data quality; and coordination failures are common within overburdened statistical systems. The added stresses of COVID-19 have further exacerbated the vulnerability of household surveys and their corresponding data infrastructure in countries. As of May 2020, almost all countries had either fully or partially stopped face-to-face surveys as a result of the pandemic.[3] Furthermore, of more than 180 countries that implemented phone surveys to measure

[1] United Nations, 2019. Mapping of SDG indicators. Report of the Inter-Secretariat Working Group on Household Surveys, background document. The exercise was carried out before the IAEG-SDGs 2020 Comprehensive Review of the global indicator framework. Revisions of the indicator framework were adopted by the UN Statistical Commission at its 51st session (https://unstats.un.org/unsd/statcom/51st-session/documents/2020-2-SDG-IAEG-E.pdf)

[2] World Bank, 2021. Updated Estimates of the Impact of COVID-19 on Global Poverty: Turning the Corner on the Pandemic in 2021? Available at https://blogs.worldbank.org/opendata/updated-estimates-impact-covid-19-global-poverty-turning-corner-pandemic-2021

[3] United Nations Statistics Division and the World Bank, 2020. Global COVID-19 Survey of National Statistical Offices, May 2020.

COVID-19 impacts, only 43 percent were able to use an updated sampling frame from a recent household survey.[4]

3. At the same time, the modern data ecosystem has recently seen significant advances in the form of new data sources that provide more granular and timely data (including geospatial data, mobile phone data, sensor data, among others), new technologies for data collection, new approaches for engaging with respondents and data users, and new business architecture models for running national statistical systems.

4. With this context in mind, this paper presents eight technical priority areas for household surveys to overcome existing challenges, adapt to the changing data ecosystem, meet the ever-increasing demand for data, and increase development policy and research impact in the remaining years under the 2030 Agenda for Sustainable Development. While there is undoubtedly cross-country heterogeneity in the extent of financial, technological and human resources that would be required to adopt recommendations in each priority area, the priority areas are intended to (a) Inspire countries in pursuing innovations and considering priorities to further improve and transform their household survey systems and (b) guide the Inter-Secretariat Working Group on Household Surveys (ISWGHS) in the execution of its mandate of supporting countries to achieve the SDGs. The paper also presents the key elements, both at the national and international level, of an enabling environment that can best support household survey systems to produce more and higher-quality survey data that are affordable and responsive to policy needs.

5. The paper has benefited from extensive reviews by key stakeholders including national statistical offices (NSOs), line ministries within national statistical systems, researchers, civil society organizations, and regional and international agencies. An annotated outline of the paper[5] was initially presented to the UN Statistical Commission in 2021. Key aspects of the paper were also presented at various meetings and conferences including the UN Statistical Commission, the United Nations World Data Forum, the World Statistical Congress, and the International Association of Survey Statisticians (IASS) in 2021.

2. Technical priority areas for household surveys for the next decade

6. This chapter outlines eight technical priority areas for household surveys in the next decade: (1) enhancing the interoperability and integration of household surveys; (2) designing and implementing more inclusive, respondent-centric surveys; (3) improving sampling efficiency and coverage; (4) scaling up the use of objective measurement technologies, (5) building capacity for CAPI, phone, web, and mixed-mode surveys; (6) systematizing the collection, storage, and use of paradata and metadata; (7) incorporating machine learning and artificial intelligence for data quality control and analysis; and (8) improving data access, discoverability, and dissemination. For each priority area, a short summary is provided on recent developments and advances based on a review of academic research and country experience. Suggestions

[4] Inter-Secretariat Working Group on Household Surveys, Dashboard on COVID-19 impact surveys. Available at https://unstats.un.org/iswghs/task-forces/covid-19-and-household-surveys/COVID-19-impact-surveys/ . In-person data collection gradually resumed after the initial lockdown: in May 2021 proportion of countries stopped fully or partially face-to-face interviewing reduced to 57 per cent. United Nations Statistics Division and World Bank, 2021. Monitoring the State of Statistical Operations under the COVID-19 Pandemic, highlights from the fourth round of a global COVID-19 survey of National Statistical Offices (NSOs). Available at: https://covid-19-response.unstatshub.org/posts/nso-still-face-disruptions-and-challenges/

[5] United Nations, 2021. Statistical Commission Fifty-second session, item 3(l) on Household Surveys. Background document: Positioning Household Surveys for the Next Decade Annotated Outline, available at https://unstats.un.org/unsd/statcom/52nd-session/documents/BG-3l-Positioning_household_surveys-E.pdf

are made for next steps, ranging from improving basic survey data infrastructure for phone, web, and mixed-mode surveys, to conducting experiments on the scalability of different methodological approaches.

7. The priority areas were chosen based on three primary criteria: (1) areas that have been proven to be successful or have a great potential to make a medium-term impact; (2) areas that both build a strong data foundation and expand the frontier for research and development; and (3) areas that are more likely to benefit low- and middle-income countries as the key users of the document. However, these priorities are neither comprehensive nor "one-size-fits-all", and thus countries are encouraged to set their own priorities based on the levels of statistical development and set up of their national statistical systems. While many of the examples provided in the paper have been successful in some countries, further piloting and experiments under national circumstances may be necessary.

2.1. Enhancing the interoperability and integration of household surveys

8. Enhancing the interoperability and integration of household surveys among themselves and with censuses, geospatial data, administrative records, and different types of non-traditional sources, such as earth observation, call detail records and social media platforms, can increase the cost-effectiveness and relevance of survey data production and achieve higher levels of accuracy and granularity (in terms of both spatial and temporal resolution) that is only possible through data integration. It can also counteract common criticisms of household surveys in terms of respondent burden, coverage, and timeliness, and enable their downstream reuse for ground-truthing and calibration purposes, inter alia.

9. An abundance of research has been produced on methods for integrating household surveys with other data sources. A review paper by Lohr and Raghunathan (2017)[6] highlights a number of broad objectives that can be achieved through this kind of integration, including: (a) improving the efficiency of sampling by using multi-source frames or auxiliary information from other data sources (e.g. stratification), (b) bridging household survey data gaps through direct record linkages[7,8] or with model-based imputation[9], and (c) improving the precision, timeliness and granularity of survey-based estimates through integration of surveys with censuses, other surveys, and other types of data sources, as discussed below. The following subsections highlight key considerations for creating successful data integration programs in countries.

10. Moving towards an integration by design approach for survey integration with other data sources also coincides with the larger transformation of national statistical offices (more details in *3.1.b. Modernize national statistical systems* the discussion around how household surveys fit in the

[6] Lohr, S., and Raghunathan, T.E. (2017). Combining survey data with other data sources. *Statistical Science*, 32, 293-312.

[7] The Canada Income Survey ask a minimum number of questions related to income since the tax records of the respondents are retrieved. This exercise involves linkage of individual records and the respondents were informed during the interview (the practice is called "informed replacement") For more information, please consult Statistics Canada, 2014. Note to Users of Data from the 2012 Canadian Income Survey. Available at https://www150.statcan.gc.ca/n1/pub/75-513-x/75-513-x2014001-eng.htm.

[8] A related example is the Netherlands' Labor Force Survey where the information on economic activity for employees is derived from the Jobs and Social Security Register. For more information, please consult Eurostat, 2013. The use of registers in the context of EU-SILC: challenges and opportunities. Edited by Markus Jäntti, Veli-Matti Törmälehto and Eric Marlier. Available at https://ec.europa.eu/eurostat/documents/3888793/5856365/KS-TC-13-004-EN.PDF (August 2021)

[9] An example could be the case of integrating two surveys, one with a smaller sample but a complete coverage of data of interest and another with a larger sample but a more limited, though still overlapping, coverage of the same data. Missing data in the larger survey can be imputed through a model of the outcome variable of interest that is estimated as a function of the predictor variables overlapping across the two surveys. For more discussion, please consult Kim and Rao (2011). Combining data from two independent surveys: a model-assisted approach. Biometrika (2012), 99, 1, pp. 85-100.

larger data ecosystem. The Trusted Smart Statistics model[10], currently under development in the European Statistics System, calls for a multi-source paradigm system that each type of data sources serves multiple purposes and each statistical domain benefits from different types of data sources.

11. In practice, data integration by design should always start with a thorough understanding of data needs, through consultations with key stakeholders as described in *3.1.a Strengthen engagement with policymakers and data users*. Then the following steps need to be carried out for planning a data integration: (a) assessing the availability, accessibility and quality of other data sources to NSOs; (b) gathering sufficient information about the input data such as all necessary metadata, quality and interoperability; and (c) reconciliating the concepts, definitions and inferences produced across different data sources.[11] The steps covered above in planning a data integration raise a number of common challenges that should be highlighted.

a. Improve accessibility of other data sources for integration

12. Accessibility of data outside of NSOs for integration has been challenging for many. As highlighted by countries that are just starting to experiment with small area estimation method, one of the biggest challenges is often the accessibility of administrative data sources.[12] Most countries can only rely on census as the auxiliary data source because neither administrative data or non-traditional data are available to NSOs. Strong legislative backing would be helpful to allow access to other data for official statistical purposes and guards the confidentiality of personal information in the integrated data, as well as in the original data sources. There also has been discussion on moving from sharing data to sharing computation given the sensitive of personal "nano-data"[13], which can hopefully reduce the pressure in data privacy breach and the heavy requirement on the IT infrastructure.

b. Foster data interoperability by design

13. Integration across different data sources demands data interoperability by design. *Interoperability* is a key requirement for data to be valuable for development and relates to the ease with which data sources can be linked and integrated through geospatial coordinates, common questions, time stamps, common classification standards, or common identifiers for persons, facilities, or firms, among others.[14] Given governments' budget constraints and the need for more granular data, many countries are pursuing greater integration across different data sources –between censuses and surveys, exclusively among surveys, and between surveys and other non-census/survey data sources.

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[10] Ricciato et. al., 2020. Trusted Smart Statistics: How New Data will Change Official Statistics. Data & Policy (2020), 2: e7. Doi: 10.1017/dap.2020.7.

[11] Steps recommended for integration of survey data and administrative data, by Eric Rancourt (2019). Admin-First as a Statistical Paradigm for Canadian Official Statistics: Meaning, Challenges and Opportunities. Proceedings of Statistics Canada Symposium 2018. Similar steps also apply to integration of survey with other data sources.

[12] UNSD, 2022. Toolkit on Small Area Estimation for SDGs, produced under the guidance of ISWGHS and IAEG-SDGs.

[13] Referring to data records at sub-individual level such as mobile phone position data at below-individual level. Ricciato et. al., 2020. Trusted Smart Statistics: How New Data will Change Official Statistics. Data & Policy (2020), 2: e7. Doi: 10.1017/dap.2020.7.

[14] Jolliffe, D. M., Mahler, D. G., Veerappan, M., Kilic, T., and Wollburg, P. R. (2021). "Under What Conditions Are Data Valuable for Development?" World Bank Policy Research Working Paper No. 9811.

14. Integration of census and survey data for small area estimation of development outcomes is a well-known example of how interoperability between censuses and surveys can enable the production of more disaggregated estimates, most notably of consumption poverty but has been expanded to other areas such as mortality, labour force participation, disability and other areas of SDGs, that cannot be achieved by sample surveys alone.[15,16] Using a common list of administrative units across censuses and surveys, and including identical census questions in subsequent household surveys are key to these applications.

15. Moreover, integration can be sought exclusively among surveys. While the applications of survey-to-survey imputation to improve the availability, quality, timeliness and cost-effectiveness of official statistics have been mixed, the technique has been used routinely in applications of proxy-means testing and evaluation of subnational project impacts, typically focused on poverty measurement.[17,18] As pointed by an experiment carried out by Newhouse et. al. (2014)[19], successful survey-to-survey imputation relies on two assumptions: (a) that the questions in the two surveys are asked in a consistent way; and (b) that common variables of the two surveys explain a large share of the variations of the outcome indicator. In this particular example the imputation between household income and expenditure survey and the labour force survey in Sri Lanka failed, because of these two assumptions did not hold. The paper also argues different sampling design across two surveys could also be problematic.

16. There is significant scope for methodological research to rigorously validate and develop guidelines on the use of survey-to-survey imputation by survey practitioners and data analysts, including for filling data gaps in official statistics. Recent research has focused on resolving this constraint from a poverty measurement perspective,[20] but much remains to be done in building the capacity of NSOs in low- and middle-income countries to (a) implement "light" surveys (i.e. with shorter questionnaires, potentially with smaller samples – depending on the specific imputation application at hand) that are implemented primarily to collect the required data for the predictor variables included in the imputation models, and/or (b) ensure the collection of core set of questions on predictor variables as part of other surveys that may be designed with different measurement objectives but that provide the required data for imputation purposes.

17. Integration of administrative data sources and household surveys has also been carried out in countries when administrative data is accessible. For example, mandated by law, Chile integrates administrative data from Ministerio de Desarrollo Social Y Familia with the National Socioeconomic Characterization Survey (CASEN) to produce poverty estimates for 345 *communas*.[21] The Canada Income Survey ask a minimum number of questions related to income since the tax records of the respondents are

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15 Elbers, Chris, Jean O. Lanjouw, and Peter Lanjouw. (2003). "Micro-Level Estimation of Poverty and Inequality." Econometrica, 71(1): 355-364.

16 Tarozzi, Alessandro. (2007). "Calculating Comparable Statistics from Incomparable Surveys, With an Application to Poverty in India". Journal of Business and Economic Statistics 25, no. 3:314-336.

17 Dang, H., Jolliffe, D., and Carletto, C. (2019). "Data Gaps, Data Incomparability, and Data Imputation: A Review of Poverty Measurement Methods for Data-Scarce Environments". Journal of Economic Surveys, 33(3): 757-797.

18 Dang, H., and Verme, P. (2021). "Estimating Poverty for Refugee Populations Can Cross-Survey Imputation Methods Substitute for Data Scarcity?" ECINEQ Working Paper 2021-578.

19 Newhouse et. al. (2014) How Survey-to-Survey Imputation can Fail. World Bank Policy Research Working Paper. Available at https://openknowledge.worldbank.org/handle/10986/19364

20 Dang, H., Kilic, T., Carletto, C., and Abanokova, K. (2021). "Poverty Imputation in Contexts without Consumption Data: A Revisit with Further Refinements." World Bank Policy Research Working Paper No. 9838.

21 Inter-Secretariat Working Group on Household Surveys and IAEG-SDGs, forthcoming. Toolkit for Using Small Area Estimation for SDGs.

retrieved. This exercise involves linkage of individual records and the respondents were informed during the interview (the practice is called "informed replacement").[22]

18. For better integration of survey and administrative data, eliciting administrative identifiers for individuals, firms, facilities as part of household surveys can enable unit-record linkages with administrative data sources, allowing researchers to combine information from survey and administrative sources. This can serve multiple purposes, for example to assess the quality of survey data by leveraging identical information contained in administrative data, to provide a basis for calibration or weighting, or to populate some survey variables, for example linkage to taxation databases to avoid the need to ask extensive questions on income in countries will well developed and comprehensive administrative sources. Harmonized concepts and definitions, as much as possible, should be used in these two data sources.[23]

19. At the same time, the use of linking variables that can enable integration between surveys and administrative sources increases privacy risks, which should be hedged against through appropriate measures: obviously ensuring the omission of such variables in public use datasets and making available confidential datasets inclusive of linking variables only if data privacy can be ensured, as discussed later in this section.

20. When integrating household surveys with other data sources, the use of georeferencing has enabled household surveys to be used for validating and calibrating machine learning models that combine georeferenced survey data with publicly available satellite imagery and processed geospatial data to derive precise estimates of poverty, asset wealth, and agricultural outcomes at high spatial resolution.[24,25,26]

21. These efforts have traditionally relied on public use datasets that include spatially anonymized GPS locations of surveyed communities (i.e., aggregated and offset measures of confidential GPS locations of surveyed households). In the context of public use datasets, this is basically the current state of arts, and data producers should be endowed with sufficient technical capacity to adopt and implement spatial anonymization techniques. At the same time, data users do not yet fully understand the potential scope for bias brought on by the use of spatially anonymized household survey data for a broad range of applications that integrate surveys with other data sources.[27] As such, further research should be conducted on the

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[22] Statistics Canada, 2014. Note to Users of Data from the 2012 Canadian Income Survey. Available at https://www150.statcan.gc.ca/n1/pub/75-513-x/75-513-x2014001-eng.htm.

[23] Administrative data are often not collected for statistics purposes. As such, their concepts and definitions can be different vis-à-vis household surveys. For instance, to integrate livestock registry data from the Ministry of Health Decree with its sample survey on livestock, the Italian National Statistical Institute (ISTAT) has carried out extensive assessment and testing on reconciling concepts - units of data and classifications are different between the two sources, and the coverage and updating frequency of the register were also issues that were considered carefully.

[24] Yeh, C., Perez, A., Driscoll, A., Azzari, G., Tang, Z., Lobell, D. B., Ermon, S., and Burke, M. (2020). "Using Publicly Available Satellite Imagery and Deep Learning to Understand Economic Well-Being in Africa." *Nature Communications*, 11, 2583.

[25] Burke, M., Driscoll, A., Lobell, D. B., and Ermon, S. (2021). "Using Satellite Imagery to Understand and Promote Sustainable Development." *Science*, 371, 6536, eabe8628.

[26] Burke, M. and Lobell, D. B. (2017). "Satellite-Based Assessment of Yield Variation and its Determinants in Smallholder African Systems." *Proceedings of the National Academy of Sciences*, 114.9, pp. 2189– 94.

[27] There is an expanding body of empirical evidence to help fill this knowledge gap. For instance, the research shows that the integration of spatially anonymized household surveys with publicly available geospatial datasets on rainfall and temperature have limited to no impact on the estimation of the relationships between climate outcomes and smallholder agricultural productivity. For more information, please consult Michler, J. D., Josephson, A., Kilic, T., and Murray, S. (202 1). "Estimating the Impact of Weather on Agriculture." World Bank Policy Research Working Paper No. 9867.

downstream impacts of spatially anonymization in public use datasets, such that data users would be aware of potential biases in their work, if any.

22. At the same time, there are already known applications of data integration in which the use of spatially anonymized household surveys is not an option. For instance, the available research on integration of household surveys with satellite imagery and processed geospatial data for high spatial and temporal resolution estimates of agricultural outcomes, such as crop-specific measures of area under cultivation, production and yield, emphasize the collection of precise GPS-based plot outlines[28] and a range of complimentary data collected on the ground through objective measurement approaches, such as crop cutting, implemented at scale (i.e. across the entire survey sample) or on a sub-sample basis.[29,30]

23. On the whole, the use of georeferencing household and community locations and creating spatially anonymized public use datasets should accelerate, and this will in turn facilitate cutting-edge research activities in which household surveys play a central model validation and calibration role. In parallel, survey practitioners should also (a) adopt more intensive survey methods (e.g., capturing GPS-based plot outlines and implementing crop cutting for objective crop yield measurement) to enable specific data integration applications that their surveys are asked to inform, and (b) increase secure access to confidential GPS locations that are not included in public use datasets. The discussion on secure survey microdata dissemination is further covered in *2.8 Improving data access, discoverability, and* dissemination.

24. Finally, including common questions in national household surveys and citizen-generated data (CGD)[31] or other types of collection efforts allow survey data to validate and calibrate the insights generated by CGD and other types of non-probabilistic data. Relevant paradata could also be helpful in calibration to correct the selection biases and measurement errors generated from CGD.[32,33] Well-designed and high-quality surveys have been successfully used to correct biases from non-probabilistic survey data in several countries.[34,35] However as the types of CGD vary greatly from each other, a better understanding and testing are needed on what could be a good set of auxiliary variables and what calibration methods to use for different CGD type.

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[28] Azzari, G., Jain, S., Jeffries, G., Kilic, T., and Murray, S. (2021). "Understanding the Requirements for Surveys to Support Satellite-Based Crop Type Mapping: Evidence from Sub-Saharan Africa." *Remote Sensing*, 13.23, 4749.

[29] Lobell, D. B., Azzari, G., Burke, M., Gourlay, S., Jin, Z., Kilic, T., and Murray, S. (2019). "Eyes in the Sky, Boots on the Ground: Assessing Satellite- and Ground-Based Approaches to Crop Yield Measurement and Analysis." *American Journal of Agricultural Economics*, 102.1, pp. 202-219.

[30] Lobell, D. B., Di Tommaso, S, You, C., Yacoubou Djima, I., Burke, M., and Kilic, T. (2020). "Sight for Sorghums: Comparisons of Satellite- and Ground-Based Sorghum Yield Estimates in Mali." *Remote Sensing*, 12.1, 100.

[31] There is no international-agreed definition on citizen-generated data. CGD has been referred to as "a problem-focused type of data that can take many forms, often framed around people collaborating to collect data they need to understand and tackle a problem that affects them" (https://www.data4sdgs.org/initiatives/citizen-generated-data-task-team) or as "data produced by non-state actors under the active consent of citizens to tackle social issues explicitly" (https://paris21.org/cgd). Common types of CGD may include crowdsourcing data (e.g., from a non-probabilistic web survey), community-driven data, data collected by civil society organisations, and sometimes even social media data.

[32] Pew Research Center, May 2016. Evaluating Online Nonprobability Surveys.

[33] Meng, X.-L. (2018). Statistical paradises and paradoxes in big data (I): Law of large populations, big data paradox, and the 2016 US presidential election. Annals of Applied Statistics

[34] Pew Research Center, January, 2018. For Weighting Online Opt-In Samples, What Matters Most?

[35] Beaumont, J.-F. (2020). Are probability surveys bound to disappear for the production of official statistics?. *Survey Methodology*, Statistics Canada, Catalogue No. 12-001-X, Vol. 46, No. 1. Paper available at http://www.statcan.gc.ca/pub/12-001-x/2020001/article/00001-eng.htm.

25. From an institutional perspective, in countries that are organizing a large number of surveys, there is a movement away from a domain-oriented approach to a process-oriented approach to survey data production. Under the domain-oriented approach, an independent team is in charge of the entire process of survey operations, from planning, collection, processing to dissemination, for a specific survey (e.g., labor force surveys, living standards surveys, health surveys, etc.). On the other hand, the process-oriented approach establishes units that are in charge of different steps of survey operations, regardless of the type of surveys. For example, one unit would be in charge of methodology and sampling, another unit would be in charge of data collection, and so on.

26. The process-oriented approach has been adopted by a number of countries currently working with the ISWGHS on survey coordination, including Canada, Costa Rica, and Ireland.[36] The advantage of this approach is that different sub-processes of household survey operations are coordinated and standardized. For example, the questionnaire design unit ensures that the same definitions and classifications are used for the same variable across surveys. Such an approach improves coordination and standardization across surveys, while also making the surveys more interoperable and efficient. However, for countries running limited numbers of surveys, the resulting gains in efficiency are unclear. More information about this approach is covered in *3.1.b. Modernize national statistical system.*

b. Establish a total quality framework for data integration

27. Although the "total survey error" (TSE) framework identifies each source of error for household surveys,[37] other data sources come with their own quality issues including potential biases and measurement errors for which a similar total error framework is usually absent, except perhaps in the case of administrative data used for statistical purposes.[38] More work is needed to quantify the errors associated with other data sources such as earth observation data and CGD, as well as the errors produced during the integration process.[39,40,41] For planning any types of data integration, quality assessment of all input data (surveys and other data sources) should be carried out, in terms of coverage (are certain population groups under-represented?), timeliness (how often is the data available?) and measurement errors (are data accurate?).

28. Data integration methods, including record linkage and model-based estimates, will also come with errors including data linkage error or, for model-based estimates, errors due to the violation of assumptions or poor input data. For model-based estimates, validating model assumptions is an unavoidable step that requires additional time and resources. Estimating the mean square error of estimators is another important aspect that should be further researched and developed. A further aspect of concern can be the match or otherwise between the target variable and the phenomenon captured by the administrative data source, something which should be adequately assessed and transparently reported as a key element of data quality.

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36 Work carried out under the ISWGHS task force on Developing Recommendations on a Comprehensive National Household Survey Programme. Terms of reference for the task force is available at https://unstats.un.org/iswghs/task-forces/documents/ISWGHS-TF-comprehensive-survey-programme-ToR-v3.pdf. More information will be made available once the country report is available.

37 Groves et. al. (2009). *Survey Methodology*, 2nd Edition. John Wiley and Sons.

38 Wallgren, A. and Wallgren, B. (2007). Register-based statistics: administrative data for statistical purposes. Hoboken, NJ: Wiley.

39 Beaumont, J.-F. (2020). Are probability surveys bound to disappear for the production of official statistics?. *Survey Methodology*, Statistics Canada, Catalogue No. 12-001-X, Vol. 46, No. 1. Paper available at http://www.statcan.gc.ca/pub/12-001-x/2020001/article/00001-eng.htm.

40 Eric Rancourt (2019). Admin-First as a Statistical Paradigm for Canadian Official Statistics: Meaning, Challenges and Opportunities. Proceedings of Statistics Canada Symposium 2018.

41 Hill et. al. (2021). Big data meets survey science: a collection of innovative methods.

Therefore, a data quality framework for integrating surveys with other data sources needs to be systematically developed.

c. Maintain high ethical standards and data confidentiality

29. Data integration increases the risk of data breaches and misuse. Conversely, limited access of certain data sources can hamper data integration. In the first instance there can be important barriers to access by NSOs often related to data protection concerns and strong legal frameworks and institutional arrangements are required to enable access under appropriate conditions. Furthermore, in generating public use datasets, personal identifiers (that allow linkages with administrative records) or precise GPS coordinates (that enable integration with satellite imagery and other georeferenced and processed geospatial data) are considered confidential and are excluded (in the case of the former) or anonymized (in the case of the latter).

30. While international standards and analytical tools are available for the deidentification of household survey data,[42] the risk of disclosure is increasing with enhancements in data interoperability, requiring continued improvement of deidentification techniques and strengthening of NSO capacity to successfully adopt these standards and analytical tools.[43] NSOs should invest in both the creation of anonymized public use datasets, including spatially anonymized GPS coordinates, as well as the creation of (a) *scientific use datasets* (e.g., datasets that are accessed subject to data licensing and non-disclosure agreements and that only include a limited number of processed/constructed variables, without household or personal identifiers that are included in public use datasets, but with georeferenced information that are typically excluded from public use datasets and that enable precise integration with satellite imagery) and (b) *offline data enclaves* that facilitate access to confidential survey data necessary for specific applications of data integration with high development value.

31. Another important aspect to consider is related to ethics and respondents' right to be informed about the use of their own data, including data integration. For example, when Statistics Canada replaced income survey questions with data from tax records, respondents were informed about this practice during the interview. Addressing respondents' concerns over the use and protection of their data and the potential benefit of collecting those data is an important issue for consideration.[44] In Zambia, for instance, one needs an ethical clearance for data collection, which involves a signed or thumb printed consent form by respondents to show that they understood what the survey is about, how the data will be used for and their rights during the interview.

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[42] Links to various guidelines are available at International Household Survey Network: http://www.ihsn.org/anonymization

[43] Inter-Secretariat Working Group on Household Surveys, 2021. Spatial Anonymization, available at https://unstats.un.org/iswghs/task-forces/documents/Spatial_Anonymization_Report_submit01272021_ISWGHS.pdf

[44] Hurst, B. (2015) Big data and Agriculture: Innovation and Implications. Statement of the American Farm Bureau Federation to the House Committee on Agriculture.

2.2. Designing and implementing more inclusive, respondent-centric surveys

32. A major challenge for face-to-face household surveys today is declining unit and item response rates, correlated with increasing urbanization and income levels[45,46,47] and most recently with social distancing measures that are brought on by the COVID-19 pandemic. As is well known, non-response rates have been traditionally higher in high-income contexts – certainly in the context of face-to-face surveys and even more so in the case of phone surveys[48].

33. The reliance on proxy respondents, which has been adopted widely in large-scale survey operations that collect data on individuals, is a related area of concern and a convenient design feature that hedges against the risk of otherwise missing information that should ideally be reported by household members themselves.[49],[50] Recent research has highlighted the biases associated with proxy reporting, minimization of which would undoubtedly enable data producers to more accurately capture the livelihoods, experiences and behaviors of individuals.[51,52,53]

34. Below, we highlight various approaches for mitigating against nonresponse and minimizing the use of proxy respondents and improving the availability and quality of individual-disaggregated survey data, including on marginalized populations.

a. Transform respondents into collaborators and co-producers

35. Transforming respondents to collaborators and co-producers is a requisite for combating nonresponse, which requires rethinking the relationship between NSOs and survey respondents to build public trust. This runs the gamut from designing surveys that are clear and simple, to being responsive to

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45 Declining response rate was documented since 1990s in the United States. National Research Council 2013. *Nonresponse in Social Science Surveys: A Research Agenda*. Washington, DC: The National Academies Press. https://doi.org/10.17226/18293.

46 Declining response rate was also observed in 16 countries and 10 different surveys documented in De Leeuw, Edith, and Wim de Heer. 2002. Trends in Households Survey Nonresponse: A Longitudinal and International Comparison. In Survey Nonresponse, edited by Robert M. Groves, Don A. Dillman, John Eltinge, and Roderick J.A. Little. Wiley.

47 Item imputation rate gradually increased during the period 1990-2013 for survey questions on receipt of transfer income in the US Current Population Survey and the Survey of Income and Program Participation. Meyer, Mok and Sullivan, *Household Surveys in Crisis*, Journal of Economic Perspectives, Volume 29, Number 4, Fall 2015, pages 199-226. Similar trends were documented for the American Community Survey, the Consumer Expenditure Survey and the Panel Study of Income Dynamics, Meyer, Bruce D., Wallace K. C. Mok, and James X. Sullivan. 2015. *The Under-Reporting of Transfers in Household Surveys: Its Nature and Consequence*s. NBER Working Paper 15181. Updated version June 2015.

48 One exception is the phone surveys that have been implemented during the COVID-19 pandemic in low-income contexts and that have used face-to-face household surveys as sampling frames have exhibited significantly lower rates of non-response. See Gourlay S, Kilic T, Martuscelli A, Wollburg P, Zezza A. (2021). "High-Frequency Phone Surveys on COVID-19: Good Practices, Open Questions." *Food Policy*, 105, 102153.

49 United Nations. (2019). Guidelines for Producing Statistics on Asset Ownership from a Gender Perspective. Retrieved from https://unstats.un.org/edge/publications/docs/Guidelines_final.pdf.

50 Hasanbasri, A., Kilic, T., Koolwal, G., and Moylan, H. (2021). "LSMS+ Program: Overview and Recommendations for Improving Individual-Disaggregated Data on Asset Ownership and Labor." World Bank: Washington, DC. Retrieved from https://documents1.worldbank.org/curated/en/539311620191657449/pdf/LSMS-Program-Overview-and-Recommendations-for-Improving-Individual-Disaggregated-Data-on-Asset-Owne)rship-and-Labor-Outcomes.pdf

51 Kilic, T., Moylan, H., and Koolwal, G. (2021). "Getting the (Gender-Disaggregated) Lay of the Land: Impact of Survey Respondent Selection on Measuring Land Ownership and Rights." *World Development*, 146, 105545.

52 Deininger, K., Xia, F., Kilic, T., and Moylan H. (2021). "Investment Impacts of Gendered Land Rights in Customary Tenure Systems: Substantive and Methodological Insights from Malawi." *World Development*, 147, 105654.

53 Kilic, T., Van den Broeck, G., Koolwal, G., and Moylan, H. (2020). "Are You Being Asked? Impacts of Respondent Selection on Measuring Employment." World Bank Policy Research Working Paper No. 9152.

problems, concerns, and questions, to making surveys more inclusive by bringing respondents with diverse needs and abilities into the survey research and development process.[54,55,56] Asking direct questions about response burden can also help survey implementers better understand and reduce nonresponse.[57] On the whole, the extent and drivers of non-response are expected to vary across and within countries (both across topics and geographic area) - though, the related cross-country empirical evidence is not immediately available. As such, the issue needs to be studied in each context and various solutions should be adapted and piloted accordingly.

36. For example, the Australia Bureau of Statistics (ABS) worked with behavioral economists and communications specialists to make their survey easier for respondents to understand.[58] Contact materials and survey materials were developed and tested to ensure that they were direct and communicated the survey purpose clearly, and straightforward instructions were provided. Additionally, the survey was designed to be responsive to concerns of the public, namely with regards to privacy. Privacy and legal specialists were embedded in the data collection project to provide ongoing support, and an external prominent privacy expert was also engaged in an independent review and issued a public statement of assurance. Other efforts to reduce nonresponse taken by ABS included targeted campaigns and crisis management plans, leading ultimately to a response rate of nearly 80%.

37. Another area in which the surveys can be more "respondent-centric" is regarding the sharing of survey findings with the public at-large and surveyed communities/respondents in particular. Just as there are numerous examples of pre-fieldwork efforts to announce and promote participation in large-scale household surveys, through print media, TV and radio programming, and social media, similar approaches should be pursued in the dissemination of survey findings. Conditional on resource availability, these efforts can also be targeted specifically at surveyed respondents/communities through revisits and/or SMS-based outreach efforts, where possible (conditional on respondent consent at the time of data collection).

b. Minimize the reliance on proxy respondents to improve quality of data on individuals

38. The targeting and evaluation of policies to provide social protection for raising living standards and mitigating against shocks; promote access to and ownership of physical and financial assets; and remove barriers to technology adoption, to name a few, require on high-quality individual-disaggregated data that accurately reflect the economic and social roles and choices of men and women. Similarly, a clearer picture of the intra-household distribution of labor — across sectors, wage- or self-employment activities, and unpaid care and domestic work — can better inform targeting of employment and training programs. Relatedly, monitoring progress towards several targets of the SDGs across poverty reduction, agriculture, gender, employment, and inequality, require individual-disaggregated data on asset ownership, labor, time use, and roles in family enterprises.

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54 Palmer and Stathis, 2019. Learning from the 2016 Australian Census and ensuring effective issues management during ABS' most challenging sensitive and divisive data collection. Australian Bureau of Statistics.
55 Groves and Couper, 1998. Nonresponse in Household Interview Surveys.
56 Wilson and Dickinson, 2021. Respondent Centred Surveys: Stop, Listen, and then Design.
57 Young, 2019. Assessing how a household survey is perceived by respondents. U.S. Bureau of Labor Statistics Office of Survey Methods Research. Available at https://www.bls.gov/osmr/research-papers/2019/pdf/st190130.pdf The US Consumer Expenditure Survey introduced a set of response burden questions at the end of the last wave of interview. Such data can be analyzed together with data collected from surveys to allow a better understanding of respondent burden and its relationship to response bias.
58 These included changes to the approach envelope for the survey, the letter, survey form, paid reply envelope, and materials for specific audiences such as eligible overseas Australians and silent electors.

39. One of the promising sources of individual-disaggregated data to analyze these issues and their interactions are household surveys. However, their reliability and usability is mediated by questionnaire design choices and respondent selection protocols. Regarding the latter, it is common for individual-level household survey modules to allow for proxy respondents to report on behalf of adult household members – a measure that cuts costs and seemingly avoid missing information. On other topics, such as asset ownership, it has been common for household surveys to either collect information at the household-level (even when assets are owned by individuals) or identify intra-household asset owners but elicit information from a single, "most knowledgeable" household member.

40. Momentum has been increasing to increase the availability, scope and quality of individual-disaggregated survey data collected in household surveys on a range of topics including asset ownership, work and employment, time use, and violence against women. Through the formulation of international guidelines on these topics, with a focus on improved approaches to questionnaire design and respondent selection; the efforts to promote their adoption in large-scale surveys; and the research that has demonstrated the utility of intra-household, self-reported survey data vis-à-vis data that are collected based on sub-optimal respondent selection protocols, the countries have an expanding base of knowledge and experiences to draw from in minimizing the reliance on proxy respondents to improve the quality of data on individuals.

41. Moving forward, there is a need for NSOs to be more systematic in tracking the reliance on proxy respondents in their survey operations; to be critical about their fieldwork implementation protocols vis-à-vis existing international guidance; to draw on documented experiences in improving their approach to interview scheduling with adult household members and minimizing the reliance on proxy respondents; and to be supported, particularly in lower-income contexts, in the adoption of best practices. Getting better individual-disaggregated survey data may require additional financial resources, mainly to allow additional time for interviewers to schedule and conduct private interviews, as such the approach to costing household surveys and securing the required financial resources may also be revisited.

c. Improve the correction of nonresponse bias

42. While calibration and imputation have been widely used by survey organizers to reduce nonresponse bias, two additional approaches could result in its further reduction. The first is to invest in high-quality benchmarking data sources, that is, high quality data sources (in terms of measurement and representation errors) with auxiliary variables that have prediction power for the outcome indicators.[59] The second is to enhance the collection and use of paradata during electronic data collection, as discussed in section 2.6. *Systematizing the collection, storage, and use of paradata and metadata.* Survey Solutions, for instance, is an example of a CAPI/CATI platform that automatically collects and allows the users to download the paradata associated with each survey. While the type of paradata available for nonresponse bias correction varies by mode of data collection, in general, three types of paradata can be used for this purpose: (1) call history data, containing information on interview attempts and outcome of each attempt, (2) interviewer observations of the sample units, and (3) measures of the interviewer-household interaction.[60]

[59] The American Community Survey data have been used as an excellent benchmarking tool for many small surveys carried out in the United States. The survey is large, interviewing around 2.1-2.3 million housing units and covering a wide range of variables. Franco and Bell, 2021. Using American Community Survey Data to improve estimates.

[60] Kreuter, F., 2013. Improving Surveys with Paradata: Analytic Uses of Process Information. John Wiley & Sons.

2.3. Improving sampling efficiency and coverage

43. Continuous improvements to sampling frames and adoption of innovative sampling techniques are required to improve sampling efficiency and coverage in household surveys. A proper sampling frame covers all target populations in the country, is accurate and up to date, and provides adequate contact information for survey organizers to approach respondents through different survey modes as needed. This is particularly relevant for COVID-19 fieldwork protocols and the need to reduce travel footprint in the post-pandemic era. The importance of necessary auxiliary variables to facilitate efficient sampling should also be emphasized. Proper sampling approaches reach the target population with the required precision while also meeting budget requirements.

a. Improve sampling frames for household surveys

44. The most common sampling frame comes from population censuses, through the area frame that contains hierarchical geographical areas from the largest area (at the national level) to the smallest geographic division, usually called enumeration areas (EAs) and a list frame that contains the list of households located within each EA. Efforts should be made to ensure census records are geospatially enabled, i.e., geocoded to a specific location[61] – this can facilitate selecting samples for household surveys as well as data integration (as discussed in *2.1.Enhancing the interoperability and integration of household* surveys). In a 2019 survey carried out by the UN Statistics Division of 158 countries, 86 per cent indicated that they have or will collect, as part of the 2020 round of censuses, GPS coordinates for enumeration areas and 70 per cent for buildings and housing units.[62]

45. Address-based sampling frame started to gain its ground in high income countries given its efficiency and quality. The addresses are usually obtained from a commercial vendor and updated regularly. Important auxiliary variables are also available to help improve sampling efficiency. In the United States, Address-based sampling frame is built on addresses provided by United States Postal Service. Contact information for face-to-face, telephone or web surveys can be acquired from vendors.[63] For countries that do not have resources or capacity to maintain a comprehensive list of addresses, a master sample frame have been used. With a master sample frame address list is updated only for selected enumeration areas. The master sample frame in Brazil, for example, has been used by all household surveys. The frame allows sharing cost of listings and a better knowledge of the selected areas and provides opportunities for richer data analysis.[64]

46. For the 2020 round of censuses, many countries plan to use telephones to follow up with respondents to address missing values and nonresponses.[65] For countries without a good telephone frame for phone surveys, phone numbers collected during censuses (or surveys, as discussed in section 2.5) can

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[61] United Nations, 2019. The Global Statistical Geospatial Framework.

[62] United Nations Statistical Commission, 2020. 51st session, item 3(j), background document. Report on the Results of the UNSD Survey on 2020 round population and housing censuses. Available at https://unstats.un.org/unsd/statcom/51st-session/documents/BG-Item3j-Survey-E.pdf

[63] American Association for Public Opinion Research, 2016. Address-based Sampling. Available at https://www.aapor.org/Education-Resources/Reports/Address-based-Sampling.aspx#1.2%20What%20is%20Address-based%20Sampling?

[64] Quintslr and Hypólito, 2009. Development of an Integrated System of Household Surveys: The Brazilian Experience.

[65] United Nations Statistical Commission, 2020. 51st session, item 3(j), background document. Report on the Results of the UNSD Survey on 2020 round population and housing censuses. Available at https://unstats.un.org/unsd/statcom/51st-session/documents/BG-Item3j-Survey-E.pdf

be used for subsequent surveys. However, this requires the following of strict protocols and consent from respondents. More information about obtaining consent is available in section *2.5.*

47. *Improving capacity for CAPI, phone, web and mixed-mode* surveys.

48. When a survey aims to sample hard-to-reach populations, the use of multi-frame sampling can improve the cost efficiency of the overall survey. For example, an epidemiology survey could use an area frame for a general population health survey alongside another list frame of clinics specializing in a certain disease. This method allows for capturing data from a higher number of populations with this specific disease, while reducing the cost of screening to be carried out in the area frame.[66] Multi-frame sampling can also be helpful in post-disaster settings when many respondents are displaced. For example, sampling school districts was found to be an efficient method for reaching families who relocated in the aftermath of Hurricane Katrina.[67]

49. For countries that lack census records for EA selection or have outdated census frame, high-resolution satellite data can be used to generate estimated population densities and demarcate EA boundaries.[68] For example, the last population census in Somalia was carried out in 1975 with a population count of 3.9 million. Given significant increases in population size (an estimated 15 million in 2019) and high levels of displacement within the country, a gridded population approach was developed to create a frame for the first selection stage of the 2017 Somalia Rapid Emergency Response Survey. Geographical areas of Somalia were divided into 100 by 100-meter grid cells and neighboring cells were combined to form primary sampling units (PSUs).[69, 70] A sample of PSUs was then selected using probability proportional to estimated size, with the population figure obtained from WorldPop.[71] Relatedly, geospatial data can also help build equal size EAs for better management of field work and improve efficiency of sampling.[72]

b. Adopt innovative sampling methods for difficult-to-sample population groups

50. Under the leave-no-one-behind pledge, surveys are required to cover various vulnerable population groups, of which many are difficult to sample due to various challenges. These include difficulties in identifying certain populations due to stigma and sensitivity, in locating and accessing certain population groups that are small in percentage or dispersed, and in persuading populations to be interviewed. The need for self-reported (as oppose to proxy-response) data at individual level, crucial for study from a gender perspective, is also a challenge in household surveys.

51. There are many ways to improve the coverage of samples of certain population groups. For rare populations such as ethnic minority, over-sampling areas that have more concentrated minority groups can

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[66] Kalton, G., and Anderson, D.W. (1986). Sampling rare populations. Journal of the Royal Statistical Society, Series A, 149, 65-82.
[67] Ausbrooks et al., 2009. Ethical issues in disaster research: lessons from Hurricane Katrina. Population Research and Policy Review, 28, 93-106. Doi: 10.1007/S11113-008-9112-7.
[68] Stephanie Eckman and Kristen Himelein, Chapter 7. Methods of Geo-Spatial Sampling, from Hoogeveen and Pape, 2020, Data Collection in Fragile States – Innovations from Africa and Beyond, available at https://link.springer.com/content/pdf/10.1007%2F978-3-030-25120-8.pdf
[69] Using a quadtree algorithm, which combines cells to meet specified criteria, in this case, area and population size. See Samet (1984), for a description of the methodology, and Minasny et al. (2007), for an application of the methodology to sample design.
[70] Qader, S.H., Lefebvre, V., Tatem, A.J. et al. Using gridded population and quadtree sampling units to support survey sample design in low-income settings. Int J Health Geogr 19, 10 (2020). https://doi.org/10.1186/s12942-020-00205-5
[71] https://www.worldpop.org/
[72] French National Institute of Statistics and Economic Studies. *Handbook of Spatial Analysis*, 2018.

improve sample coverage and reduce costs for expensive screening. Guidance on sampling vulnerable population groups is currently being compiled by the ISWGHS through a Wiki site.[73]

52. Network sampling uses an expanded sample screening process so that information is also obtained from others outside of the household, such as neighbors, relatives, and other connected individuals. This can maximize coverage when collecting data on rare events or sensitive topics. A network survival method, generated from the traditional sibling survival method, was proposed to estimate adult mortality in household surveys. As adult mortality is a rare event, the network survival method was able to generate far more information on adult mortality through a regular household survey than the traditional sibling survival method.[74] Network sampling is also recommended by UNODC for surveys with a focus on population groups that are marginalized and face social stigma, such as those using drugs.[75] Another interesting example is using machine learning models to predict ethnicity and help with more targeted sampling as covered in *2.7. Expanding capacity for machine learning and artificial intelligence*.

c. Apply responsive and adaptive sampling design

53. An evidence-based approach for guiding real-time design decisions during survey data collection, responsive and adaptive sampling design takes advantage of advances in electronic data collection such as the availability of geospatial information and paradata. One experiment conducted as part of the 2009 Swedish living conditions survey explored various adaptive survey design strategies, such as terminating data collection as soon as the response rate reaches a certain threshold. The results showed that the design reduced the data collection cost through significantly fewer call attempts.[76] Another example comes from Nigeria, where a population-based HIV survey adopted a responsive survey design that used paradata to expedite the survey data collection and release.[77] The overall data collection duration was reduced by 1 week from the original plan and saved about $4.4 million in costs.

2.4. Scaling up the use of objective measurement methods

54. Household survey data may include measurement errors driven by a range of factors, including recall bias, strategic misreporting, confirmation bias, social desirability bias, and self-esteem bias, among others.[78] To the extent that measurement errors are systematic and non-classical in nature, the findings and policy recommendations of household survey data analyses will be biased.

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73 Will be publicly available this year once it is finalized. The guidance covers guidance on sampling a number of population groups such as the poor, women and men, children and older persons, ethnic minority, geographical location, migrants and IDPs, persons with disabilities, prisoners, drug users, and LGBT.

74 Feehan et. al., 2017. The network survival method for estimating adult mortality: evidence from a survey experiment in Rwanda. Demography (2017) 54: 1503-1528. DOI 10.1007/s13524-017-0594-y

75 Me, 2020. Collecting data on sensitive topics and on rare events through surveys, presentation during the UN Statistical Commission Friday Seminar: Household Surveys in a Changing Data Landscape

76 Lundquist and Sarndal, *Responsive and adaptive design in the Swedish Living condition survey*, 2013, Journal of Official Statistics, Vol. 29, No. 4, 2013, pp. 557-582.

77 Jahun et al., 2021. Lessons from rapid field implementation of an HIV population-based survey in Nigeria, 2019. JAIDS Journal of Acquired Immune Deficiency Syndromes 87 (Suppl 1): S36-S42. DOI:10.1097/QAI.0000000000002709

78 Abay, K., Barrett, C., Kilic, T., Moylan, H, Ilukor, J. and Vundru Drazi, W. (2022). "Nonclassical Measurement Error and Farmers' Response to Information Reveal Behavioral Anomalies." World Bank Policy Research Working Paper.

55. Methodological survey research to develop and validate improved methods for survey data collection has surged over last decade, particularly in low- and middle-income contexts. The expansion in research has been motivated by not only long-standing concerns around measurement errors in self-reported survey data but also increasing availability of scalable technologies and methods that allow for addressing these measurement errors through direct measurement.

56. Research has demonstrated the extent and econometric implications of non-classical measurement errors in self-reported survey data on a range of topics, while also documenting the accuracy, feasibility, and cost implications of adopting direct measurement tools, such as GPS technology for plot area measurement and outline capture,[79,80,81,82] crop cutting for crop yield estimation,[83,84,85,86] high-frequency phone survey data collection for measuring household agricultural labor inputs,[87,88] DNA fingerprinting for crop variety identification, [89 , 90] physical activity trackers (i.e. accelerometers) for informing the measurement and analysis of labor productivity, effort, and poverty,[91,92,93,94] smartphone applications for time use measurement, recording social interactions between respondents and interviewers, or real-time

79 Carletto, G., Gourlay, S., Murray, S., Zezza, A., 2017. Cheaper, faster, and more than good enough: is GPS the new gold standard in land area measurement? *Survey Research Methods* 11(3), 235-265.

80 Carletto, C., Gourlay, S., Winters, P., 2015. From guesstimates to GPStimates: land area measurement and implications for agricultural analysis. *Journal of African Economies* 24(5), 593–628.

81 Carletto, C., Savastano, S., Zezza A., 2013. Fact or Artefact: The Impact of Measurement Errors on the Farm Size–Productivity Relationship. *Journal of Development Economics*, 103: 254–61.

82 Kilic, T., Zezza, A., Carletto, C., Savastano, S., 2017. Missing (ness) in action: selectivity bias in GPS-based land area measurements. *World Development*, *92:*143-157.

83 Desiere, S., Jolliffe, D., 2018. Land productivity and plot size: Is measurement error driving the inverse relationship? *Journal of Development Economics* 130(1): 84-98.

84 Gourlay, S., Kilic, T., Lobell, D., 2019. A new spin on an old debate: Errors in farmer-reported production and their implications for inverse scale-productivity relationship in Uganda. *Journal of Development Economics*, 141, 102376.

85 Abay, K. A., Abate, G. A., Barrett, C.B., Bernard, T., 2019. Correlated Non-Classical Measurement Errors and 'Second Best' Policy Inference: The Case of The Inverse Size-Productivity Relationship in Agriculture. *Journal of Development Economics* 139, 171-184.

86 Yacoubou Djima, I. and Kilic, T. (2021). "Survey Measurement Errors and the Assessment of the Relationship between Yields and Inputs in Smallholder Farming Systems: Evidence from Mali."

87 Arthi, V., Beegle, K., De Weerdt, J., Palacios-López, A., 2018. Not your average job: measuring farm labor in Tanzania. *Journal of Development Economics* 130, 160-172.

88 Gaddis, I., Oseni, G., Palacios-Lopez, A., and Pieters, J. (2021). "Measuring Farm Labor: Survey Experimental Evidence from Ghana." *World Bank Economic Review*, 35.3, pp. 604-634.

89 Kosmowski, F., Aragaw, A., Kilian, A., Ambel, A., Ilukor, J., Yigezu, B., Stevenson, J. 2019. Varietal identification in household surveys: results from three household-based methods against the benchmark of DNA fingerprinting in Southern Ethiopia. *Experimental Agriculture*, 55(3): pp. 371-385.

90 Hodson et al. 2020. "Ethiopia's transforming wheat landscape: tracking variety use through DNA fingerprinting." *Scientific Reports*, 10, 18532.

91 Akogun, O., A. Dillon, J. Friedman, A. Prasann, P. Serneels (2020) "Productivity and Health: Physical Activity as a Measure of Effort", The World Bank Economic Review, lhaa011, https://doi.org/10.1093/wber/lhaa011

92 Friedman, J., Gaddis, I., Kilic, T., Martuscelli, A., Palacios-Lopez, A., and Zezza, A. (2021). "The Distribution of Effort: Physical Activity, Gender Roles, and Bargaining Power in an Agrarian Setting." World Bank Policy Research Working Paper No. 9634.

93 Picchioni et al. (2020). "Gender, Time-Use and Energy Expenditures in Rural Communities in India and Nepal." *World Development*, 136, 105137.

94 Srinivasan et al. (2020). "Drudgery Reduction, Physical Activity and Energy Requirements in Rural Livelihoods." *Economics and Human Biology*, 37: 100846.

travel patterns,[95,96,97,98,99] low-cost testing kits for the rapid measurement of water quality,[100] and "webscraping" for automating the collection of prices for selected internet retailers, as opposed to relying exclusively on survey operations for the Consumer Price Index (CPI).[101]

57. On the whole, direct measurement has been documented to increase the accuracy and scope of survey data collection while also reducing respondent burden, depending on the application. Before scaling up the use of objective measures in household surveys, experiments need to be carried out to enable the investigation of different types of bias, measurement errors, and privacy concerns that may be inherent in direct measurement tools (more discussion on experimental statistics is available in *3.1.f. Foster a programme of experimental statistics*).[102,103] And it should be noted that direct measurement, as exemplified in this section, will not apply to all topics that are covered in household surveys.

58. Finally, direct measurement may increase data collection costs in terms of procuring handheld GPS devices, accelerometers, smartphones, or testing kits, or in terms of additional time spent in the field by interviewers. However, the marginal cost will vary according to the direct measurement method in question (for example, procuring a handheld GPS device for each interviewer, or scheduling an additional visit to each household). If the cost of adopting direct measurement is prohibitive at full scale (that is, across all enumeration areas and households), it can be limited to a subsample. A within-survey imputation approach can then be pursued, if needed – depending on the objective, to derive imputed direct estimates for the portion of the sample not subject to direct measurement.

2.5. Improving capacity for CAPI, phone, web and mixed-mode surveys

59. In the past decade, many countries have moved from paper-and-pencil interviewing (PAPI) to computer-assisted personal interviewing (CAPI) for their household survey data collection. While it represents a significant technological advancement to move from PAPI to CAPI, the halting of face-to-face surveys during the COVID-19 pandemic has revealed the need to build technical capacity and technological infrastructure for implementing phone, web, and mixed-mode surveys in many lower-income countries.

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95 Zanello, G., Srinivasan, S. and Nkegbe. P. (2017). "Piloting the Use of Accelerometry Devices to Capture Energy Expenditure in Agricultural and Rural Livelihoods: Protocols and Findings from Northern Ghana." *Development Engineering*, 2: 114-31.

96 Daum et al. (2019). "Time Have Changed: Using a Pictorial Smartphone App to Collect Time-Use Data in Rural Zambia." *Field Methods*, 31.1, pp. 3-22.

97 Sugie, N. F., 2018. Utilizing smartphones to study disadvantaged and hard-to-reach groups. Sociological Methods and Research, 47, 458-491.

98 Zegras et al. (2018). "Assessing the representativeness of a smartphone-based household travel survey in Dar es Salaam, Tanzania." *Transportation*, 45.3.

99 Statistics Netherlands, 2018. CBS experimenting with sensors.

100 Ambel, A. A., Mugera, H. K., and Bain, R. E. S. (2020). "Accounting for drinking water quality in measuring multidimensional poverty in Ethiopia." *PLOS ONE*, https://doi.org/10.1371/journal.pone.0243921

101 Statistics Canada, 2020. The Integration of Web-Scraped Data into the Clothing and Footwear Component of the Consumer Price Index. Available at https://www150.statcan.gc.ca/n1/pub/62f0014m/62f0014m2020003-eng.htm

102 The, Kempa-Liehr and Wang, 2020. Sensor data quality, a systematic review. Journal of Big Data, 7:11.

103 Kreuter et. al., 2019. Collecting survey and smartphone sensor data with an App: opportunities and challenges around privacy and informed consent. Social Science Computer Review 2020, Vol. 38(5): 533-549.

60. Mobile phone penetration rates and the use of internet are still quite low in lower-income contexts.[104] Furthermore, both phone and web surveys are more likely to significantly higher rates of nonresponse than surveys administered through face-to-face interviewing. Both would contribute to potential biases in the survey results. There are also some surveys, particularly sensitive ones, wherein behavioral cues are helpful and cannot be captured remotely. Given these facts, face-to-face interviewing will not be completely replaced by remote data collection in the near future. However, strengthening NSO capacity in remote data collection will be a key strategic step to ensure that phone and web surveys can be used together with their face-to-face counterparts, both to rapidly respond to data needs in the aftermath of shocks or under emergency situation for example in countries in conflict and to increase the frequency and timeliness of survey data collection.

a. Build sample frames for phone surveys

61. One of the biggest challenges for telephone interviewing faced by NSOs during COVID-19 was the lack of contact information available for use as a sampling frame.[105] In a compilation of national COVID-19 impact surveys maintained by ISWGHS, only 43 percent of approximately 180 countries used a recent household survey as a sampling frame for telephone interviews; the remaining countries lacked an updated sample frame with telephone numbers.[106] Countries that lacked contact details for reaching survey respondents during COVID-19 adopted various methods to obtain the phone numbers, such as obtaining phone numbers through mobile phone service operators, random digit dialing, or using administrative data sources like population and electoral registries. For example, Mongolia used its newly updated household-based registry, which contains one or more phone numbers, to reach respondents sampled in the 2020 MICS Plus.[107]

62. Countries that have long relied on computer-assisted telephone interviewing (CATI) and computer-assisted web interviewing (CAWI) for their official surveys can serve as models for maintaining an enabling survey infrastructure for remote data collection. A recent EU workshop on multi-mode data collection for labor force surveys[108] showed that the most common data collection mode for labor force surveys within the European Union was a combination of CAPI (mostly for the first round) and CATI (for following rounds). Contact information is obtained during the first round. For example, the labor force survey in Canada uses either in-person interviews or CATI (if the phone number is available from administrative files) for the first round, and CATI and CAWI for subsequent survey rounds. Only a few countries, unsurprisingly those with comprehensive registration systems, rely exclusively only on CATI and/or CAWI for data collection.

63. Relying on face-to-face household surveys as sampling frames for phone surveys implemented during the COVID-19 pandemic revealed the advantages of this approach in minimizing household-level

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104 Out of 88 countries and areas with data on mobile phone ownership (SDG indicator 5.b.1) since 2014, only 48 (55%) indicate that 80% or more of their population own a mobile phone. Only 1 out of 17 countries in sub-Saharan Africa with data for the indicator have mobile phone ownership at 80% or above. Data extracted in December 2020 from https://unstats.un.org/sdgs/unsdg. In 2019, 51% of the world population use internet, compared to18% in sub-Saharan Africa. Data available for SDG indicator 18.8.1, last extracted in December 2021 at https://unstats.un.org/sdgs/files/report/2021/secretary-general-sdg-report-2021--Statistical-Annex.pdf

105 ILO, 2021. Global review of impacts of the COVID-19 pandemic on labour force surveys and dissemination of labour market statistics. Available at wcms_821387.pdf (ilo.org)

106 Available at https://unstats.un.org/iswghs/task-forces/covid-19-and-household-surveys/COVID-19-impact-surveys/

107 UNICEF, 2021. Mongolia MICS Plus Survey Methodology. Available at https://mics.unicef.org/mics-plus/mics-plus-results.

108 Lucarelli, Carlo and Martino, Anna-Emilia, 2021. EU-LFS data collection state of play and perspectives. Labour Market Statistics (LAMAS) Working Group Workshop on multi-mode data collection.

coverage and nonresponse bias, albeit with limits.[109,110] Going forward, contact information for household members may be elicited in all future face-to-face surveys, which can in turn be used as sampling frames as well as to correct bias.[111] While longitudinal face-to-face surveys routinely collect this type of information to facilitate tracking efforts, cross-sectional surveys should also more systematically collect phone numbers. These efforts should be coupled with revisions to privacy and consent agreements with face-to-face household survey respondents, given the potential for the individuals to be contacted for other surveys down the line. Countries should also consider collaborating with private data providers such as mobile telecommunication or research institutes with experience of CATI to obtain access to data needed for building relevant sampling frames.

b. Develop phone and web survey tools and protocols

64. Strong phone and web survey infrastructure must be coupled with required survey tools and protocols. For example, phone questionnaires need to be significantly shorter and simpler given the challenges in keeping respondents engaged during remote data collection, issues with mobile network connectivity, and concerns about respondent fatigue. The flow of questions and visual cues for phone and web questionnaires also vary significantly from face-to-face questionnaires. Meanwhile, protocols should be established for respondent selection, incentive provision, phone and e-mail contact attempts to recruit respondents, proper consent and ethical requirement and the formulation of scripted introductions and transitions during the interviews. These will be critical for successful survey implementation, as well as to ensure the general representativeness of the data.

65. When adopting a mixed-mode survey design that includes CATI and CAWI as possible options, NSOs need to decide whether the choice of CATI versus CAWI would be offered initially or down the line. If the latter, NSOs will need to determine the initial survey mode and the number of days to be allowed before the second mode can be offered. Decisions must also be made on the number of reminders to the respondents and their frequency.[112] When moving towards a mixed-mode system, every decision should be tested and investments made to develop a survey management system that can support the complexity of mixed-mode data collection. A strong IT system to support the mixed-mode data system is also important.[113]

c. Conduct more systematic analysis of mode effects

66. Phone surveys and other data sources such as citizen-generated and social media data raise many concerns of quality, selectivity, and coverage, inter alia. Given increased reliance on phone and web surveys, users must understand the relative accuracy, reliability, and affordability of these surveys vis-à-vis their face-to-face counterparts, ideally through survey experiments that randomize the mode of interview for the same types of questions included in different surveys and questionnaire instruments. These experiments to discern potential survey mode effects can be conducted under the suggested program on survey methods

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109 Ambel, A., McGee, K., Tsegay, A., 2021. Reducing bias in phone survey samples: effectiveness of reweighting techniques using face-to-face surveys as frames in four African countries. World Bank Policy Research Working Paper No. 9676.

110 Brubaker, J., Kilic, T., and Wollburg, P. (2021). "Representativeness of individual-level data in COVID-19 phone surveys" Findings from Sub-Saharan Africa." *PLOS ONE*, https://doi.org/10.1371/journal.pone.0258877

111 Gourlay S, Kilic T, Martuscelli A, Wollburg P, Zezza A. (2021). "High-Frequency Phone Surveys on COVID-19: Good Practices, Open Questions." *Food Policy*, 105, 102153.

112 Eurostat, 2011. Labour Market Statistics (LAMAS) Working Group Workshop on multi-mode data collection. Country presentations.

113 Schouten, et. al., 2021. Mixed-mode official surveys: design and analysis. Boca Raton: Chapman and Hall/CRC.

discussed in *section 3.1.f. Foster a programme of experimental statistics*. However, it is understood that even with identical questions included in different surveys, face-to-face, phone versus web survey questionnaires will exhibit differences generally in terms of length and design choices, again as part of a respondent-centric implementation approach.

2.6. Systematizing the collection, storage, and use of paradata and metadata

67. As CAPI, CATI, and CAWI become common in survey data collection, increasing amounts of paradata are being collected as a byproduct of the data collection process, including keystroke records, eye-tracking, mouse-tracking, and GPS-tracking of interviewer location.[114] These paradata can be used for a variety of purposes, including (i) computing granular interview duration statistics for specific questions, modules, interviewers, and/or subpopulations, (ii) investigating question modification patterns and interviewer compliance with the intended flow of the questionnaire as part of broader survey quality control operations, (iii) tracking interviewer compliance with fieldwork plans and intended visits to sample enumeration area and household locations,[115] and (iv) studying respondent behavior and predicting participation in the next survey wave.[116] As paradata are a byproduct of a given data collection operation, the format, layout, and content of paradata are a function of the system that generated the data and may vary greatly from one form of data collection to another.[117]

68. The US Census Bureau uses the Performance and Data Analysis (PANDA) system, based on CAPI trace files, data files, and other case information, to assess data quality and capture falsified data.[118] At Statistics Canada, various analytical studies have been carried out around data collection and processes using paradata. For example, paradata showed that more attention should be paid on the time spent between the first contact with a household and completing the interview (or confirming a nonresponse), rather than focusing on the number of calls.[119] In Statistics Austria's recent experiment of including CAWI as one of the data collection modes for their labor force survey, paradata was used as a component for monitoring quality.[120]

69. Available evidence on what paradata can do to improve data quality is generally scarce for lower-income countries. Moving forward, it would be informative to have more case studies on the use of paradata collected as part of CAPI and CATI systems implemented in lower-income contexts. Doing so will require strengthening NSO capacity to store, analyze, and report on paradata. This could be pursued under the proposed NSO business line on experimental statistics discussed in section *3.1.f. Foster a programme of experimental statistics*.

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114 https://www.census.gov/topics/research/paradata.html

115 Paradata as data source for census data collection monitoring: Brazilian census of agriculture case, IBGE, presented during the 50th session of the UN Statistical Commission. https://unstats.un.org/unsd/statcom/50th-session/side-events/documents/20190306-1L-Brazil.pdf

116 Bristle et. al., (2019) The contribution of paradata and features of respondents, interviewers, and survey agencies to panel co-operation in the Survey of Health, Ageing and Retirement in Europe. J R Stat Soc Ser A Stat Soc. 2019 January; 182(1): 3-35. Doi:10.1111/rssa.12391

117 Kreuter, Frauke, Improving Surveys with Paradata: Analytic Uses of Process Information, Wiley Series in Survey Methodology, 2013

118 Comparing CAPI Trace File Data and Quality Control Reinterview Data as Methods of Maintaining Data Quality, Jans et. al., 2011. http://www.asasrms.org/Proceedings/y2011/Files/300407_64067.pdf

119 Laflamme, François, 2009. Data collection research using paradata at Statistics Canada. Symposium 2008: Data Collection: Challenges, Achievements and New Directions

120 Hartleib et. al., 2021. Implementing CAWI in the Austrian Microcensus/LFS: experiences and challenges. Labour Market Statistics (LAMAS) Working Group Workshop on multi-mode data collection.

70. In addition, metadata, including but not limited to, date of interview; complementary time stamps for start and end of interviews and survey modules (though, these could also be retrieved from paradata); numerical codes for interviewers and field supervisors; identifiers for replacement households and reasons for replacement; and information on presence of other household members during interviews with household members; are essential to collect and use for various purposes. The applications can include monitoring progress and incoming data quality as well as ex-post research on interviewer effects, correlates of data quality, seasonality in our measurements, to name a few. These efforts can inform design of implementation plans and near-real-time data quality checks for subsequent household surveys as well.

2.7. Expanding capacity for machine learning and artificial intelligence

71. Artificial intelligence, machine learning, and predictive analytics can improve the efficiency of every step of survey operations, from sampling, questionnaire design, data collection, and processing to data analysis and dissemination.[121] For example, sampling rare populations has always been a challenge for large-scale household surveys. While a common screening exercise on large samples could be prohibitively costly, the use of classification trees and machine learning help build a prediction model with existing information from surveys and administrative data, making the sampling of rare population groups more efficient for future surveys.[122] Paradata analysis could predict the ideal time window for enumerators to contact each household, helping to improve contact rates for telephone and face-to-face interviews.[123]

72. Machine learning can also be useful for data processing that tends to be resource-intensive and error-prone. For example, data collected through open-ended questions (for example, on occupation, industry, and time use activities, among others), great efficiency can be gained by using machine learning to code open-ended responses automatically. The US Bureau of Labor Statistics used machine learning to automatically code responses to its open-ended work injury question, reducing the coding workload while improving the overall coding quality.[124]

73. The use of artificial intelligence and machine learning has been central to applications discussed in section *2.1.Enhancing the interoperability and integration of household surveys* This includes the use of georeferenced household survey data for calibrating and validating models that combine survey data with high-resolution satellite imagery and processed geospatial data to obtain precise, high spatial resolution estimates of poverty, asset wealth, cultivated crop areas and crop yields, among others. Other applications of machine learning in household surveys include predicting attrition rates in panel surveys,[125] "fast-tracking" survey estimation and imputation procedures to speed up data dissemination efforts,[126] and

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121 A recent overview on the use machine learning in official statistics is written by Yung, W., Karkimaa, J., Scannapieco, M., Barcarolli, G., Zardetto, D., Sanchez, J. A. R., ... & Burger, J. (2018). The Use of Machine Learning in Official Statistics. UNECE Machine Learning Team report. Available at https://bit.ly/mlforofficialstats

122 Dutwin, David, 2021. Feedback loop: using surveys to build and assess registration-based sample religious flags for survey research. Big Data Meets Survey Science: A Collection of Innovative Methods, Hill et. al., Wiley Series in Survey Methodology.

123 Wagner, James, 2013. Using paradata-driven models to improve contact rates in telephone and face-to-face surveys. Improving Surveys with Paradata Analytic Use of Process Information, Kreuter, Frauke. Wiley.

124 Measure, Alexander, *Deep Neural Networks for Worker Injury Autocoding*, US Bureau of Labor Statistics, 2017. Available at https://www.bls.gov/iif/deep-neural-networks.pdf

125 Mingnan Liu, 2021. Using machine learning models to predict attrition in a survey panel. Big Data Meets Survey Science: A Collection of Innovative Methods.

126 Cohen and Shorey, 2021. Artificial intelligence and machine learning derived efficiencies for large-scale survey estimation efforts. Big Data Meets Survey Science: A Collection of Innovative Methods.

imputing consumer expenditures for areas that are not sampled[127] or deriving imputed direct/objective measures of outcomes when direct measurement is restricted to a subsample.[128]

74. Applications of artificial intelligence and machine learning in household survey design, implementation, and analysis are still scattered and concentrated mostly in countries with more advanced statistical systems. Building and strengthening NSO capacity in the use of these methods should be a priority for lower-income contexts, including as part of the suggested efforts to strengthen the NSO focus on experimental statistics and survey methods. More discussion on capacity building is covered in *3.1.e. Strengthen the capacity of national statistical* .

2.8. Improving data access, discoverability, and dissemination

75. Any improvements to household surveys must include effective strategies for documentation and dissemination to leverage the full analytical potential of collected data and maximize the return on investing in household surveys. Looking forward, data producers should aim for timely data dissemination and accelerate gains in the public availability of deidentified household survey datasets. In doing so, NSOs should communicate to the general public the importance of data for evidence-based decision making, as well as how the collection of these data will respect data protection laws and the confidentiality of personal information. NSOs should also accelerate the deposits of anonymized unit-record public use survey datasets (inclusive of spatially anonymized GPS locations of enumeration areas, as discussed in section 2.1) into national portals and international platforms for household survey dissemination, including the International Household Survey Network[129], the World Bank Microdata Library[130], the FAO Microdata Library for Agricultural Surveys and Censuses[131], the ILO Central Data Catalogue[132] and UNHCR's Microdata Library[133]. Key survey design information should accompany the disseminated survey microdata, such as anonymized primary sampling units, strata and final weights.

76. NSOs should consider providing secure access to confidential survey microdata to promote further use and research by creating offline data enclaves that allow access to the complete set of georeferenced unit-record survey data.[134] Once approved, access should be free. While access to microdata through physical data enclaves has been limited during COVID-19, some national statistical offices have continued this service to researchers through securely managed access to data from home.[135]

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127 Knappenberger and Lee, 2021. Model-assisted state expenditure estimates, US Bureau of Labor Statistics. Presentation made during the UK ONS-UNECE Machine Learning Group 2021 Webinar.

128 Yacoubou Djima, I. and Kilic, T. (2021). "Survey Measurement Errors and the Assessment of the Relationship between Yields and Inputs in Smallholder Farming Systems: Evidence from Mali."

129 http://ihsn.org/

130 https://microdata.worldbank.org/index.php/home

131 https://www.fao.org/food-agriculture-microdata/en/

132 https://www.ilo.org/surveyLib/index.php/catalog/

133 https://microdata.unhcr.org/index.php/home

134 Dissemination of Microdata Files, Principles, Procedures and Practices, International Household Survey Network Working Paper No. 005, 2010. Available at https://ihsn.org/sites/default/files/resources/IHSN-WP005.pdf.

135 Accessing secure research data as an accredited researcher, UK ONS, October, 2020. Available at https://www.ons.gov.uk/aboutus/whatwedo/statistics/requestingstatistics/approvedresearcherscheme#assured-organisational-connectivity-to-the-secure-research-service

77. Relatedly, "scientific use datasets" should be made available freely and through online means, upon submission and approval of a research proposal, and subject to a data licensing agreement and a non-disclosure agreement that cover the terms of data access, use and disposal. These datasets can include confidential household GPS coordinates or georeferenced plot outlines but they must be divorced from community, household, plot identifiers included in the microdata and can only include a very limited set of processed variables that would be used for model training and validation purposes (such as total household consumption expenditures or cultivated crop identifiers and yields). While access to microdata through physical data enclaves has been limited during COVID-19, some national statistical offices have continued this service to researchers through securely managed access to data from home.[136]

78. The importance of disseminating real-time data or prioritizing the publication of time-sensitive data has been recognized widely. As shown during the pandemic, many countries were able to release near real-time data based on high frequency or pulse surveys. With the help of machine learning, countries can "fast-track" survey estimation and imputation procedures to speed up data dissemination efforts (see section *2.7.Expanding capacity for machine learning and artificial intelligence*).

79. Moreover, various data outputs should be provided by NSOs, not only in tabular format but also through analytical reports. The most useful forms of data outputs focus on specific topics and population groups (such as migrants, labor force, poverty) with integrated information from multiple sources, as opposed to data disseminated based on sources (such as a report based on a single survey, without linkages to other relevant data outputs that could be combined to provide a more comprehensive picture on a specific issue).

80. Disseminating information based on topics and population groups of interest requires a strong metadata system that describes the content of all microdata files, the content of aggregated tabular output, the content of analytical or descriptive reports, and the nature of specialized services provided by the agency. This kind of system enables better coordination and integration of household surveys with other data sources.

81. It also facilitates the production of integrated data products that are easy for users to understand, hence improving the use and usability of the data. Training of national statistical offices' staff on the requisite skills for producing user-centric analytical reports and communicating with the public and journalists is also key to improving the usage of household survey data. All efforts to improve data availability must be accompanied by the development of strict data privacy and anonymization protocols.

82. Any dissemination programme should incorporate an appropriate system of data quality reporting build on robust quality assessment approaches. This should be part of any regular dissemination to inform the interpretation of published data, and is crucial at times when new methods are introduced or important changes take place, for example changes in mode of data collection, integration of new data sources, changes in survey design etc. Given the desired innovation and modernization of household surveys over the coming years, NSOs will need to have well developed quality assessment systems leveraging existing statistical quality assurance frameworks such as the UN National Quality Assurance Framework[137].

[137] https://unstats.un.org/unsd/methodology/dataquality/

3. Fostering a stronger enabling environment for household surveys

83. This chapter identifies the critical elements of an enabling environment at both the national and international levels to accelerate the realization of the vision described in this paper.

3.1. At the national level

a. Strengthen engagement with policymakers and data users

84. Official statistics are collected to inform policy, promote policy discussions, and increase knowledge. As an integral part of the national data ecosystem, household surveys offer a unique opportunity to respond to the data needs of policymakers and the general public. To ensure that data collected from household surveys are relevant, policymakers and all relevant stakeholders including marginalized population groups should be key partners at all stages of survey planning, data collection, analysis, and dissemination. These engagements build co-ownership of data and the entire household survey process with policymakers, which in turn helps to secure financial support for household survey operations in the country.

85. Various ways of engaging with policymakers and key stakeholders have been adopted in countries. For example, the Canadian Statistics Advisory Council serves as a body for Statistics Canada to engage with the ministries and key experts on matters related to overall quality and various aspects such as data collection, data access, privacy issues, and data dissemination. To better understand the needs from regional and local governments, the Federal-Provincial-Territorial Consultative Council on Statistical Policy collaborates with Statistics Canada to determine data requirements, consult on current statistical activities, and coordinate the data dissemination.[138]

86. Another way to connect with the public directly is through open consultation. For example, open consultation was carried out in 2020-21 by the Australian Bureau of Statistics (ABS) about the Aboriginal and Torres Strait Islander health survey.[139] The consultation helped ABS design a culturally appropriate approach to collect information on health with three components: survey content, biomedical tests, and data integration. The public was asked to complete an online survey and/or submit inputs through email or mail. A report of the consultation is published online. Topics for open consultations are broad, ranging from data collection as in the above example for Australia, data dissemination, or the use of data. Surveys supported by the World Bank Living Standard Measurement Study (LSMS) team establish a Technical Working Group within each country, including NSO officials, line ministries that use the survey data, think tanks, research centers, and academia. The Data Users Group advises on questionnaire design to align with policy needs and increase the use of survey data.

87. On the whole, strong user engagement can identify not only the data needs on the part of stakeholders but also the ways in which household surveys are used. The latter is critical for identifying the type of household survey data that are critical to on-going policy design and evaluation processes.

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138 More information about the advisory groups of Statistics Canada is available at https://www.statcan.gc.ca/eng/about/relevant

139 https://consult.abs.gov.au/population-and-social-statistics/copy-of-aboriginal-and-torres-strait-islander-surv/

b. Modernize national statistical systems

88. In recent years, many NSOs have taken on the task of modernizing their statistical systems. Drivers for this transformation are both internal and external. Internal drivers may include organizational silos that prevent the reuse of knowledge and data produced under different streams of work, duplication, lack of consistency of solutions, limited interoperability across data sources, and limited capacity for research and innovation. External drivers for modernization include increasing demand for statistical information, the availability of new data sources and methods, and increasing challenges with the traditional data sources that are typically under the auspices of NSOs.[140] Attempts to introduce innovations into household surveys would benefit greatly from a modernized national statistical system. For example, a process-oriented data collection system (discussed in more details under *2.1.Enhancing the interoperability and integration of household surveys*), which is a key element of a modernized statistical system, can help ensure harmonization across surveys and facilitate data integration.

89. Another key aspect of a modernized statistical system is the increasing reliance on both primary data collection such as population censuses and household surveys and on other data sources such as administrative sources and non-traditional data sources. This transformation serves as a catalyst for innovative survey methodologies and better data integration. The shift to multi-purpose sources and multi-source statistics also ensures that the collected survey data are re-used for multiple purposes, hence adding values to existing surveys.[141]

c. Quantify the benefits and communicate the value of surveys

90. National statistical offices must invest in data visualization and data journalism to better communicate the value addition of household surveys, both in and of themselves and through integration. This is critical for boosting the understanding of the importance of household survey data, and in turn, securing political commitment to and predictable financing for household survey programs. It is also important for NSOs to document how survey data have been used for policymaking, hence can be used to demonstrate the value of household surveys.

91. In the age of abundance in information and misinformation, it is important to develop and maintain a brand for NSOs that is associated with trust, relevance, independence, and quality. Consumer consultation, staff engagement, and communication and marketing strategies are key elements for building such a brand.[142]

d. Sustain financing for household surveys

92. During the COVID-19 pandemic, 40 percent of NSOs saw data collection costs rise, while 70 percent of NSOs globally experienced decreased government funding.[143] In sub-Saharan Africa, 61 percent

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[140] Opening address: Modernization at Istat and the centralization of data collection. Piero Demetrio Falorsi, Istat, Italy. UNECE Workshop on Statistical Data Collection – Vision on Future Surveying, 2016, the Hague, Netherlands

[141] Ricciato et al, 2020. Trusted Smart Statistics: How new data will change Official Statistics, Data & Policy (2020), 2: e7. doi:10.1017/dap.2020.7

[142] UNECE, 2021. Brand and reputation management guidelines (draft).

[143] United Nations Statistics Department, World Bank. (June 2021). One Year into the Pandemic: Monitoring the State of Statistical Operations Under COVID-19. Retrieved from World Bank Document

of countries experienced increases in data collection costs, with 71 percent seeing a decrease in government funding and 59 percent a decrease in donor funding.[144] These challenges are being experienced by systems that were already insufficiently funded yet are required to produce accurate and timely data. An analysis carried out by the World Bank puts the average cost of conducting a face-to-face household survey, based on a sample of 18 living condition type of surveys, at USD 170 per household.[145] Significant variations exist in the cost among these 18 surveys, ranging from USD 64 in Bangladesh to above USD 400 per household in Nigeria. The cost of a national MICS6 survey ranges from USD 29 to USD 370 per household.[146] As we move forward, cost of household surveys is likely to increase, many low-income will continue to lack the resources to consistently fund their national surveys.

93. Domestic resource mobilization remains the most sustainable funding resource for statistical advancement. At the national level, systematic funding mechanisms should be in place to support household survey operations as an integral part of the national statistical system. There must be strong statistical advocacy programs in place that can enhance the work done by NSOs for the benefit of politicians and policy makers to ensure that household surveys are priority activities in annual budgets. Demonstration of use cases may be helpful in resource mobilization.

94. Public-private partnerships should be encouraged by national governments as a means to drive funding toward statistical development. Special trust funds for the sole purpose of advancing statistics could be established on already existing tax revenue platforms.

95. The last two years dealt a major blow to the world economy and lower-income countries were hit particularly hard. Funding statistical development must continue being a priority for national governments and the international community if economies are to rely on evidence-based policy responses to emerge from the downturn.

e. Strengthen the capacity of national statistical systems

96. Quality official statistics can only be offered by a national statistical system that has the requisite managerial and technical skills to deliver on its mandate. Training and capacity building programs can improve on existing skills and help develop new technical skills that can improve NSOs' responses to increasing opportunities to leverage new types of data sources and new methods.

97. As seen from discussion covered in Chapter 2, the skills mix of NSOs must diversify to increase the development impact of household surveys, expanding to areas such as the use of new data sources (e.g., earth observation data), new techniques (such as machine learning, artificial intelligence and anonymizing survey microdata), and data integration. Research skills need to be developed to support methodological innovation and communication skills need to be improved to better engage with respondents and users. Such improvements can be undertaken together with establishing a new (or strengthening the existing) business line on *experimental statistics*, as discussed in section *3.1.f. Foster a programme of experimental statistics* and as originally called for by the World Development Report 2021: Data for Better Lives.

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[144] Ibid.
[145] Kilic, T., Serajuddin, U., Uematsu, H., and Yoshida, N. (2017). Costing Household Surveys for Monitoring Progress Toward Ending Extreme Poverty and Boosting Shared Prosperity. World Bank.
[146] Provided by the UNICEF MICS team

98. Furthermore, an assessment of 15 NSOs on training needs identified additional areas in high demand but often overlooked by statistical trainings programmes, including coordination of the national statistical system, user engagement, and management as some of the priorities.[147] These issues are particularly relevant for countries as they begin modernizing their national statistical systems (see section *3.1.b. Modernize national statistical system)* and as NSOs take on new roles in an Integrated National Data System.[148]

99. There is substantial variation on the extent of capacity of NSOs and the NSS in providing training for their staff. National training programs range from having an established statistical training institute within or outside of NSOs (as in Brazil, Indonesia, and the Philippines), relying on a small training unit within the NSO (as in Ireland and Ethiopia), to providing only ad-hoc training or no training at all[149]. There is also large variation on what kind of trainings are being provided to staff and by whom. Good practices of successful national statistical training programs should be shared and expanded to others.

100. The challenges of COVID-19 have prompted many statistical agencies, at both international and national levels, to rethink their training programs. At least 75 percent of all statistical capacity development events in 2020 were conducted online, compared with only about 5 percent in 2019, according to the United Nations Statistics Division Global Calendar of Statistical Events, which includes information from major international agencies. Given its efficacy, remote training is likely to continue, even if combined with in-person initiatives.[150]

101. Many e-learning courses have been developed by international agencies on various topics such as phone surveys,[151] small area estimation,[152] and collecting data through household surveys for various SDG indicators.[153] Bringing these courses together to maximize access for NSOs and to avoid duplication of efforts is essential. In this regard, the Global Network of Institutions for Statistical Training (GIST)[154] has established a hub that allows just this; the UN SDG:learn statistics hub[155] currently holds more than 70 e-learning courses on various topics from different providers, including FAO, UNICEF, UNSD, WB, regional training institutes NSOs and others. More courses are in the process of being added, including from the DHS team. The hub also provides so-called microlearning materials such as brief learning videos, platforms, blogs and similar survey-related training materials are also being made available on the ISWGHS website.[156]

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147 Nielsen, Vibeke Oestreich. 'How Can We Better Coordinate and Make Use of Statistical Training Resources? A Few Reflections Linked to the Work of the Global Network of Institutions on Statistical Training (GIST)'. 1 Jan. 2021 : 753 – 767.

148 World Bank, 2021. World Development Report: Data for Better Lives.

149 United Nations, 2021. Sustainable Statistical Training Programs at National Statistical Offices. Available at https://unstats.un.org/gist/resources/documents/Sustainable-statistical-training-programs-at-NSOs.pdf

150 United Nations, 2021. Sustainable Development Report: Investing in Data to Saves Lives and Build Back Better.

151 Remote Training on Phone Surveys, World Bank Living Standard Measurement Study Programme. Available at https://olc.worldbank.org/content/remote-training-phone-surveys

152 UN Statistics Division, ECLAC and UNFPA. Forthcoming

153 E-learning courses on SDG Indicators under FAO Custodianship. Available at https://www.fao.org/sustainable-development-goals/news/e-learningcourses/en/

154 https://unstats.un.org/GIST

155 https://www.unsdglearn.org/statistics/

156 unstats.un.org/iswghs

f. Foster a programme of experimental statistics

102. This position paper echoes one of the recommendations of the World Development Report 2021 for NSOs to establish a business line on *experimental statistics* under which a more systematic approach to supporting and conducting methodological survey research can be pursued. [157] In this context, a business line could be established on experimental statistics that use new data sources and new methods to improve methodologies and/or to provide more timely data to better meet users' need.

103. Experimental statistics are communicated with users as they are still in the testing phase and not yet fully developed but they serve as an avenue for organizing testing and experiments. Experiments could be carried out through a dedicated program on survey methods, under which new measurement tools can be tested and validated vis-à-vis their gold-standard counterparts, ideally through small-scale randomized survey experiments. Many of the priority areas covered in Chapter 2 above require experimentation within national context, for example, on methods on data integration (section 2.1), the use of objective measure (section 2.4), the collection and use of paradata (section 2.6) and machine learning and artificial intelligence (section 2.7).

104. To build a successful experimental statistics business line, NSOs in lower income contexts will likely require technical assistance in building the internal capacity to carry out these activities. Fostering a culture of carrying out small experiments within national household survey programme is also important. Eurostat maintains a website that links to experimental statistics published by NSOs in the EU and is a great example in fostering experimentation in countries.[158] Similar exercises can be carried out through other regional statistical organisations or at the global level.

g. Invest in ICT infrastructure

105. In the third quarter of 2020, 25 percent of NSOs were reported to lack adequate ICT infrastructure for staff to work away from the office effectively.[159] The lack of cloud computing services for data storage and exchange as well as suitable facilities for remote training are common challenges highlighted by the UN-WB survey. Significant disparities exist in low- and high-income countries' abilities to manage a forced work-from-home situation, where only 57 percent of low- and lower-middle-income countries were able to provide their staff with the necessary tools (such as personal computers, tablets, and monitors) to continue their work, as compared to upper middle (72%) and high-income (88%) countries. Stronger and smarter technological infrastructure should be available at the national level for implementing mixed-mode surveys. These measures should be coupled with enhancements in data storage, data protection, creation or strengthening of data dissemination platforms, establishment of offline data enclaves for the use of confidential survey data, as discussed in section 2.8, and steps to address the hardware and software needs of NSOs.

106. Finally, the successful integration of household survey data with other data sources generated by NSOs as well as those from the private sector requires strong legislative backing. The requisite legislation

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[157] World Bank, 2021. World Development Report: Data for Better Lives.

[158] Eurostat, ongoing. Experimental statistics hub of the European Statistical System. Available at: https://ec.europa.eu/eurostat/web/experimental-statistics/overview/ess

[159] United Nations, World Bank. (August 2020). Monitoring the state of statistical operations under the COVID-19 pandemic.

must allow access to other data sources for official statistical purposes while guarding the confidentiality of personal information in both the integrated data and the original data sources.

3.2. At the global level: the role of the international development community and ISWGHS

a. Pursue a coordinated and systematic approach to supporting national statistical offices

107. To unleash their full potential, household surveys must be adequately funded and positioned strategically so as to emphasize the critical role of a functional household survey program within the national data ecosystem. For example, during COVID-19, countries that already had existing household survey systems equipped with necessary contact information established were able to use them as sampling frames to rapidly launch and successfully implement phone surveys on COVID-19, taking advantage of investments in capacity building over a decade prior to the pandemic. Just so, investments are needed now to improve the responsiveness and resilience of future data collection systems.

108. Collaborative efforts at the regional and international level are key to a coordinated household survey program with a medium- to long-term plan at the country level, especially for countries that rely technically or financially on international agencies and the donor community. The ISWGHS should be the forum to foster such collaboration.

b. Sustain financing at the international level

109. Shifting the narrative from decrying the "funding gap" to discussing "investment opportunities" creates a better context for statistical development.[160] To build strong national statistical systems in low-income countries that can produce quality and timely data, donors need to think of data in terms of investments into tracking and achieving the Sustainable Development Goals (SDGs) and national development goals.

110. The Bern Network on Financing Data for Development is supporting a Clearinghouse, a platform that allows assessing the state of data financing in the poorest and most fragile countries, highlighting ongoing and forthcoming projects and providing guidance to donors on where to make investments. The function of the Clearinghouse is being augmented through the parallel establishment of a Global Data Facility (GDF) at the World Bank which will provide innovative financing mechanisms to address, inter alia, some of the most impelling funding data gaps identified through the Clearinghouse. By consolidating donor financing towards key priority areas, the GDF will enable greater coordination and create much needed synergies across donors so as to deliver more efficiently on the commitments of the Cape Town Global Action Plan for Sustainable Development, which called for ."... [greater] participation of non-state actors in funding statistical activities through innovative funding mechanisms…" The GDF could be a game-changer in supporting a renewed household survey agenda for the next decade by complementing government resources and leveraging other data investments, including project financing for large statistical capacity building operations.

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160 UNESCAP (2020, October 5). Asia-Pacific Stats Café Series: Financing Statistical Development. Retrieved from Asia-Pacific Stats Café Series: Financing Statistical Development | ESCAP (unescap.org)

c. Support a stronger role for ISWGHS

111. Implementing the priority areas identified in this paper requires a strong coalition of international agencies and countries to support such an ambitious agenda. The ISWGHS can bring together this coalition by complying with its mandate in three areas of work: coordination, methodological development, and advocacy and communication.[161]

112. Before exploring possible prescriptions for the ISWGHS, it is important to discuss its relative advantages and limitations. The ISWGHS consists of 11 international agencies and 8 member states. International agency members are responsible either for a survey programme (MICS, LSMS, 50X2030, etc.) or for providing regular training and technical support for household surveys in areas under their mandate. Member states either rely significantly on household survey programs for official statistics or offer technical and/or financial support to the work of the group. The eight country members are geographically representative to ensure that the need of the countries in their respective regions are taken into consideration in setting priorities.

113. All agency members have a mandate to support countries on household surveys, with a focus on specific thematic areas. For example, ILO is responsible for labor market data, UNHCR on forcibly displaced and stateless people, UNICEF for data on the wellbeing of children, UN Women for data on the empowerment of women and girls, and the World Bank for data on poverty and other dimensions of wellbeing. A collaborative group like ISWGHS is well-positioned to focus on the coordination of international survey efforts and cross-cutting methodologies. A good example on how ISWGHS members work together is the COVID-19 impact survey dashboard[162] that has been put together in May 2020, with information on surveys supported by members, has played an important role in coordinated efforts within countries. ISWGHS has also produced a number of cross-cutting methodologies that are of interest to all areas of work, as listed in paragraphs below.

114. The other relative advantage of ISWGHS, with its secretariat housed within the UN Statistics Division, is its close tie with the UN Statistical Commission,[163] which serves the highest body of the global statistical system that brings together Chief Statisticians from all member states. Working closely with NSOs improves support for national needs as well as country adoption of international standards and methods.

115. In 2021, ISWGHS organized or contributed to 11 virtual meetings with more than 20 speakers and over 2,000 participants**,** covering a range of topics including survey data integration, microdata dissemination, the use of citizen-generated data for SDGs, and implementing household and phone surveys in the midst of a pandemic. The group also produced or supported in the production of several technical reports, including Spatial Anonymization; Technical Guidance Note on Planning and Implementing Household Surveys Under COVID-19; Processing Education Expenditure Data from Household Surveys; and the Counted and Visible Toolkit, which guides countries in better using existing household survey data

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161 Terms of Reference for the Inter-Secretariat Working Group on Household Surveys is available at https://unstats.un.org/iswghs/documents/ToR-ISWGHS-final-2020-05-14.pdf

162 ISWGHS, ongoing. Dashboard of COVID-19 impact surveys supported by ISWGHS members. Available at https://unstats.un.org/iswghs/task-forces/covid-19-and-household-surveys/COVID-19-impact-surveys/

163 https://unstats.un.org/unsd/statcom/

to produce disaggregated gender data. ISWGHS is also continuing to compile information on COVID-19 impact surveys to support COVID response efforts and revamping its website to provide an entry point for training materials and methodological guidelines related to household surveys.

116. More importantly, ISWGHS has been playing an important role to amplify the impact of tremendous amount of work undertaken by its members including innovative approaches, through various channels including its website, webinars, blogs and regular newsletters.

117. At the same time, ISWGHS faces significant constraints. Funding to support the group's collaborative work relies mostly on member contributions, and only one staff member is fully dedicated to supporting the ISWGHS work program, with ad-hoc technical support from members. Resource constraints will undoubtedly affect future ambitions and the level of support that ISWGHS can provide to countries.

118. As we look towards supporting household surveys during the next decade, we suggest a number of priorities and activities that the ISWGHS can carry out to support countries in the short-term (with additional funding needs in italics). These include:

Coordination

i. Assessing national needs regularly and identifying capacity building needs
ii. Providing a common platform for all training materials (*additional funding for IT support*)
iii. Coordinating activities of members in initiating innovative approaches and experimentation and fostering exchange of experiences

Methodological development

i. Developing guidelines and training materials along priority areas outlined in this position paper (*additional funding for consultancies*)
ii. Supporting experiments on new methodologies in countries (*additional funding to support small experiments*)

Advocacy and communication

i. Fostering the exchange of experiences and innovative methods through webinars, small group focused discussions and blogs (*additional funding for communication*)
ii. Collaborating with key partners including NSOs, CSOs, regional organisations, academia, key professional association such as ISI-IASS (International Association of Survey Statisticians) and other scientific associations to stay abreast of latest developments and seek collaboration opportunities (*additional funding for research/literature review if scaling up*)
iii. Organizing meetings and workshops at the international and regional level (*additional funding for communication/technical staff if scaling up and funding to support participation of countries*)