Technical Guidance for Strengthening the Vital Statistics Production Process

Implementing the Vital Statistics Business Process Model for the production and dissemination of vital statistics from civil registration

United Nations
Economic Commission for Africa

ESCAP

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DATA FOR HEALTH INITIATIVE

Vital Strategies

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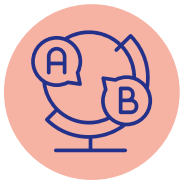
Abbreviations



AAR	Assessment, Analysis and Redesign Phase of the CRVS Systems Improvement Framework
BPM	Business Process Map
CRO	Civil Registration Office
CRVS	Civil Registration and Vital Statistics
ECA	United Nations Economic Commission for Africa
ECE	United Nations Economic Commission for Europe
ESCAP	United Nations Economic and Social Commission for Asia and the Pacific
GAMSO	Generic Activity Model for Statistical Organizations
GSIM	General Statistical Information Model
GSBPM	Generic Statistical Business Process Model
IMF	International Monetary Fund
ISCED	International Standard Classification of Education
LCR	Local Civil Registrar
LMIC	Low- and Middle-Income Country
NCRO	National Civil Registration/ Registrar's Office
NCT	National Core Team
NSDS	National Strategy for Development of Statistics
NSO	National Statistics Office
OECD	Organization for Economic Cooperation and Development
P&R	United Nations Principles and Recommendations for a Vital Statistics System
S&AP	Strategic and Action Plans
SAR	Systems Analysis and Redesign Tools of the CRVS Systems Improvement Framework
SOPs	Standard Operating Procedures
TT	Thematic Team
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
UN NQAF	United Nations National Quality Assurance Framework
VSBPM	Vital Statistics Business Process Model

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About this document

Production and dissemination of vital statistics is one of the key outcomes of a civil registration system. When the civil registration system is incomplete or the data collected through the system are not of desired quality, countries resort to surveys and censuses or adopt indirect techniques to provide demographic estimates. However, these sources and methods cannot be considered as substitutes to the Civil Registration and Vital Statistics (CRVS) system as the primary source of data for producing demographic estimates. The regional initiatives on strengthening CRVS systems, particularly in Africa and Asia-Pacific, identified production and dissemination of vital statistics as an important focus area. The programs led by the United Nations Economic Commission for Africa (ECA) and the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP), supported by various regional and global agencies (including Vital Strategies), encouraged countries in the regions to produce annual vital statistics reports based on civil registration even when the data are incomplete and of inadequate quality. The ECA and ESCAP, in collaboration with Statistics Norway, developed guidelines and templates for the production of vital statistics reports. The first revision of this guide and template has been developed and published by Vital Strategies in collaboration with other partners, including Norway, ESCAP, and ECA (Vital Strategies, et al., 2020).

The CRVS Systems Improvement Framework, developed by Vital Strategies, ECA, ESCAP, Centre of Excellence for CRVS systems and the Pacific Community in collaboration with other partners, provides a step-by-step guide for the assessment of the current status of a CRVS system in a country and the development of a strategic action plan for strengthening that CRVS system (Vital Strategies, et al., 2021). The framework also provides guidance on implementation of the strategic action plan as well as its monitoring and evaluation. The framework adopts a process-centric approach in assessing, analyzing and redesigning the civil registration business processes as well as recommending strategies for improving organizational capabilities such as policies, laws and regulations, human resources, information technology, physical infrastructure, management and coordination, and advocacy and communication. One of the key components of the framework relates to the improvement of the existing system for the production and dissemination of vital statistics in countries and where vital statistics are not produced, to develop them as an integral part of the overall improvement of the CRVS system.

This Technical Guidance for Strengthening the Vital Statistics Production Process: Implementing the Vital Statistics Business Process Model for the production and dissemination of vital statistics from civil registration, hereafter referred to as the "Technical Guidance", provides a step-by-step guide to improve or build a vital statistics system from the data collected in the civil registration system. The Technical Guidance uses a Vital Statistics Business Process Model (VSBPM), which is adapted from the Generic Statistical Business Process Model (GSBPM) version 5.1 published by the United Nations Economic Commission for Europe (ECE) in January 2019 (Annex 1). It has been developed as an addendum to the CRVS Systems Improvement Framework, keeping in mind that some of the key processes in the initial phases of the VSBPM will fall well within the domain of civil registration as seen in Figure 1, Chapter 2.

In most countries, the national statistics office (NSO)[1] is responsible for compilation of vital statistics based on civil registration data. Although the NSO's role begins only after it receives the statistical data from the civil registration office, it should play a very crucial role in ensuring that a) the statistical data items collected at the time of civil registration of various events are aligned to international and country requirements; b) these statistical data are of desired quality; and c) they are received in a timely manner. This is unlike other administrative data systems in which the statistics are only a byproduct of these systems and, more often than not, fall within the exclusive domain of the department/ministry that is responsible for the operations and management of the system (for example, crime statistics or tax statistics). The NSO, therefore, is an important cog in the wheel that drives the process of improvement of a CRVS system.

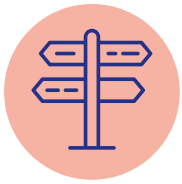
When a country decides to implement the CRVS Systems Improvement Framework, the NSO could use this Technical Guidance to systematically engage and work hand in hand with the civil registration agency and other stakeholders right from the planning stage. It also provides direction to the NSO to make advance technical preparations for identifying their data needs and assessing their own organizational capabilities in terms of IT and physical infrastructures and human resources. The downside of not being an integral part of the CRVS improvement process from the beginning will be a huge loss of opportunity for the country in producing timely and quality vital statistics in accordance with international recommendations.

This Technical Guidance can also be applied independently and selectively of the CRVS Systems Improvement Framework, if a country decides to improve the existing vital statistics system or build one without redesigning the civil registration system.

It is well-recognized that the health sector is an important provider of information required for the purpose of civil registration, particularly when a birth or a death event occurs in a health facility. This is usually in the form of an evidentiary document (often referred to as notification). The possible use of notification forms to collect some statistical data items and its implication in data capture and trasmisison as well as data quality has been discussed in various sections in the Technical Guidance.

1. There are countries (e.g., India and Kenya) where the responsibility of compilation of vital statistics from civil registration lies with the civil registration office/agency itself. Further, the NSOs are named differently in different countries; for example, Central Statistics Office (CSO), National Institute of Statistics (NIS). For the purpose of this document, the acronym NSO will be used to encompass all variations that exist.

CHAPTER 1
Introduction



According to the UN, civil registration is the preferred and best source of vital statistics. A complete and efficient civil registration system provides information on vital events and their characteristics on a continuous and permanent basis that can help produce vital statistics at regular intervals, unlike other sources such as population census and household sample surveys, which are undertaken at longer intervals. Vital statistics based on civil registration can be produced on a continual basis up to the lowest administrative levels, which is crucial for local level planning and program implementation. An automated CRVS system can provide data in real time and help produce timely vital statistics. Basic counts of live births and deaths occurring in a population are crucial for estimating the natural increase (or decrease) of that population, as well as the annual change in population size and structure. Vital events, particularly birth and death, are used to continuously (and often in real time) update population registers in some countries, which in addition to other administrative benefits also provides dynamic population statistics and some basic vital statistics.

The UN Principles and Recommendations for a Vital Statistics System revision 3 (United Nations, 2014a) (hereafter referred to as the P&R) provides complete guidance on the collection and production of vital statistics based on civil registration. It provides details of data items to be collected through civil registration processes and standard tabulations to be produced as a part of the vital statistics report. It also deals with quality assurances of vital statistics based on civil registration starting at the early stage of collection of information of vital events and their characteristics at the time of registration and across the value chain leading to the production of vital statistics. The ECA and ESCAP, in collaboration with Statistics Norway and Vital Strategies, have developed a handbook (Vital Strategies, et al., 2020) that provides a standard template for writing a vital statistics report.

Although there has been global technical guidance on the topic for many years, few low- and middle-income countries have produced a vital statistics report based on civil registration records. One of the reasons often cited for noncompilation of vital statistics is incomplete levels of registration. Hence, the NSO, which are mainly responsible for the production of statistics, have continued to fall back on infrequent sources for obtaining vital statistics, such as population censuses and household sample surveys. Since the early 2010s, the statistical divisions of ECA and ESCAP, in collaboration with various global and regional partners and stakeholders, have been able to prominently highlight the importance of compiling vital statistics as part of their renewed effort in improving CRVS in the two registration-deficient continents, namely Africa and Asia[2]. The countries in those continents are being encouraged to produce simple vital statistics even when their registration completeness levels are lower than the threshold of 90% suggested by the UN for producing extensive tabulations of vital statistics compiled from the civil registration system[3]. One of the key programmatic strategies was to emphasize a more coordinated approach at all levels to ensure that the three key stakeholders — namely, the NSO, Civil Registration Office

2. The proportion of children under 5 years whose births have been registered was 46% for Sub-Saharan Africa and 46% for Central and Southern Asia. (United Nations, 2019). Asia includes the Pacific countries.

3. An extensive tabulation program is useful only when the degree of completeness of registration is 90% and over. Short of that, tabulations should be limited to simpler tables, with emphasis on the need to achieve improvements in the completeness of registration and the accuracy of the contents of the reporting of statistical information. (See *Annex II, Annual tabulation programme of vital statistics compiled from civil registration data* (paragraph 3, page 153) (United Nations, 2014a).

(CRO), and the health ministry — work hand in hand to improve CRVS systems in their respective countries. One of the main objectives of the improvement efforts was to develop countries' capacity to build complete and efficient civil registration systems that are able to produce the vital statistics tabulations recommended by the UN and use them for policymaking, planning and program implementation.

Under the regional programs led by ECA and ESCAP, countries were provided guidance and equipped with tools for conducting comprehensive assessments and developing strategic and action plans for improvement of CRVS systems. A large number of countries in Asia and Africa undertook these assessments and developed action plans, most of them medium-term (about five years). Production of vital statistics was invariably an important component of these plans, and implementation was in most cases to be led by the NSOs. Several countries in Asia, the Pacific and Africa were able to produce vital statistics reports. But only a few middle-income countries produced all the required UN recommended tabulations. Challenges have been found in the following areas that need to be addressed: quality, capacity, laws and procedures, resource requirements, and coordination. Other challenges include data sharing and access, as well as issues related to data privacy. Quality assurance mechanisms are often inadequate, and therefore in most cases the data quality standards of the vital statistics are not adhered to. Capacity of the statistical offices, particularly those that had not produced a single vital statistics report, has been a hindrance. There are issues with capabilities such as legal framework, human resources and IT that act as serious bottlenecks. Coordination, including data sharing, between the data collection agencies (civil registration and ministry of health) and vital statistics compiling agencies (NSOs) in most countries is also a challenge.

Purpose of the Technical Guidance

The CRVS Systems Improvement Framework (Vital Strategies, et al., 2021) introduces a process improvement approach to strengthen CRVS systems. Building on the important lessons learned and experiences shared by countries that have conducted comprehensive assessments and prepared strategic and action plans for CRVS, the framework introduces a unique, "process-centric" approach for strengthening CRVS systems.

"The civil registration office and other government ministries, departments and agencies involved in CRVS perform a chain of activities leading to the delivery of services. These chains of activities are called business processes. Examples of such processes in CRVS systems are the registration and certification of a birth or a death, or the production of vital statistics. The performance of the CRVS system and its business processes depend on how well the processes are designed and executed". (Vital Strategies, et al., 2021)

"The CRVS Systems Improvement Framework is designed to help all relevant stakeholders analyze and redesign existing business processes that will significantly improve the performance of the CRVS system. CRVS systems are complex and involve multiple stakeholders. A holistic focus on processes ensures that all stakeholders who are required to implement the process are engaged in the process improvement effort. Because of this focus on improving business processes, the approach can be referred to as 'process-centric.' " (Vital Strategies, et al., 2021)

This Technical Guidance follows the process-centric approach as adopted for the CRVS Systems Improvement Framework. It is important to note that a substantial part of the processes of the Technical Guidance has to begin during the Assessment, Analysis and Redesign (AAR) Stage of the CRVS Systems Improvement Framework and has to be actively led by the NSOs as a key partner in the overall improvement of the CRVS system. Given the nature and extent of the technicality involved in the complete process of collection and production of vital statistics, the Technical Guidance proposes to apply the Generic Statistical Business Process Model (GSBPM) to the vital statistics system. This will provide a scientific approach in the assessment, analysis and redesign of the vital statistics system and develop a roadmap to collect, produce and disseminate quality and timely vital statistics tabulations as per UN recommendations.

When a country decides to evaluate its CRVS system, it opens up a huge opportunity for the NSO and civil registration authority to evaluate the existing vital statistics systems or it provides an opportunity to design a new system if none exists. The process and tools for data collection fall within the realm of the CRO, which can be redesigned only when a comprehensive evaluation of the overall CRVS system is undertaken. The NSO, therefore, should be one of the major advocates for improving

the CRVS system and should exhort the CRO to initiate system improvements based on the CRVS Systems Improvement Framework. The NSO should, however, be in a state of readiness to deploy the VSBPM as and when the opportunity arises. This would include, e.g., identifying data needs to produce the required tabulations in accordance with the P&R, and building in-house capacity to analyze, process and disseminate vital statistics.

NSOs lead the development and implementation of the vital statistics component of the CRVS Strategic and Action Plan in close collaboration with CROs, health ministries, and other stakeholders. This document is expected to provide NSOs with the practical steps that need to be taken for improvement of the vital statistics system using the VSBPM. More details of the VSBPM and its positioning within the CRVS Systems Improvement Framework is discussed in the following section.

Intended audience

This Technical Guidance is more of a reference guide[4] that is primarily intended to be used by the officials from the NSO, who will be actively engaged in all three stages of the implementation of the CRVS Systems Improvement Framework[5] and the subsequent development and implementation of the vital statistics action plan. This Guidance document will also help the NSO technical support team build its case for producing quality and timely vital statistics based on civil registration that is aligned with the 2014 P&R. The Guidance is also intended to be used by an adviser/consultant if the country chooses to engage one to support the process.

4. The Guidance document captures every phase and process of the VSBPM in great detail so that NSO officials actively engaged in the implementation of the model will gain a comprehensive knowledge of the topic. However, subsequent companion documents will be produced to supplement the Guidance for easy use.

5. Stage 1: Assessment, Analysis and Redesign; Stage 2: Development of the Strategic Action Plan; Stage 3: Implementation, monitoring and evaluation (page 7 (Vital Strategies, et al., 2021).

CHAPTER 2

GSBPM and its adaptation for the vital statistics production process

The latest version (version 5.1, January 2019) of the GSBPM published by the ECE (Choi, 2021) and widely adopted by the global official statistics community provides the foundations for the VSBPM which will be the core of the Technical Guidance. It would be advisable for the Task Team[6] on vital statistics that is created and convened during the AAR Stage of the CRVS Systems Improvement Framework to fully acquaint itself with the GSBPM[7]. This will help the team get perspective on the proposed approach to improving, and in some countries establishing, the vital statistics system based on civil registration[8].

The GSBPM describes and defines the set of business processes needed to produce official statistics. It provides a standard framework and harmonized terminology to help statistical organizations modernize their statistical production processes, as well as share methods and components. A statistical business process is a collection of related and structured activities and tasks used to convert input data into statistical information. In the context of the GSBPM, organizations or groups of organizations perform statistical business processes to create official statistics to satisfy the needs of the users.

The GSBPM has three levels and is represented in a matrix form (see Annex 1)

- Level 0, the statistical business process
- Level 1, the eight phases of the statistical business process
- Level 2, the subprocesses within each phase

The GSBPM recognizes several overarching processes with a strong statistical component that apply throughout the eight phases, which mainly includes quality management, meta-data management, and data management. For the purpose of this Technical Guidance, the GSBPM has been adapted to the context of vital statistics production and is referred to as the Vital Statistics Business Process Model (VSBPM), as presented in Figure 1.

The VSBPM is not a rigid framework in which all the steps must be followed in a strict order. Instead, it identifies the possible steps in the vital statistics business process and the interdependencies between them. Although it follows the logical sequence of steps in most statistical business processes, the elements of the model may occur in different orders in different circumstances. The VSBPM can be viewed as a checklist to make sure that all necessary steps have been considered, or as a "recipe" to identify all the "ingredients" of a statistical business process.

The boxes representing subprocesses in Figure 1 are categorized in two colours. Those in the blue boxes should be implemented as part of the overall CRVS improvement process. These, as may be seen in Figure 2, extend from the Evaluate to the (Re)Design phases of the VSBPM and are embedded within the AAR Stage of the CRVS Systems Improvement Framework, led by the CRO. However, it would be important to note that the NSO, as part of its advance and background preparation, will also undertake activities related to the vital statistics component within these blue boxes. For example, the NSO, as a part of its in-house exercise, is expected to conduct its own desk review to gather technical information related to the current production processes and tools (subprocess 1.5). Some of the findings of this internal desk review will contribute to the overall CRVS desk review. The subprocess 2.1 that relates to statistical data needs will also be initiated by the NSO as part of advance preparation. This subprocess may include the desk review of the current statistical data items collected for vital statistics production and benchmark them against the UN-recommended core topics. The NSO, through its internal and external consultative process, will finalize its needs for data items and would have to bring it on the table for discussion and acceptance during the CRVS improvement process.

6. Five task teams are proposed to be thematically created to support the AAR work of the CRVS Systems Improvement Framework (Stage 1). These teams are groups of six to eight technical staff drawn from different CRVS stakeholder ministries/agencies that are charged with the responsibility of undertaking some specific tasks. One such task team is recommended to be constituted for vital statistics. See also section 3.7 of the CRVS Systems Improvement Framework.

7. Training materials are available at https://statswiki.unece.org/display/GSBPM/GSBPM+Training+Materials (Vale & Choi, 2022).

8. NSOs producing official statistics more or less follow all the business processes and subprocesses of the GSBPM, albeit with different degrees of sophistication, and continue to mature and modernize over time. However, their experience with official statistics is mainly in the area of sample surveys and censuses, and not in administrative statistics, where the responsibility of data collection is with other departments and is therefore, in many cases, outside their sphere of control.

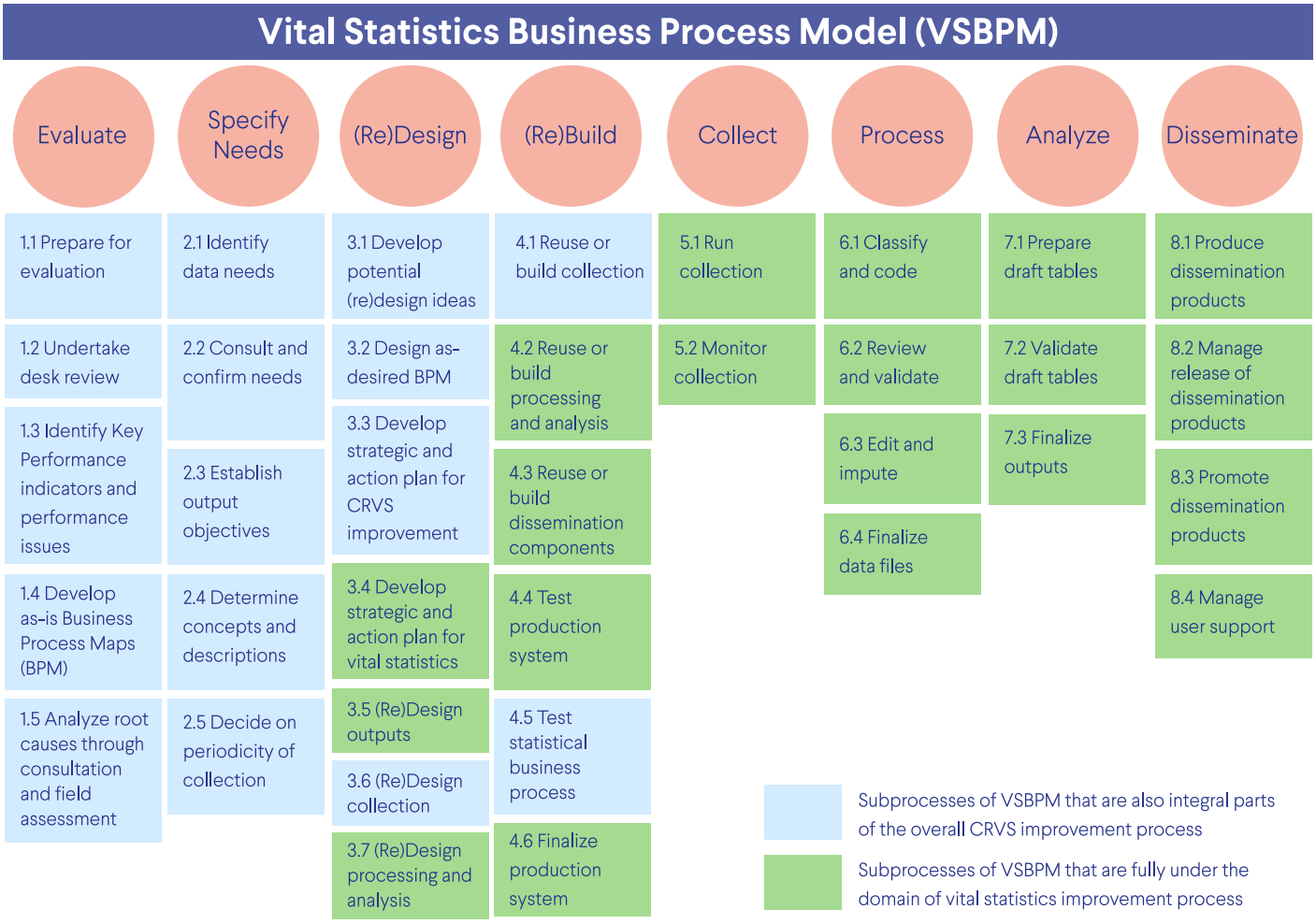


Figure 1: Vital Statistics Business Process Model (VSBPM) adapted from GSBPM

The subprocesses in the green boxes mainly fall within the domain of the NSO. However, some of these subprocesses cannot be implemented without the support and collaboration of the CRO. For example, although building a collection system (subprocess 4.1) under the (Re)Design phase of the VSBPM is about the collection of statistical data and should fall under the realm of the NSO, this can only be achieved with the joint effort of the civil registration agency and NSO. Civil registration agencies have to implement activities such as changes in business processes on collection and transmission of data, redesign of the digitisation process and software application, training of staff, etc. The NSO would work together with the civil registration agency to make sure that all these activities are undertaken based on the two entities' technical inputs.

VSBPM and CRVS Systems Improvement Framework

When looking at the phases of the VSBPM (Figure 2), the connection between the CRVS Systems Improvement Framework and VSBPM becomes apparent. The outer circle in the figure represents the *change work phases* of the VSBPM in which the first two phases, namely "Specify Needs" and "Design", together correspond to the AAR stage of the CRVS Systems Improvement framework. The "Build" phase builds and tests the production solution to the point where it is ready for use in the "live" environment. The vital statistics Task Team should ensure that all the required subprocesses for the first two phases within the *change work phases* are carefully assessed, analyzed and redesigned before moving on to "Build" based on strategic and action plans with clear timelines. Once the redesigned vital statistics system is built, the NSO can begin implementing the *ongoing work phases* of VSBPM shown in the inner circle of Figure 2 to produce and disseminate vital statistics on a regular basis. The change work phases are then only considered when a new output is created or when the process is revised after being evaluated. Once the output becomes part of "normal" ongoing activity, these phases can be undertaken again after a new evaluation process is done to move to the next level of maturity and quality.

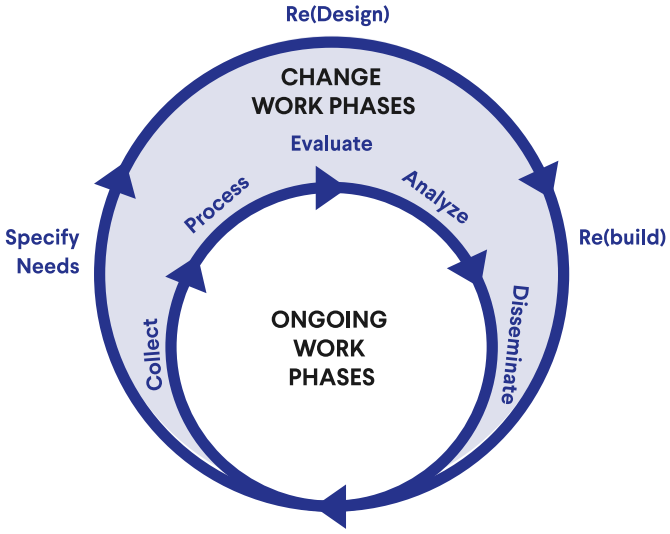


Figure 2: Change work phases and ongoing work phases of the VSBPM

It is more than likely that many LMICs may, depending on their administrative and statistical capabilities, require multiple iterations of evaluations (Figure 3) to be able to produce timely and quality vital statistics in accordance with the international recommendations.

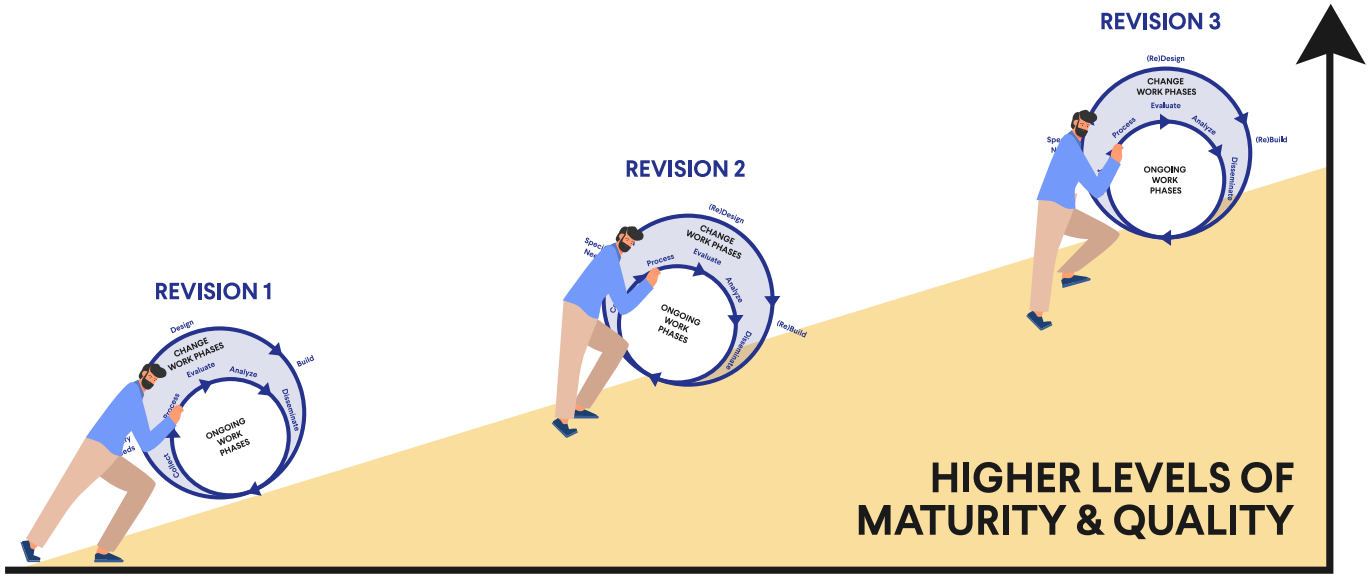


Figure 3: Progressive improvement of Vital Statistics System using VSBPM

Table 1 depicts how the two subsets of the phase of the VSBPM described in the previous paragraphs fall within the realm of CRO or NSO or both, and provides a few examples of the subprocesses for each of the phases[9]. It reinforces the need for the NSO and CRO to work closely[10], particularly in the *change work phases*, to (re)design an improved vital statistics system. The table also maps out the various steps in the CRVS Systems Improvement Framework with the VSBPM phases. This will help the task team on vital statistics organize its work during the AAR Stage, when they would develop a plan for building an improved vital statistics system.

9. The health sector plays an important role in the vital statistics improvement process as a provider of data and also as a data user. Since the data obtained from the health sector for events occurring in institutions, and in some countries for events occurring at homes as well, get transmitted to the NSO only through the CRO, the subprocesses within the medical facilities will be similar to those for the CRO, and therefore not separately depicted in Table 1. The NSO and CRO, however, have to work together with the health sector in designing, building and running an efficient vital statistics system.

10. The health sector has to be the part of the team right from beginning as it is an important provider of some of data items that are used for compilation of vital statistics.

Table 1: VSBPM phases and subprocesses, their correspondences with CRVS Systems Improvement Framework, and responsibilities/accountabilities of NSO and CRO

VSBPM phases	Correspondence with CRVS Systems Improvement Framework	National Statistics Office	Civil Registration Office
		Subprocesses (example)	*Subprocesses (example)*
Change work phases			
Evaluate*	Assess, Analyze and Redesign (Stage 1) using CRVS-System Analysis and Redesign (CRVS-SAR) tools Develop strategic and action plan (Stage 2)	**Undertake desk review**	**Undertake desk review**
Specify Needs		**Identify needs** for statistical data items**	**Identify needs** for legal data items
(Re)Design		**Design outputs**	
		Design collection	**Design collection**
(Re)Build	Implement the plan (Stage 3)	**Build collection based on new process**	**Build collection based on new process**
		Build dissemination components	
Ongoing work phases			
Collect	Implementation, monitoring and evaluation (Stage 3)	**Run collection** of data items from civil registration for production of vital statistics	**Run collection** of legal and statistical data items and transmission of relevant data items to NSO
Process		**Edit and impute**	
Analyze		**Prepare draft tables**	
Disseminate		**Produce dissemination products**	

* Although 'Evaluate' is an overarching phase, it has been placed within the *change work phases* to allow for alignment with the CRVS Systems Improvement Framework. It is for the same reason that the Evaluate phase has been considered as the first phase instead of the last, as depicted in the generic GSBPM. The other reasons for this adjustment are further discussed in Chapter 4 of this document.

** See Annex II for a list of legal and statistical data items (United Nations, 2014a).

Table 2 shows the three situations described above with regard to the current status of vital statistics systems and the entry points for the initiation of an improvement process in relation to the VSBPM and CRVS Systems Improvement Framework.

Table 2: Status of vital statistics systems and the entry points for an improvement process in relation to VSBPM and CRVS Systems Improvement frameworks

	Status of vital statistics system based on civil registration data, with proposed action by the country	VSBPM	CRVS Systems Improvement Framework
Category 1	Vital statistics produced but not according to international concepts and definitions — country proposes to improve the existing system	The improvement process will start with the Evaluate phase before moving on to the other three phases, Specify Needs, (Re)Design and (Re)Build	The vital statistics improvement process will be an integral part of the AAR stage of the CRVS Systems Improvement Framework
Category 2	Vital statistics not produced — country proposes to build a vital statistics system as part of the CRVS systems improvement process	The improvement process will start with the Specify Need phase before moving to Design	Building a new process will be an integral part of the AAR stage of the CRVS Systems Improvement Framework
Category 3	Vital statistics not produced — country proposes to produce vital statistics without waiting for the CRVS Systems improvement process to begin	VSBPM will apply but will begin from the Design phase	Outside the purview of CRVS Systems Improvement Framework

The countries that fall under the first two categories listed in Table 2 are those that are already planning to implement a CRVS Systems Improvement Framework. Countries in this position have a unique opportunity to enhance the quality and timeliness of vital statistics that they already produce (Category 1) or to build a vital system where none exists (Category 2). A country that has not produced any vital statistics reports in the past may decide to produce vital statistics based on existing data without any immediate plans and efforts to improve its civil registration system (Category 3). Countries falling into that third category can use this guidance document and start from the Design phase to produce vital statistics based on existing data from the civil registration system. The Design phase in the third category of countries would entail designing the collection of data from the civil registration records by putting a mechanism in place that can also serve as an ad hoc or stopgap arrangement pending implementation of a newly designed system. Quite often, this is done through a memorandum of understanding (MOU) signed between ministries in charge of the CRO and NSO. The rest of the phases and subprocesses of the VSBPM will be implemented as required, keeping in mind the limitations in the content and flow of statistical information. The NSO, while making this special effort to produce vital statistics, should persistently advocate for building an improved CRVS system.

GSBPM and its link with other frameworks and models

There are a number of frameworks and models that complement the GSBPM and help establish common standards, tools and methods to support modernization of official statistics. These include the Generic Activity Model for Statistical Organizations (GAMSO) (Willis-Núñez & Choi, 2021) and the General Statistical Information Model (GSIM) (Hamilton & Muriel, 2021). Brief descriptions of GAMSO and GSIM are provided in Annex 2. The GSBPM should also be complemented with a Quality Management Framework. This has been discussed separately in Chapter 6 of this document.

NSOs should take on board these models and frameworks as standards in assessing, designing, building and managing all statistical programs that fall under its purview, such as censuses, surveys and administrative data systems. The extent to which these are applied in a systematic and structured manner depends on the level of maturity of the country in producing official statistics from different sources. Nevertheless, these models and frameworks, which accompany the GSBPM, are essential to guide the NSOs in producing timely and quality official statistics following the Fundamental Principles of Official Statistics (United Nations, 2014b). Some of the NSOs may already be using these models for other statistical programs and can adapt them to implement the Technical Guidance. It's worth noting that since most of the elements or activities in these models and frameworks fall completely under control of the NSO, these will not be discussed in depth in this document. Necessary reference will be made to their specific elements and activities while discussing the various subprocesses under the different phases of the GSBPM.

CHAPTER 3

Planning for vital statistics system improvement

Although the overall planning for the CRVS Systems Improvement Framework already takes into account planning for vital statistics systems improvement, the NSO on its own accord needs to undertake some additional and/or advance actions for the work that falls under its sphere of control. This will mainly be aimed at ensuring that the NSO, as the lead institution for the production and dissemination of vital statistics, is in a state of readiness for implementing the vital statistics improvement process alongside the implementation of the CRVS Systems Improvement Framework, if and when initiated. The actions that an NSO should take in preparing to implement the Technical Guidance are described below[11]. Where a country plans to develop or strengthen its vital statistics production without the CRVS Systems Improvement Framework, the NSO will implement the Technical Guidance in its own time.

Governance

The NSO should be represented in the high-level steering committee and the technical working group (TWG), established under the CRVS Systems Improvement Framework, to provide oversight on specific activities, as well as in a national core team (NCT) established specifically to design and implement the system improvements. A sample terms of reference (TOR) of the groups is provided in *Annex A Sample terms of reference for the High-level Interagency CRVS Coordination Committee and the Technical Working Group* of the CRVS Systems Improvement Framework. The NSO should also constitute a technical support team comprising officials from the vital statistics division or section as well as those who deal with data processing. This team should be assembled immediately after the government decides to implement the CRVS Systems Improvement Framework. The team should be responsible for undertaking an internal review of the existing vital statistics system, develop a necessary technical document to guide the vital statistics improvement process (Annex 3), and provide technical support as and when necessary during the implementation of the AAR stage of the CRVS Systems Improvement Framework. One of the objectives of the team should be to provide technical backup support to officials representing the organization in the above-mentioned committees and whenever required, to prepare all the necessary technical notes for the representatives of the NSO who are participating in deliberations in the various governance committees and groups. The team should continue to guide and monitor the implementation of strategic and action plans for (re)building the (re)designed vital statistics system.

Preparing for implementation

The NSO, as stated above, should prepare far ahead of time in order to make the most of the opportunity provided by the CRVS improvement process to revamp the existing vital statistics system. The NSO should have a clear vision, goals and well-stated objectives. In addition, through a process of consultation, the NSO should develop a set of outcomes that it would strive to achieve through this vital statistics improvement exercise to redesign or establish a vital statistics system if none exists. The NSO, as part of its advance preparation, should evaluate its internal processes, tools and methods in the production and dissemination of vital statistics from civil registration records.

This guidance document and those referred to herein should be used to train the technical support group members to carry out their tasks in a systematic and efficient manner. One of the first outputs of the team should be to prepare a technical note that very clearly describes the various subprocesses under the VSBPM and the manner and sequence in which these will be implemented in redesigning or building the vital statistics system. The document, for example, among others, should specify a) the statistical data items to be collected in the civil registration system and their use, and b) the proposed tabulations and their use. It may also include suggestions for changes in data flow within the organization and in the software required for data processing. The details of the type and extent of preparation required for successful intervention in the CRVS systems improvement process is given in Annex 3.

Advocacy and communication

The NSO should prepare advocacy documents, aimed at various audiences, that clearly highlight the benefits of vital statistics compiled from civil registration records for policymaking and program implementation as well as monitoring of

11. The activities and tasks within the various planning steps in the CRVS Systems Improvement Framework (Vital Strategies, et al., 2021) are not repeated here but are referred to as and where necessary.

SDGs and other development indicators. The fact that the vital statistics from a complete civil registration system can be produced on a continual and permanent basis up to the lowest of administrative levels, makes it the most preferable source, much more valuable than other sources. Separate advocacy documents with well-crafted messages should be prepared for different clients such as policymakers, administrators and government functionaries at the highest levels in various ministries and departments, as well as for other stakeholders, including development partners, donors and nongovernmental organizations (NGOs). The advocacy and communication effort also needs to be initiated well in advance to ensure support for implementation of the Technical Guidance.

Stakeholder engagement

Early identification and engagement with stakeholders is essential to support an NSO's efforts during the planning stage of the vital statistics improvement process. The stakeholders would include various types of users of vital statistics, such as ministries or departments that are engaged in planning, implementing and monitoring social and economic sector programs, academic and research institutions, local development partners, and individual researchers. A key first step that the NSO should take as part of its preparatory activities is to organize a data users' conference/meeting[12] with the above-mentioned stakeholders to seek guidance and obtain feedback on a range of technical aspects related to the collection, production and dissemination of vital statistics. For example, the meeting can advise the NSO on the selection of statistical data to be collected through the civil registration system as well as on the tables to be produced as part of the vital statistics report. The consultation will also deliberate and decide on the data dissemination strategy, including the issues with regard to types of data[13] to be released, as well as the mode of dissemination.

Resource mobilization

The NSO should make a systematic effort to raise resources to support its internal preparatory activities such as training staff on the Technical Guidance, organizing a data users' meeting, and acquiring external expertise and technical assistance if required. Advance planning coupled with targeted advocacy efforts would be required by the NSO to mobilize the necessary resources for implementing the above-mentioned activities. Countries that have already included vital statistics improvement as a strategic area for statistical development and woven it into their National Strategy for Development of Statistics (NSDS)[14] may use the instrument to seek governmental and external support for the preparatory stage, as well as for the implementation of all the phases of the VSBPM. The NSO is also expected to provide staff time for the implementation of the AAR and planning stages of the CRVS Systems Improvement Framework to ensure that all requirements for designing and building an improved vital statistics system are suitably taken care of. The NSO also has to release staff for fieldwork during the AAR stage of the CRVS Systems Improvement Framework.

Human resource requirement for implementation of the framework

The NSOs of almost all LMICs in the past few years have built in-house capacity in collection, production and dissemination of official statistics, particularly in the area of censuses and household sample surveys. However, with not much experience in the collection and processing of vital statistics based on data obtained from civil registration, some countries may have to engage external assistance (e.g. a senior consultant) to provide support and guidance to the NSOs in implementing the Technical Guidance. The consultant should know how to build the capacity of the NSO staff so they can (re)design the vital statistics system to be self-sustainable, further improving the quality and timeliness of a country's vital statistics.

12. This could be replaced with other means of consulting stakeholders and reaching consensus.

13. This will include both aggregated data and individual level data. The latter could be released following existing protocols for release of data for other statistical programs of the NSO.

14. An NSDS is expected to provide a country with a strategy for developing statistical capacity across the entire national statistical system (NSS). The NSDS will provide a vision for where the NSS should be in five to 10 years and will set milestones for getting there (Paris 21, 2017).

CHAPTER 4

Phase 1 Evaluate, Specify Needs, (Re)Design and (Re)Build

This section provides a step-by-step process for implementing various stages of the Technical Guidance. It would start with an **Evaluation** of the existing vital statistics system to identify bottlenecks, **Specify Needs** in accordance with the international concepts, definitions and best practices, and recommend **(Re)Design** for an improved vital statistics system. Once approved at the appropriate levels within the government, strategic and action plans will be prepared to **(Re)Build** a newly designed vital statistics system. In countries where no such vital statistics systems exist, the process will start by specifying needs, since there will be nothing to evaluate. To reemphasize, the exercise to design a new vital statistics system or redesign an existing one will essentially be an integral part of the Assessment, Analysis and Redesign (AAR) stage of the CRVS Systems Improvement Framework and not a parallel exercise.

The vital statistics improvement process begins with the Evaluate phase, which to a large extent will be an integral part of the overall CRVS assessment process. The officials representing the NSO in the governance committees and the NCT will have to ensure that the subprocesses under the VSBPM are suitably incorporated within the AAR stage of the CRVS Systems Improvement Framework. At the operational level, the task team for vital statistics (constituted as one of the five thematic teams during the AAR stage of the CRVS Systems Improvement Framework) will have to ensure that the data needs, processes and tools for their collection, and finally their transmission, are assessed and (re)designed to meet the requirements of the NSOs for production and dissemination of timely and quality vital statistics. The task team will be supported by the technical support team of the NSO, which, as mentioned in Chapter 3, will already have prepared to provide the necessary technical inputs to the officials participating in the AAR process[15]. The CRVS-System Analysis and Redesign (CRVS-SAR) tool (section 3.5 of the CRVS Systems Improvement Framework) will be used for implementing the first three phases of the VSBPM, namely, Evaluate, Specify Needs and (Re)Design[16].

The next part of this section considers each phase in turn, identifying the various subprocesses within that phase and describing their contents.

Evaluate

As stated, the subprocesses under the Evaluate phase of the VSBPM are fully integrated into the assessment process of the entire CRVS system adopted in the CRVS Systems Improvement Framework. The AAR stage of the CRVS Systems Improvement Framework uses the CRVS-SAR tool to systematically collect information and analyze the performance of the CRVS system against a list of agreed-upon Key Performance Indicators (KPIs). The tool captures the KPIs and baseline performance of a CRVS business process and defines target performance for those indicators. It identifies the root causes and their categories[17] for suboptimal performance against each of the KPIs by using tools such as the as-is Business Process Maps (BPM) for each type of vital event, which is further supplemented through field assessment. The assessment exercise begins with the desk reviews undertaken by the NCT and is followed by workshops and field assessments in which the five thematic teams, including the one on vital statistics led by the NSO, actively participate and contribute. The NSO representative(s) in the NCT and the vital statistics thematic team are responsible for ensuring that the findings of assessments related to the vital statistics component are suitably incorporated into the overall CRVS assessment report as a separate chapter.

15. The NSO may want to nominate a few members of the technical support team as members of the task team for vital statistics.

16. It may be noted that the subprocess *3.5 Develop Strategic and Action plan* is under the Evaluate phase of the Generic GSBPM (Choi, 2021) and has now moved under (Re)Design phase in the VSBPM to ensure proper alignment with the stages of the CRVS Systems Improvement Framework (Vital Strategies, et al., 2021).

17. Categories of root causes would include the business process and other organizational capabilities such as the legal framework, human resources, management and coordination, physical infrastructure, and information technology.

1.1: Prepare for evaluation: The guidance document of the CRVS Systems Improvement Framework describes in detail the preparations that must be made before implementating each stage of the Framework. Chapter 3 of this document also provides details of the in-house technical preparations that the NSO should make in advance so as to fully use the opportunity to revamp the existing vital statistics system, or build one if none exists.

1.2: Undertake desk review: A comprehensive desk review is undertaken by the NCT as part of the AAR Stage under the CRVS Systems Improvement Framework. A wide range of available documents are reviewed by the NCT including the legal framework, forms used for collection of registration data, current standard operating procedures (SOPs), past assessments reports, relevant international standards and guidance documents, and vital statistics reports, whenever available. It may be important to note that the NSO's technical support team would already have completed its own review of all the relevant documents/materials as part of its work in developing the internal note on improving the vital statistics system. Therefore, the NSO representatives in the NCT only need to ensure that the findings of such review are appropriately reflected in the desk review report and used for populating the initial part of the CRVS-SAR tool. The focus of the vital statistics-related review would include statistical data items collected as part of a civil registration system, SOPs for collection and transmission of data, as-is business processes descriptions and maps, vital statistics-related provisions in the civil registration and statistics law, level of digitisation, IT infrastructure, and human resources capabilities.

1.3: Identify KPIs and performance issues: KPIs measure the performance of processes and their outputs and outcomes in CRVS systems against a set of performance targets and are also used to monitor progress toward specific defined objectives. The selection of appropriate KPIs and targets helps identify the performance gaps in a systematic and robust manner, leading to a set of recommendations for improved CRVS business processes and organizational capabilities. The KPI sets should be sufficiently detailed to capture all likely issues and challenges in current practice. There are two types of KPIs considered in the CRVS Systems Improvement Framework, 1) those that focus on clients (for example, families registering vital events) and 2) others that focus on service providers (for example, the civil registration office) and other institutional beneficiaries of the system (for example, NSO for compilation of vital statistics). The KPIs in Annex G of the CRVS Systems Improvement Framework provides a possible list of KPIs, which includes three high-level indicators related to vital statistics, presented below:

- Does the country produce an annual vital statistics report based on civil registration records?
- If the country produces an annual vital statistics report, does it meet the quality standard, and is it produced on time?
- If the country compiles an annual vital statistics report, does it produce the minimum tabulations recommended by the P&R?

Although all three KPIs are about producing a report on vital statistics, a country may be producing or want to produce and disseminate vital statistics electronically. A country may want to adjust these KPIs to lower its ambition and aim toward producing vital statistics as the final goal, without aspiring to produce an annual report. The NSO therefore has a crucial role to play in deciding an appropriate KPI, depending on the nature and level of the goals that the NSO would like to achieve.

The NCT initiates the process of populating the CRVS-SAR tool by first identifiying the KPIs for implementing the CRVS Systems Improvement Framework. The team sets the baselines and targets and identifies performance issues for each of the KPIs through a process of desk review and consultations. This information is validated and further refined based on consultation with stakeholders during the analysis workshop (See *Section 3.8 – Analysis of the performance of the current CRVS system processes* of the CRVS Systems Improvement Framework) and findings from the field assessment. The NSO member-representative in the NCT provides the necessary inputs for filling in the initial set of information for the vital statistics -related indicators, and the task team on vital statistics further validates these during the above-mentioned workshop and field visit.

It is important to note here that the three vital statistics-related KPIs[18] listed above are outcome level indicators, which can be used to monitor the progress made in improvement or establishment of the system, as a component of overall CRVS

18. These will largely be output, process and input level indicators.

improvement. However, in addition to this, the NSO has to develop its own set of KPIs to monitor the implementation of subprocesses for each of the phases of the VSBPM. Examples of KPIs for monitoring the implementation of VSBPM are provided in Annex 5. It will also have to draw up a list of quality indicators linked to different phases of VSBPM[19], the details of which will be discussed in Chapter 6.

Table 3 below provides an example of the CRVS-SAR tool with a few initial columns (first four columns) filled for the above-mentioned vital statistics related KPIs. This includes the KPIs, baseline value, source of information for the baseline, and target value. The gap between the target value and the baseline helps us ascertain the performance gaps.

The table also provides some explanatory notes against each of the KPIs for a better understanding of the issues.

Table 3: Example of a CRVS-SAR tool with a few initial columns filled-in for three vital statistics-based KPIs (including explanatory notes)

KPI	Baseline value	Possible source of information	Target value	Explanatory note
Does the country produce an annual vital statistics report based on civil registration records?	Yes/No	NSO	Annual vital statistics report compiled	If the baseline value for this KPI is "No", then the other two KPIs for vital statistics are not relevant. In this case, the NSO, through the CRVS Systems Improvement Framework and Technical Guidance, initiates steps to establish a vital statistics system that produces an annual vital statistics report.
If the country produces an annual vital statistics report, does it meet the quality standard, and is it produced on time?	Error rate: 20% missing data 15% inconsistent data 3-year delay in producing a report 25% civil registration records received beyond the cutoff date	Quality measures compiled by NSO during data processing	Error rate: Less than 1% missing data Less than 5% inconsistent data No delay 95% civil registration records received before the cutoff date	This KPI is about improving the quality and timeliness of publishing an annual vital statistics report. It may be noted that there can be many other indicators for measuring the quality of vital statistics produced, but this KPI will be among the foremost indicators used to monitor the performance of the vital statistics system as a component of the overall CRVS improvement monitoring.
If the country compiles an annual vital statistics report, does it produce all the tables recommended by the UN?	Yes/No	Annual vital statistics report	Yes	The minimum list of tabulations recommended by the P&R* is available. These recommended tables are based on core topics that have been proposed by the UN in the P&R (pages 18-23).

* Section II of Annex II (pages 157-159) of the P&R (United Nations, 2014a)

The baseline and target values provided in Table 3 are just examples, and these values vary across countries. For example, a country may be producing, say, 10 out of 20 UN-recommended tables, or may be producing annual vital statistics reports but covering only birth events. These facts can be reflected suitably as baseline values.

19. See Quality Indicators for the Generic Statistical Business Process Model (GSBPM)—For Statistics derived from Surveys and Administrative Data Sources (version 2.0, October 2017) (Jones & Choi, 2021).

1.4: Develop as-is BPM: According to CRVS Systems Improvement Framework, the first step in documenting current business processes is to fill out a process description template for each process[20]. This gives stakeholders a detailed, accurate and common understanding of the CRVS business processes and simplifies the later task of mapping the corresponding processes, which will generate a complete and concise as-is BPM. The NCT initiates the development of the process description and the as-is BPM for each type of vital event by enlisting the participation of all stakeholders. Their input will ensure that the map represents an accurate description of the current as-is business process. The CRVS Systems Improvement Framework (See *Section 3.3 Documenting core CRVS business processes for improvement*) provides details on how a BPM is developed using a process-modeling software tool. The work of process descriptions and the as-is BPMs for each type of vital event is initiated by the NCT. The BPMs are reviewed and further validated through an interactive process during the analysis workshop in which various stakeholders and members of the thematic task teams participate. The NSO representative responsible for documenting the current business processes for the overall CRVS improvement process will lead the development of the process description and the accompanying as-is BPM related to the collection and transmission of statistical data to the NSO from the civil registration system. The task team on vital statistics will also have the opportunity to review and validate these two documents during the Analysis Workshop and, wherever required, suggest improvements. Table 4 provides a sample description of a current process of collection and transmission of statistical data, followed by Figure 4, which depicts the same through an as-is BPM. It should be noted that the as-is BPM here and the as-desired BPM presented in later sections are just generic examples and can vary from one country to another.

After receiving the statistical data from the CRO, the NSO produces and disseminates the vital statistics. There is an internal procedure established by the NSO to systematically process, validate and produce the final tabulations, then analyze and prepare the vital statistics report. Figure 5 depicts the workflow within the NSO, which is triggered when the statistical data from CRO is received and ends once the vital statistics have been disseminated.

Table 4: Sample description of an as-is business process for collecting and transmitting statistical data.

Name of process	**Collection and transmission of statistical data from civil registration to NSO**
Process actors	Civil registrar, district/provincial-level civil registrar, NSO
Process purpose	Ensures that statistical data are collected and transmitted to the NSO for timely production of vital statistics
Trigger	Formal registration of a vital event
Process flow	*1. Vital event registered* 1.1 Civil registrar records information obtained through declaration form in the register 1.2 Civil registrar registers the vital event 1.3 Civil registrar sends the second copy of the registration form physically to the district registrar once a month *2. Data entered in the IT system* 2.1 District registrar's office receives copies of registers from local registrars every month and maintains a record 2.2 District registrar's office follows up with local registrars if copies of the registers are not received within the prescribed time limit 2.3 District registrar's office enters into the centralized IT system each month the information from the registers received during the previous month *3. Statistical data transferred to NSO* 3.1 National CRO monitors the flow of digitized civil registration records from the district registrar's office and follows up if information has not been entered into the IT system 3.2 After the prescribed cutoff date, the national CRO prepares the data file in an agreed-upon format containing relevant data to be used by the NSO to produce vital statistics and sends it to the NSO annually *4. Statistical data received by NSO; vital statistics then produced and disseminated*

20. *See Section 3.3 Documenting core CRVS business processes for improvement of the CRVS Systems Improvement* Framework guidance document. This section also includes the generic process description template (Table 4) (Vital Strategies, et al., 2021).

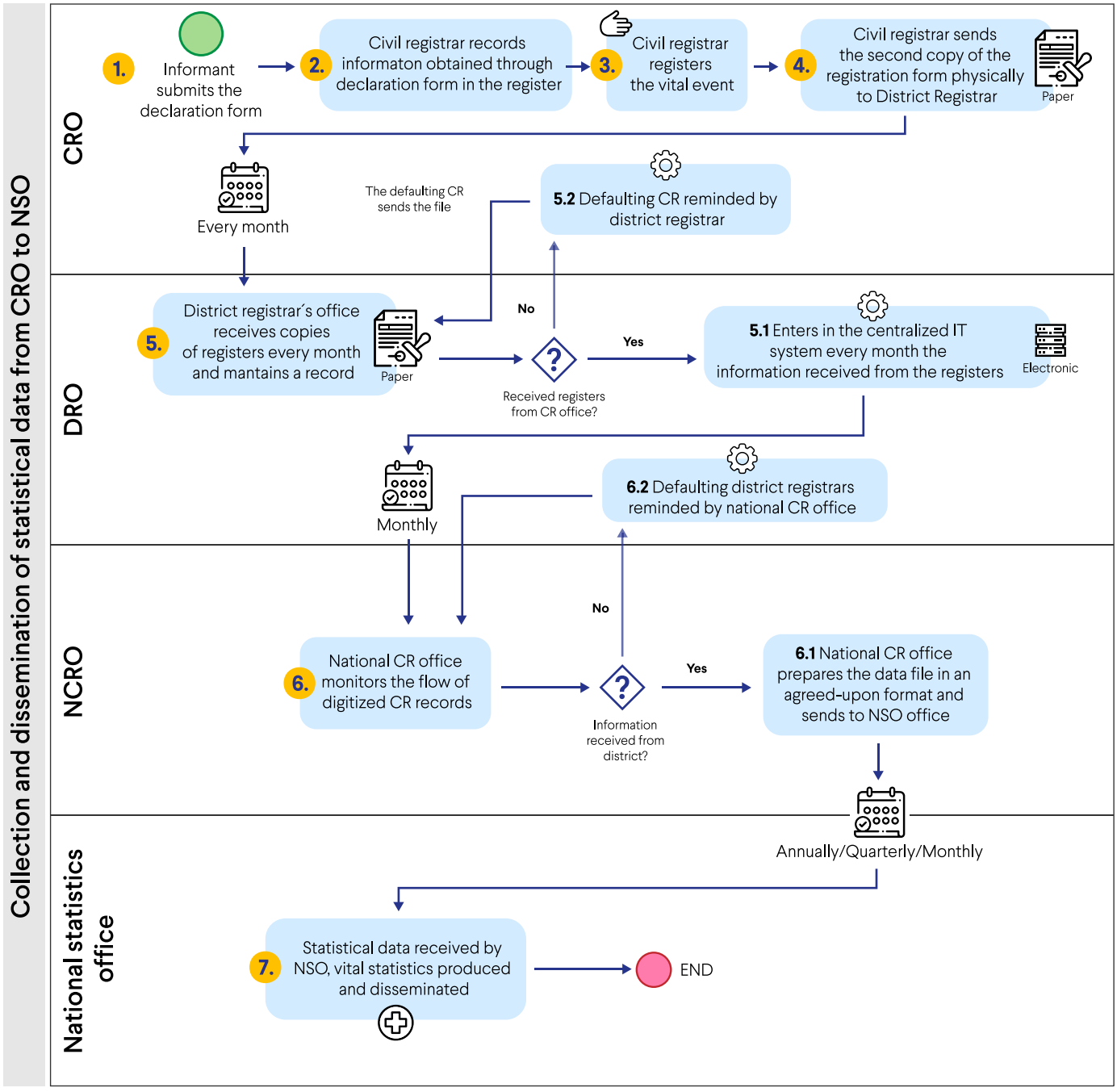


Figure 4: Example of process description for as-is business process for collection and transmission of statistical data using BPM software

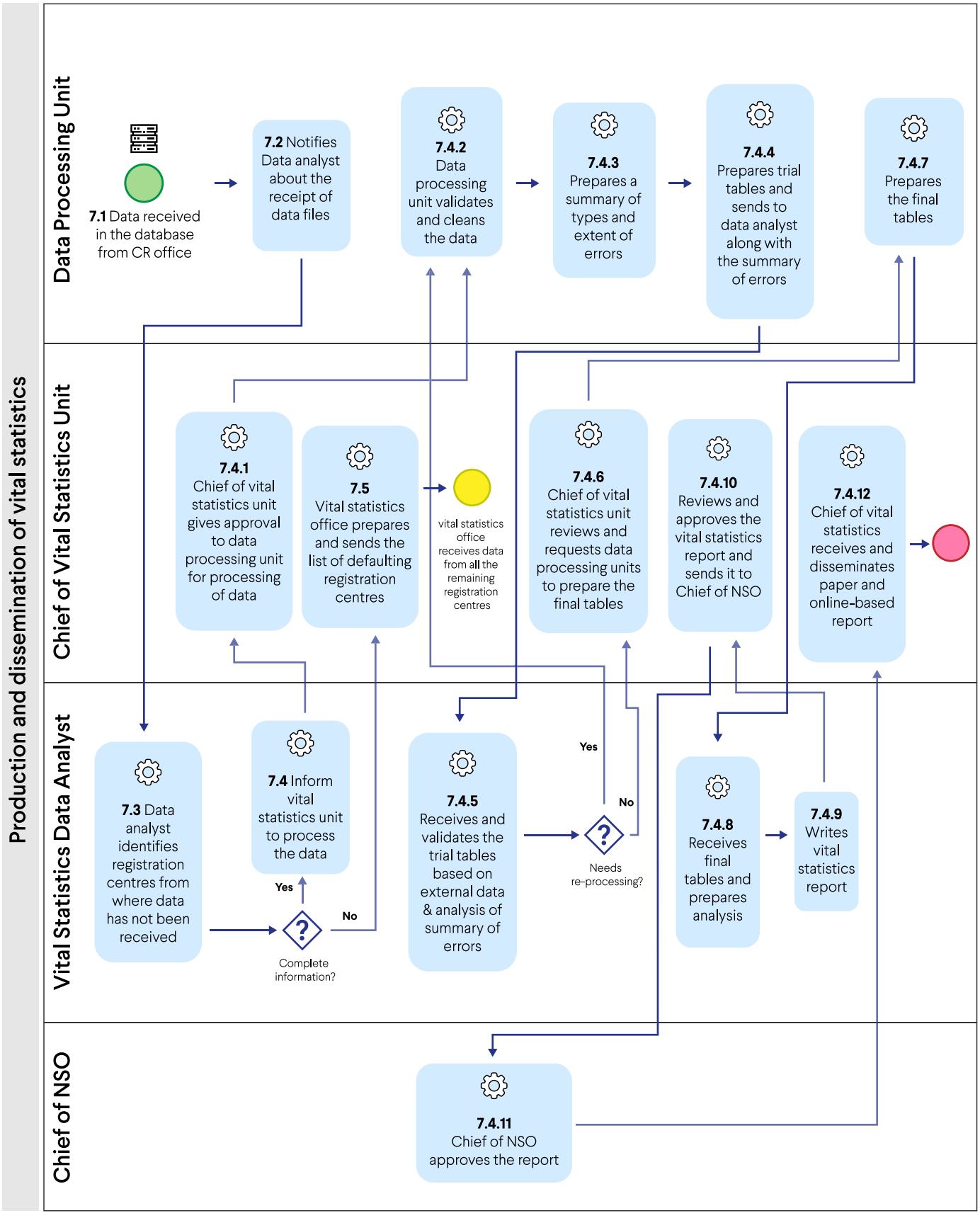


Figure 5: BPM for the subprocesses within the NSO for production and dissemination of vital statistics

1.5: Analyze root causes through consultation and field assessment: Once the performance gaps (available in filled-in CRVS-SAR tool template) related to each of the said KPIs and the as-is business processes are well understood and documented, the next step would be to undertake a root cause analysis to identify performance issues with respect to each of the KPIs. This analysis would help to ascertain the fundamental contributory factor(s) for poor performance in different areas of the existing CRVS system. This root cause analysis is initiated through a consultative process during the analysis workshop. The thematic task team members and other stakeholders review the as-is BPMs and the performance gaps, identify performance issues related to each of the KPIs, and, through a participatory process, identify the root causes for their suboptimal performance[21]. The Fishbone diagram is used as a tool for root cause analysis, the full details of which are described in the CRVS Systems Improvement Framework (*Section 3.8 Analysis of the performance of the current CRVS system processes*). There are six categories of root causes, namely a) the process itself; b) policies, laws and regulations; c) management and coordination; d) human resources; e) physical infrastructure; and f) information technologies. The field teams that are drawn from the different thematic task teams further validate the root causes during their field visits, since more information may be available on the ground where the actual registration and other related activities happen.

The thematic team on vital statistics has to play a lead role in the analysis workshop to make sure its members adopt a consistent approach while providing their technical input during the interactive sessions on root cause analysis. These interventions will largely be guided by the advance technical input provided by the technical support team of the NSO. A senior consultant hired by the NSO, if any, should participate in this crucial workshop.

During the field assessment, the members of the task team on vital statistics[22] should closely observe the process of data collection and transmission of registration data at the local level, particularly the data that will be used for compiling vital statistics. The team members should also closely examine the internal workflow process within the registration office, starting with collection of data and their eventual transmission to the NSO. The IT systems used for data entry and associated internal processes should be keenly observed. Failure to recognize an important root cause can result in improper and inadequate (re)design of the vital statistics system. The quality protocols implemented within the registration process at different levels of civil registration administration have to be carefully noted by the team members. The team members may also examine the various forms and registers related to civil registration that are filled in, and based on their observations make careful notes about the quality issues, particularly for those data items that will be used to compile vital statistics.

According to the process outlined in the CRVS Systems Improvement Framework, each team carrying out the assessment prepares a field report that includes a narrative on the actual observations, notes and/or recording of interviews and focus group discussion, photographs, and video recordings. The report also includes recommendations for redesigning of processes as well as possible enablers of improvements that are required; this information is to be captured in the "Redesign proposals" column of the CRVS-SAR tool. The as-is process map and the CRVS-SAR tool with comments are also annexed to the field report. After completing the field assessment and upon returning to headquarters, each task team leader will assemble all his or her team members to prepare a report on the theme covered by the field team. The report will be prepared through a consultative process based on input from each of the members. Therefore, a separate report on the vital statistics will be prepared by the task team on vital statistics and submitted to the NCT for further action.

Table 5 provides an example showing how the CRVS-SAR tool has to be filled in with information on performance issues against each of the three vital statistics-related KPIs and identified root causes and their categories. Explanatory notes have also been provided wherever necessary.

21. See Section 4.7 of the guidance note for the CRVS Systems Improvement Framework (Vital Strategies, et al., 2021). This exercise is undertaken is session 5 of the workshop.

22. The members of the five thematic teams are regrouped to constitute field teams for conducting field assessments. Therefore, vital statistics task team members are assigned to work with different field teams.

Table 5: Example of an CRVS-SAR tool filled in with information on performance issues against each vital statistics-related KPI, identified root causes and their categories (including explanatory notes)

KPI	Performance issues	Root causes and their categories	Explanatory note
Does the country produce an annual vital statistics report based on civil registration records?	The country does not produce any vital statistics report based on civil registration records	The registration levels of vital events are extremely low, and therefore no attempt is made to compile vital statistics based on incomplete data *(management)* The civil registration law does not provide for transmission of statistical records to a vital statistics compiling office *(law)* Low human resource capacity in vital statistics compiling office *(human resource)*	The fact that the NSO is intensely involved in the assessment exercise points to the fact that it has already decided to initiate action for establishing a vital statistics system In some countries a memorandum of understanding may be enough, and a separate legal provision may not be required for transmission of data from the civil registration system to the NSO
	The country produces vital statistics, and therefore there are no performance issues with this KPI		The country may have performance issues related to quality, timeliness and adherence to international standards. These have been dealt with in the other two KPIs
If the country produces an annual vital statistics report, does it meet the quality standard, and is it produced on time?	The vital statistics data and reports are not compiled according to the quality standards. Vital statistics are produced with a lag of three years	Lack of quality and metadata management during data collection *(management)* Registration staff have not been trained for the past five years, and there are no SOPs *(human resources)* The process of transmission of data from the registration center to the NSO is multilayered and inefficient. Having more than one agency involved at the field level causes a lot of delay and duplication *(process, coordination)* Absence of routine monitoring systems and follow up resulting in delay *(management)* Inadequate IT infrastructure at lower levels of administration is a major roadblock for digitisation *(information technology)*	These root causes are not necessarily exhaustive, and there can be other reasons for poor performance with regard to this KPI Quality and metadata management are part of the overarching process of the VSBPM The internal workflow in movement and handling of registration forms within the local registrar's office and the district offices can also provide clues about what is delaying data from reaching the NSO
If the country compiles an annual vital statistics report, does it produce all the tables recommended by the UN?	The country compiles only a few recommended tables and publishes them	Not all core statistical topics recommended in the list in the P&R are collected through the registration declaration forms *(management)*	The root cause analysis here does not use the fishbone, nor is it achieved by reviewing the current business process. This is about comparing topics included in the declaration forms and with those listed as core topics by the UN In fact, this exercise would already have been completed by the NSO technical support team as a part of its advance preparation

Specify Needs

Unlike the Evaluate phase, all the subprocesses in this phase will have to be initiated within the NSO, as these are aimed at defining the technical requirements for data collection to produce quality, timely, standard-based vital statistics. These data collection requirements will include data items, their definitions, the associated metadata and the periodicity of transmission of data from the civil registration agency to the NSO. It is in this phase that the NSO gets an opportunity to align the proposed vital statistics system with international standards, concepts and best practices. However, the trigger point for data collection is located within the domain of the civil registration system. Therefore, the NSO must closely collaborate with the civil registration agency to systematically assimilate the (re)designed data collection instruments and processes into the civil registration system. The AAR exercise of the CRVS Systems Improvement Framework provides the opportunity to advocate for and secure a broad agreement among all stakeholders with regard to the proposed data collection instruments and (re) designed business processes for transmission of statistical data to the NSO. The three KPIs used in the AAR exercise for the vital statistics component will help in reaching a consensus among the stakeholders around the new approach. However, the tools and processes of data collection and the business process to be adopted for their transmission will be finalized during the (Re)Design when the CRO and NSO work together, in collaboration with the health ministry, to firm up the finer details.

2.1: Identify data needs: In this subprocess, the NSO will have to identify the statistical data items that it would like to have collected for vital statistics purposes. This will mainly be guided by the national need and/or the statistical items recommended by the UN[23] , which also identifies those that are considered to be the core. This list is recommendatory in nature, and it is up to a country to decide its own list, depending on the country context. The likely factors that would weigh in on the selection of statistical data items are the current functional efficiency of the CRVS system and the present status with regard to its organizational capabilities in terms of the legal framework, human resources and information technology. A country that has not produced any vital statistics from civil registration in the past may want to make a modest beginning by identifying as many data items as practicable at the first instance and raise its level of ambition in the subsequent iterations based on the experience it gains in its initial or previous attempt. The technical support team within the NSO will prepare the initial list of statistical data items for further discussion and consultation before arriving at a final proposed list. This proposed list will be part of the technical note, which will be used by NSO representatives participating at different working levels in the CRVS improvement process.

2.2: Consult and confirm needs: This subprocess focuses on consulting with the internal and external stakeholders and confirming in detail the needs the vital statistics based on civil registration. A good understanding of user needs is required so that the NSO knows not only what it is expected to deliver, but also when, how and, most importantly, why (Choi, 2021). This will be achieved through a data users' meeting convened by the NSO in which all the aforesaid information, including the proposed plan for the revamping of the vital statistics system, will be presented. Data users would usually include policymakers, administrators, senior program managers from the health sector, statisticians, academic institutions, local development partners, NGOs and civil society organizations, and individual researchers. Although the CRO is the provider of data needed for the production of vital statistics, it is recommended to invite members of the NCT to participate in the meeting to learn and appreciate the importance of collecting quality data and transmitting them to the NSO on time. The final technical note, to be developed by the technical support team, will be suitably adjusted based on input from the data users. The technical note will, as mentioned before, constitute the brief that NSO representatives use to engage in a consistent manner at all levels of implementation of the CRVS Systems Improvement Framework.

23. Pages 18-23, *Principles and Recommendations for a Vital Statistics System*, revision 3 (United Nations, 2014). (See data items marked in bold.)

2.3: Establish output objectives: This subprocess identifies the statistical output objectives that are required to meet the user needs identified in subprocess *2.2 Consult and confirm needs*. It includes agreeing on the suitability of the proposed outputs and their quality measures with users. Outputs from the vital statistics system have the potential to serve several objectives. Simple counts of vital events for different administrative levels helps the government carefully plan for building various facilities such as hospitals, maternity centers, and burial or cremation grounds. Indicator-based statistics such as birth rate and infant mortality can be used to monitor various development goals, including the Sustainable Development Goals (SDGs), particularly in the health sector. The fertility and mortality data produced in the form of statistical tables are useful for policymaking and planning in the area of public health. Data on causes of death provide measures on cause-specific mortality rates that help in targeting evidence-based health interventions. Anonymized (without identifiers) unit-level data files can also be an important output that can be shared with researchers for sociodemographic and epidemiological research. Therefore, the NSO, as a part of its consultation exercise with data users, will have to highlight the objectives of each of the proposed outputs and seek an agreement on their suitability. The NSO also has to alert the users about quality considerations of the outputs and define specific indicators to asses their quality. For example, completion rates of registration of various vital events can be considered as one of the important measures for quality of the outputs.

2.4: Determine data concepts and descriptions: This subprocess determines the concepts and description of the statistical data items (referred to as variables) to be collected via the forms/registers used for data collection for registration within the civil registration system. The variables that could be derived from these data items are also determined and defined in this subprocess. This exercise will be guided by the information available in the P&R (United Nations, 2014a), particularly for the data items that will be used for compilation of vital statistics. The data collection instrument[24] (which is essentially the declaration/application form) would include data items that are used for legal purposes, statistical purposes or both. For example, sex of a newborn or the deceased is not only collected for legal purposes but is also an important data item that will be needed for producing vital statistics by sex. Annex 4 provides a list of data items recommended for inclusion in the registration form, the purpose (legal/statistical), and describes the definition and concepts, as well as their use. The NSO should share the output of this subprocess in the data users´ meeting and seek inputs. The technical note prepared by the NSO must include clear descriptions and concepts for each of the data items proposed for inclusion in the data collection instrument (as outlined in subprocess 2.2). This information will be useful background for the NSO representatives who are implementating the CRVS Systems Improvement Framework as they advocate for certain data to be included and build consensus among the stakeholders around the need to include the proposed data items in the civil registration data collection instrument. This subprocess will also provide the necessary input for developing the metadata for the sake of common and consistent understanding and application across all phases of the VSBPM. The finer details on various other aspects of data will be dealt with in the subprocess *3.6 (Re)Design collection.*

2.5: Decide periodicity of data collection: This subprocess dictates the periodicity of data transmission from the civil registration system to the NSO. While registration data are routinely collected in the local registrar's office, the data needed for vital statistics purposes, which essentially are a subset of anonymised information collected on the registration form, are often not transmitted on a routine basis to the NSO[25]. It can vary from weekly to once a year[26]; delay in receipt of all forms by the NSO is a common phenomenon. This results in delays in the production and dissemination of vital statistics. The NSO, based on the nature of output objectives, should determine how often it wants to receive data. Although vital statistics are compiled on an annual basis and relate to the previous calendar year, a steady flow of regular data manually or electronically at shorter intervals helps the NSO initiate the process of cleaning up the data. The NSO in this subprocess should also establish a deadline for receipt

24. In some countries (for example, Bhutan and Tanzania), some of the statistical data items, such as birth weight, attendant at delivery, are collected through a notification form issued by the health facility/centre. These data are combined with other data collected through the declaration/application form for the same event to create a complete registration record for an event.

25. In the case of an online registration system, the statistical extract can also get transmitted to the NSO in real time, and therefore processed at more frequent intervals.

26. Yearly transmission is usually seen in countries where the national civil registration office compiles an electronic data file consisting of all the relevant data for the previous calendar year and transfers it in one go to the NSO before the set cutoff date.

of forms. Final annual tabulations should be made on the basis of data received before a specified cutoff date. The national cutoff date should be set based on the legal length of time allowed for registration by type of vital event and the number of offices with the civil registration through which the data travel to reach the NSO.

It is evident from the discussions above that this phase of the VSBPM is about advanced in-house technical preparations that the NSO must undertake to ensure that it is ready to effectively and efficiently leverage the opportunity presented to it as a key stakeholder in the process of overall improvement of the CRVS system. The technical note to be prepared by the technical support team of the NSO, through internal and external stakeholders (data users), should include all the important aspects in detail as discussed in the subprocesses under this phase and also some more that would be discussed in the subprocesses of the (Re)Design phase. It should essentially be a complete package of technical requirements that will be made available to the NSO representatives who are expected to participate in the implementation of CRVS Systems Improvement Framework at various working levels. The NSO should organize an internal workshop to acquaint its representatives with the various details included in the technical note. Annex 3 provides an outline of the contents of said technical note.

The instrument for collection of registration data and the business processes of data flow through the civil registration hierarchy to reach the NSO will make up a significant part of the consultation during the AAR Stage of the CRVS improvement process. Therefore, some of the subprocesses within the Specify Needs and (Re)Design phases that the NSO had already finalized are likely to be reopened for discussion. For example, the CRO may not agree with all the data needs proposed by the NSO due to resource constraints. This is why some of the subprocesses within these two phases have been included in blue boxes (see Figure 1), as final decisions on these are not fully within the domain or control of the NSO.

(Re)Design

The focus of this phase is to design or redesign the existing vital statistics system based on the findings of the evaluation[27] and requirements identified during the "Specify Needs" phase. In countries where no vital statistics system exists at all, this phase is about designing such a system, and the process will begin with the "Specify Needs" phase. The implementation of the subprocesses of the previous two phases will have identified the root causes responsible for the limitations in the vital statistics system as well as provided the NSO with the opportunity to specify its requirements, finalized through a process of wider consultation. While some of the subprocesses in this phase are completely under the domain of the NSO, the others have to be implemented as a part of the (re)design exercise of the CRVS Systems Improvement Framework. For example, on the one hand, subprocess *3.7 (Re)Design processing and analysis* can only be implemented by the NSO. On the other hand, the subprocess *3.6 (Re)Design collection*, among other things, will include designing the data collection instruments as one of the activities, which can only be done jointly with the CRO and in some cases with the health ministry. Developing strategic and action plans (S&AP) will be part of this phase, one for the overall improvement of the CRVS and another specifically for the improvement or establishment of the vital statistics system.

3.1 Develop potential (re)design ideas: This subprocess is practically the next step following subprocess *1.5 Analyze root causes* of the Evaluate phase. All the subprocesses in between are largely about the back-end preparations that the NSO has to make in order to ensure that the potential (re)design ideas take into account all the requirements articulated in their internal technical note (see Annex 3). The NCT, based on the reports received from the thematic teams, will develop potential (re)design ideas using the

27. In countries where a new digitized system is being introduced and no changes in data collection or statistical output are envisaged, this phase will mainly entail subprocess *3.7 Design processing and analysis*.

CRVS-SAR tool[28] . Although updating the CRVS-SAR tool will be the primary responsibility of the NCT, the thematic team leaders or others who were involved in the field assessment may be brought into the process if needed. The lead of the thematic team on vital statistics should participate and contribute to the discussion on (re)design ideas for improvement of the vital statistics system. The potential (re)design ideas will have to address all root causes identified on performance issues related to the various KPIs. The root cause categories point toward the areas that need attention. For example, if the legal framework is in the root-cause category, it would be necessary to brainstorm on the existing provisions of the law and suggest necessary changes. Similarly, if the process itself is a root cause, there will be a need to review the as-is BPM and propose changes in the processes to ensure that the as-desired BPM takes into account these changes. It would be important to note that more than one redesign idea may have to be suggested to address a single root cause. For example, if an inappropriate business process is identified as the cause of delay in transmission of statistical data from the CRO to the NSO, the redesign may include both the modification of the process by introducing information technology, and amendment of the law to make provisions for implementation of the newly designed process. Table 6 provides examples of the possible redesign ideas included in the CRVS-SAR tool against all root causes identified in the example provided in Table 5.

Table 6: Example of a CRVS-SAR tool filled in with information performance issues against each vital statistics related KPI, identified root causes, and their categories and (re)design ideas*

KPI	Performance issues	Root causes and their categories	Re)design ideas
Does the country produce an annual vital statistics report based on civil registration records?	The country does not produce any vital statistics report based on civil registration records	The registration levels of vital events are extremely low, and therefore no attempt has been made to compile vital statistics based on incomplete data *(management)*	A new vital statistics system must be established, with a clear roadmap
		The civil registration law does not provide for transmission of statistical records to the NSO *(law)*	Change the law to clearly define roles and responsibilities for transmission of statistical records and compilation of vital statistics Simplify the process for transmission of records
		Statistical records are not transmitted to the NSO *(management)*	Explore digital transfer of statistical data items
		Low human resource capacity in the vital statistics compiling office *(human resource)*	Build staff capacity for the vital statistics compiling office
	The country produces vital statistics, so there are no performance issues with this KPI		

28. See Section *3.10 CRVS Process redesign* of the CRVS Systems Improvement Framework for detailed description of the redesign steps (Vital Strategies, et al., 2021).

(Cont) Table 6: Example of a CRVS-SAR tool filled in with information performance issues against each vital statistics related KPI, identified root causes, and their categories and (re)design ideas*

KPI	Performance issues	Root causes and their categories	Re)design ideas
If the country produces an annual vital statistics report, does it meet the quality standard, and is it produced on time?	The vital statistics data and reports are not in line with the quality standards. Vital statistics are produced with a lag of three years	Lack of quality and metadata management during data collection *(management)*	Orient the civil registration staff at the local level to the importance of statistical data items and the need to ensure quality Orient the staff in health facilities/centres who are involved in issue of notification of events Build quality checks at the time of data entry in the case of online registration to reduce error Ensure that the vital statistics compiling office provides feedback at various levels to the registration offices on the common types of errors Establish a data quality management framework with associated indicators
		Registration and other related staff have not been trained for the past five years, and there are no SOPs *(human resources)*	Institutionalise regular training program for staff at various levels using standard training materials, and develop SOPs
		The process of transmission of data from the registration center to the NSO is multilayered and inefficient. There's more than one agency involved at the field level, which causes a lot of delay and duplication *(process, coordination)*	Institutionalise coordination mechanisms at all levels
		Absence of routine monitoring systems and follow-up results in delay *(management)*	Establish a routine performance monitoring system that includes indicators related to completeness and timeliness of registration and that tracks transmission of statistical data from registration centers
		Inadequate IT infrastructure at lower levels of administration is a major roadblock for digitisation *(information technology)*	Explore the possibility of leveraging IT infrastructure throughout other agencies Explore public-private partnerships in digitisation
If the country compiles an annual vital statistics report, does it produce all the tables recommended by the UN?	The country compiles only a few recommended tables and publishes them	Not all core statistical topics recommended in the list in the P&R are collected through the registration declaration forms *(management)*	Modify the declaration/registration form to include data items from the priority list of the P&R for Vital Statistics Explore the possibility of collecting a few statistical data items through the notification form issued by health facilities/centres to reduce the reporting burden on the parents/family

3.2 Design as-desired Business Process Map: The NCT, along with the other members who worked on the (re)design ideas, will have to develop the desired CRVS process descriptions and maps. To develop the desired process map, the team may decide to modify the as-is process map by introducing (re)design ideas or creating the process map from scratch. Before creating the process map, the team should update the process description. The development of a redesigned or a newly designed (for countries where no vital statistics are yet compiled) process[29] map for collection and transmission for statistical data should be jointly undertaken by the members representing the CRO, NSO and health ministry where necessary. The collection of data at the time of registration and the transmission of the statistical part of the collected data to the NSO, fall under the sphere of control of the CRO. However, several potential (re)design ideas falling within the realm of the civil registration can have an impact on the timeliness and quality of statistical data that will be transmitted to the NSO. Therefore it is imperative that some of the NSO representatives on the team work closely with members of the CRO team to identify (re)design ideas for most of the client and service-provider-centric KPIs. Examples of some of the potential (re)design ideas and their impact on the vital statistics are given in Table 7.

Table 7: Impact of (re)design ideas on vital statistics

KPI	(Re)design ideas	Impact on vital statistics
Estimated average distance to a registration service	Change process to use community health workers, village chiefs or village-level workers to facilitate declaration and send the completed declaration forms to the registration service	Improves quality of vital statistics in terms of coverage and timeliness
Average waiting time to register an event after the declaration is made	Explore digitisation of the registration process	Improves timeliness of vital statistics as transmission of statistical data is faster, and its transmission in electronic data file helps lessen the burden on the NSO
Number of corrections made per 100 registration records	Develop SOPs that will include a detailed description of the concepts and importance of each of the data items in the registration record and the possible sources of errors and how to guard against them	Improvement in collection of data at the local registration center will help improve the overall quality of vital statistics
Percentage of the population seeking to register who are aware of the importance of registration	Develop a communication strategy with appropriate messaging	Will improve quality of vital statistics in terms of coverage
Cost of registration—separately for birth, death and marriage	Amend law to make registration services free	Will improve coverage of vital statistics
If the country compiles an annual vital statistics report, does it produce all the tables recommended by the UN?	Modify the declaration/registration form and notification form (if required) to add data items that are not included from the priority list of the P&R for Vital Statistics	Will help produce all tables recommended by the UN

The (re)design of the business process for collection and transmission of statistical data will depend on the decision of the NCT on the extent of modernization that it would like to propose as part of its (re)design. The level of digitisation and outreach of IT infrastructure, and if use of mobile technology is planned, its outreach and reliability are crucial considerations. Some countries may also opt for a mixed approach. Table 8 gives the as-desired process description corresponding to the example of as-is process description given in Table 4

29. See Section 4.10.3 of the CRVS Systems Improvement Framework (Vital Strategies, et al., 2021).

Table 8: Process description for as-desired business process for collection and transmission of statistical data

Name of the process	**Collection and transmission of statistical data from CRO to NSO**
Process actors	Civil registrar, district/provincial-level civil registrar, NSO
Process purpose	To ensure that statistical data are collected and transmitted to the NSO for timely production of vital statistics
Trigger	Civil registration of a vital event
Process flow	1. *Vital event registered* 1.1 Civil registrar enters the information obtained through the declaration form in the centralised online IT system* 1.2 Civil registrar completes registration of the vital event 2. *Statistical data is transferred to NSO* 2.1 National CRO prepares the data every month in an agreed-upon format containing relevant data to be used by the NSO for production of vital statistics 3. *NSO receives the statistical data, then produces and disseminates the vital statistics report (subprocess)*

* In countries where some of the information is collected through notification issued by the health facility/centre but not included in the declaration form, the civil registrar enters the information from both the forms into the digital system as a combined registration record for one event.

The above as-desired process description shows how establishing an online registration system at the local level can reduce delays in transmitting data to the NSO. However, constraints on financial and organizational capabilities may make it impossible for countries to replace a paper-based registration system with an online system in one go. A system may have to be implemented in a phased manner across the country. The BPM corresponding to the process description in Table 8 is given in Figure 6 below. It may be noted here that the workflow within the NSO for the production of vital statistics may have to vary due to the change in the as-desired process. For example, if an NSO that received statistical data in paper format previously now starts receiving the data in electronic format because of changes to the business process, the internal workflow process must change accordingly.

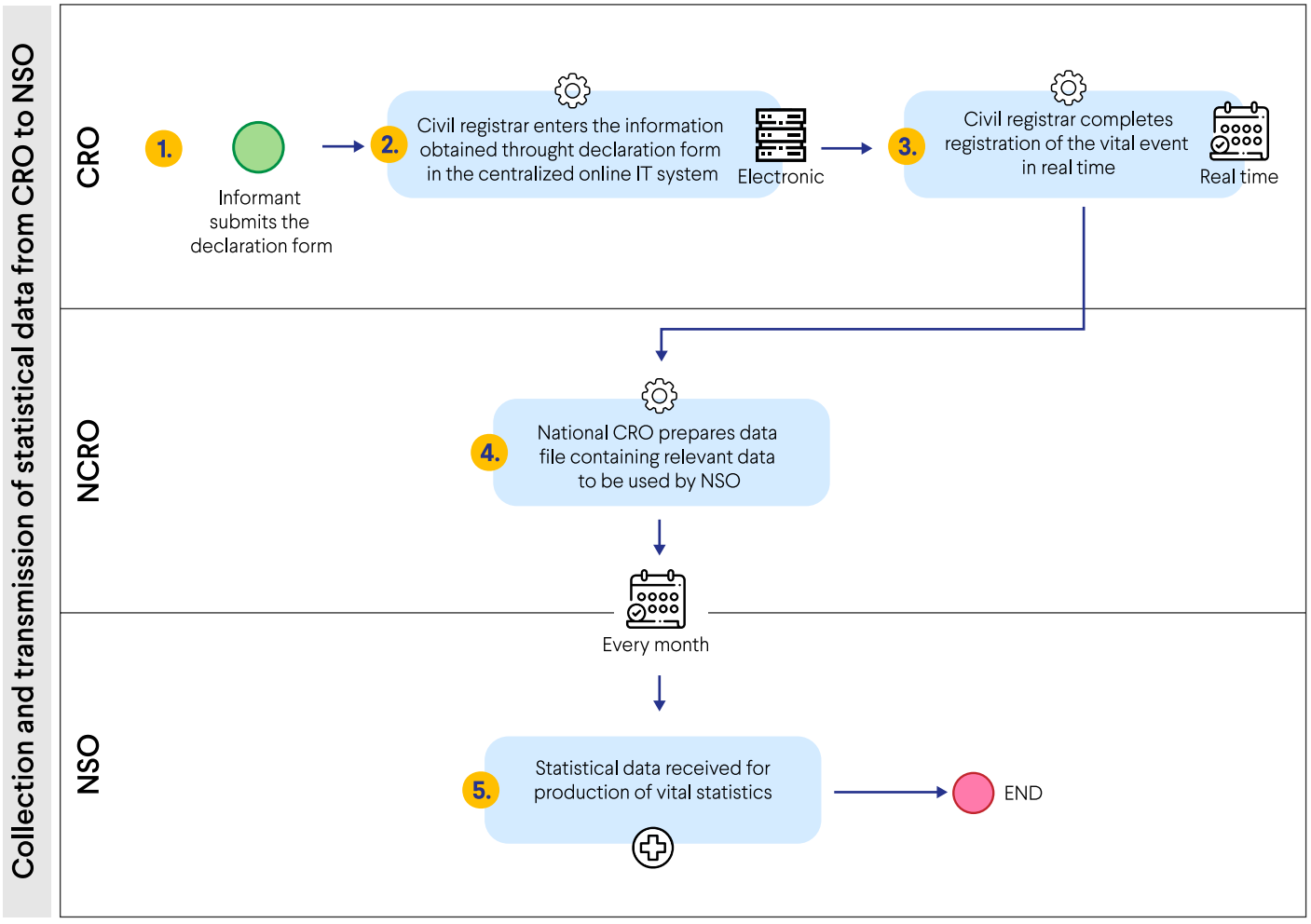


Figure 6: Description of as-desired business process for collection and transmission of statistical data using a BPM software

3.3 Develop S&AP for CRVS improvement: The preparation of S&APs for the improvement of a CRVS system will be initiated only after the AAR report is approved at the appropriate levels of government. The NSO representatives in the NCT should make sure the (re)design ideas, including the recommendations related to improvement of the vital statistics system, are suitably reflected in the report. In Section 4 of the CRVS Systems Improvement Framework, *Stage 2: Development of the strategic action plan* provides step-by-step instructions on how to develop the plan for overall improvement of the CRVS system. This overall plan may include a specific subplan for vital statistics, which will be prepared under the guidance and advice of the representatives of the NSO participating in the planning exercise. The strategic goal of the vital statistics subplan will be articulated—for example, "produce and disseminate timely and quality vital statistics". Several mutually exclusive and exhaustive outputs will be identified, which when delivered should achieve the aforesaid high-level objective of the subplan. While some of these outputs will fall within the realm of the CRO, others can only be delivered by the NSO. Outputs and activities that completely fall under the control of the NSO may not be included in the plan for improvement of the CRVS system as a whole. Therefore, the NSO has to develop its own improvement plan with the goal[30] of producing and disseminating timely and quality vital statistics based on civil registration records. The plan for the vital statistics developed by the NSO should encompass all the outputs of the vital statistics subplan, including those of the overall plan, for the sake of completeness as well as for efficient management and follow-up. The details with regard to such a plan are discussed in subprocess *3.4 Develop S&AP for improvement of the vital statistics system*. Table 9 summarises the discussion for better perspective and understanding of the two plans and their interconnectedness.

30. The strategic objective of the vital statistics subplan of the main S&AP becomes the goal for the separate plan that the NSO will develop later.

Table 9: Plans for the overall improvement of the CRVS and vital statistics systems and their interconnection

<table>
<tr><td colspan="4">Vital statistics subplan of the overall improvement plan of the CRVS system</td><td colspan="4">Plan for improvement of vital statistics system</td></tr>
<tr><td colspan="4">Strategic goal: “Produce and disseminate timely and quality vital statistics”</td><td colspan="4">Strategic goal: “Produce and disseminate timely and quality vital statistics”</td></tr>
<tr><td colspan="4">Examples of outputs</td><td colspan="4">Examples of outputs</td></tr>
<tr><td>Newly designed declaration form and/or registerion data collection instrument introduced</td><td>Established online registration system in a phased manner</td><td>Contents in the data collection instrument aligned with the UN priority list</td><td>Report on the legal review obtained and examined</td><td>Monitoring framework for tracking flow of statistical data established</td><td>Template for the annual vital statistics report finalized</td><td>Data quality management framework established</td><td>Strategy and action plan for dissemination of vital statistics report finalized</td></tr>
<tr><td colspan="4">Lead agency: NSO and CRO jointly
Main support agencies: health department and relevant development partners</td><td colspan="4">Lead agency: NSO
Main support agencies: CRO, health department and relevant development partners</td></tr>
</table>

3.4 Develop S&AP for improvement of the vital statistics system: In this subprocess, a separate plan is prepared by the NSO for improvement of the vital statistics system[31]. Table 9 shows how the vital statistics subplan is nested within the improvement plan for the overall CRVS system. The NSO will have primary responsibility for developing the vital statistics improvement plan and delivering on all outputs. Some of those outputs are related to the collection and transmission in collaboration with the CRO (as seen in the subplan in the left section of Table 9), and others, such as production and dissemination of vital statistics, are for the NSO (as seen in the right section of Table 9). A country may decide to include all the outputs related to vital statistics as part of one vital statistics improvement plan instead of developing a separate subplan. In such situations, the NSO must involve the CRO, ministry of health and other relevant stakeholders during the planning exercise, since the execution of a number of outputs related to (re)design of the collection of statistical data and its transmission to the NSO fall well within the domain of the civil registration system. An exclusive plan for improvement of vital statistics may be easier to monitor through one M&E plan. However, it will be essential for the NSO to report to the TWG and high-level steering committee on the progress made against the KPIs related to vital statistics as given in Table 3.

The plan for vital statistics improvement will include all outputs related to the design and execution of collection, production and dissemination of vital statistics. Examples of notations include “data collection instrument finalized”; “all registration functionaries trained on the procedure of registration, including use of new formats for data collection’; ‘edit rules and routines finalized”; “tabulation plan for annual vital statistics report finalized”, and so on.[32] The plan also needs to be costed starting from the activity level, adding up to the outcome levels, and finally to the project level. A costed vital statistics improvement plan helps mobilize resources in a systematic fashion.

3.5 (Re)Design outputs: There are three types of outputs that will have to be designed in advance by the NSO. These are a) simple counts of vital events registered and their levels of completeness; b) a vital statistics tabulation plan and a template for an annual vital statistics report; c) a format for release of unit-level data. The first output is about counting the number of vital events registered and measuring their levels of completeness in a systematic and regular manner. The purpose of this is

31. There can be other sources from which vital statistics can be derived, such as population census or demographic surveys. However, in this case the vital statistics system referred to is the one that is based on civil registration.

32. The term finalized here would mean that the data collection has been designed and tested for use. It would mean the same for other outputs as well.

to monitor registration performance at all administrative levels, starting from local registration offices up to the national level. Although the performance monitoring of registration is a routine CRO activity, it would be appropriate for the NSO to assist the CRO in designing the related outputs, including the format, methodology of compilation, and interpretation of the results. The NSO is also responsible for providing the necessary denominators for the calculation of completeness levels. For fully automated registration systems, standard geographic codes of various administrative levels have to be used for both the civil registration operations and the compilation of vital statistics to facilitate interoperability between the two.

The annual tabulation plan will have to be developed in accordance with those recommended in the P&R[33]. The number of standard tables to be included in the plan, however, will depend on the type and number of data items collected at the time of registration. The NSO will also have to design a template for the annual statistical report. In this regard, it will be beneficial to use the guidance document on preparation of vital statistics reports developed by UN agencies and other organizations (Vital Strategies, et al., 2020). The guidance includes a detailed structure of the report and the descriptions of the contents of the various chapters.

Some NSOs may be interested in sharing individual-level vital records for statistical research. In this case, the NSO should refer to the Handbook on Policies and Protocols for the Release and Archiving of Individual Records (Department of Economic and Social Affairs, Statistics Division, 1998) that will help establish processes governing access to any confidential records. The Handbook recommends policies/protocols governing the release of individual information on vital records for research and statistical uses.

The design of the products for the dissemination of outputs described above and the tools to be used for dissemination will be finalized in this subprocess. These dissemination tools will include published reports, statistical tables available on the NSO website, and unit-level data through downloadable files. The NSO may also want to disseminate important insights and analysis in electronic form or through brochures and pamphlets and develop the basic design structure of these products.

3.6 (Re)Design collection: This subprocess is about (re)designing appropriate data collection instruments and methods of collection. It will also include the method and format of transmitting statistical data to the NSO. The basic data collection instrument is the declaration form signed by the informant, which invariably in all cases is a paper document signed by the informant designated under the law and submitted to the local registrar for registration[34]. The declaration form usually has three sections as shown in Table 10 below.

Table 10: Three sections of the declaration form

Geographic location	Names of the province, subprovince, village/city/town and geographic codes; location of the registration center and code
Legal information	For example, name of the newborn or deceased, sex of the newborn, name of the mother
Statistical information	For example, age of the mother at time of birth, birthweight, educational level of the mother
Some of the information collected for legal purposes will also be required for statistical purposes. For example: sex of the child or deceased person, date of child's birth, date of deceased's death	

The declaration form, which is the primary instrument for data collection, can either be used for registering the event manually in a paper-based register, or digitally, either online or offline. In some cases, the registrar, having registered the event manually, would transmit a copy of the register to the next administrative level where the data can be digitized. Countries may have different processes depending on their respective legal provisions, registration organization and management, and level

33. See Annex II - Annual tabulation programme of vital statistics compiled from civil registration data (United Nations, 2014a).

34. As discussed earlier, some countries may want to collect some of statistical data items through the notification form issued by health facilities/centres. These would usually include information such as birthweight, attendant at delivery, live birth order. Therefore, there can be more instruments which can be used for collection of statistical data for the same event.

of computerization[35]. For any variant of the (re)designed process, there will have to be a stage during which the statistical information gets transmitted to the NSO. The format (manual or digital) by which the statistical information gets transmitted from the administrative level to the NSO[36] in the as-desired business process will influence the design and layout of the data collection instruments. Therefore, the NSO has to work jointly with the CRO in (re)designing the collection instrument as well as the format in which the data will be transmitted to the NSO. This exercise, though seemingly innocuous, can have an impact on the production of vital statistics in terms of quality and timeliness and thus needs the NSO's serious attention. For the CRO, the design considerations should, among other things, include reduction of local registrars' workload, and optimal use of paper and storage space.

The other important aspect of the data collection (re)design lies in monitoring data flow from the CRO to the NSO. The monitoring system should take into account the mode and periodicity of the data flow. For example, the transfer can be manual or electronic, and the periodicity can range from once a year to as it happens. Further, the administrative level within the CRO that transmits data to the NSO is also an important consideration when designing a monitoring system. The system, once established, will contain information on the transfer points within the CRO that have submitted statistical data within the prescribed time and will follow up with others that have missed the deadline. Receiving data from transfer points at national or subnational registration offices does not necessarily mean that data from all registration centers within their jurisdiction need to be included, as some of them would not be expected to submit data. Missing statistical data from even a few registration centers can affect the quality of vital statistics. Therefore, the monitoring system should be designed to identify the registration centers that have not submitted data so the CRO can follow up.

While the form's content would already have been finalized in the Specify need phase, it would be crucial to frame the questions in the data collection instruments so that they are easily understood by the informants and can easily be explained by the local registrar. The clients must understand clearly how the information will be filled in, and if required, there should be a brief instruction on the back of the form or displayed in a prominent place in the registration center. Some of the statistical information on the form may be pre-coded. For example, education level of mother, or type of attention at delivery.

One of the statistical outputs identified in subprocess *3.5 (Re)design* outputs is the simple count of vital events registered and their levels of completeness, which will have to be produced on a regular basis. This output will be used by the CRO at various administrative levels to monitor performance. A separate collection instrument may be needed to obtain the data from each registration center on a regular basis (preferably every month). This will include a simple count of the number of events registered in the month in three categories: a) number of events registered within the legally stipulated time; b) number of events registered on and after the legally stipulated time but within one year of occurrence (late), and c) number of events registered on and after one year of occurrence (delayed). This categorization is based on recommendations in the P&R. These data will help the CRO monitor the performance of each of the registration centers as well as those at the district, province and country levels. The CRO can also include these indicators when evaluating the performance of the CRVS system as part of the ministry's annual report.

Geographic location codes are used to compile vital statistics by place of registration as well as by place of usual residence. Therefore, use of standard geographic location codes is an important part of the (re)designing exercise of the instrument and method of data collection, particularly when the plan is to share data electronically between the CRO and the NSO. For the CRO, each local registration center should be uniquely identified by a number and mapped with the geographic location code in which it is situated. Availability of standard geographic names and codes is a big challenge in many countries, and there may not be an agency that maintains and updates it. In such situations, the CSO and NSO may have to use the geographic names and location codes from the latest population census exercise, and they will have to be updated at pre-

35. There are countries where the statistical data is sent to registration offices manually, to the subnational offices of the NSO. In some countries, these subnational offices not only input the data into the local computer, but also produce vital statistics as per the specified tabulation plans. The NSO receives the tables from all these subnational-level offices and aggregates them to compile annual vital statistics at the national level. This document does not include the above-mentioned variant and only takes into account the situation where the record level data flows to the NSO office electronically, either directly or through electronic batch files received from subnational civil registration offices.

36. In some countries, the as-desired process may entail transferring statistical data from the province-level CRO to the province-level NSO, instead of at the national level.

decided intervals, taking into account changes in administrative boundaries. The geographic frame, a format in which the geographic coding system should be maintained and used by the CRO and NSO, is given in Table 11 below.

Table 11: Geographic location coding system and linkage with registration centre

Province name	Province code	District name	District code	Village/city name	Village/city code	Registration center name	Registration center code

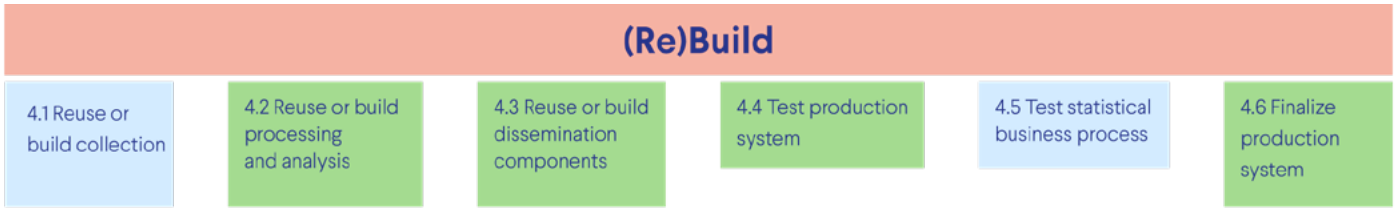
3.7 (Re)Design processing and analysis: In this subprocess, the statistical processing methodology that will be used in the Process and Analyze phases will be designed. This will include the development of coding, editing, and imputation rules and routines required for cleaning the data before they are used for statistical compilation purposes. The extent and method of coding will depend on the design of the data collection instrument and the mode of collection. For example, some data items in the instrument may already be pre-coded, such as sex of the newborn or deceased, education level of the mother, type of attention at the delivery, etc. In the case of online registration, some of these data may pick up codes that are stored internally or are under the drop-down menu of the data entry module that's used for entering registration data. Geographic location codes are some of the important parts of the statistical data set, as without them it would not be possible to provide vital statistics at various administrative levels. While the geographic locations for the place of registration can be coded in the data collection form by the civil registrar (as these will be presupplied to them), the other geographic information collected on the form (to be used for tabulations) will have to be coded by the NSO when the data are entered.

The edit rules have to be designed in advance, which again will depend on the mode of data collection. For example, in the case of online data collection, some edit rules will have to be integrated into the data entry module as checks for initial consistency and range in the registration centres. This would essentially require the NSO to work closely with the CRO in developing the data entry module of the software for online registration. However, once the statistical data set is transferred out of the civil registration domain to the NSO, it would be neither practical nor desirable to return the erroneous forms to the CRO for correction, since the error may have been on the part of the informant and gone unnoticed. The edit rules have to be developed while keeping in view all possible types of errors. In some cases it may be necessary, as a part of the edit rules, to build imputation rules, which essentially assigns a probable value to an item whose true value is unknown.

The subprocess should also include designing the rules and process of validation of results before they are disseminated in the public domain. These may entail validating results against other sources and past trends. Some external data sets may be required for analysing and calculating certain indicators. For example, calculation of crude birth rate will require data on the midyear population, and age-specific fertility will need data on the number of women in five-year age groups in the reproductive period (15-49 years), data sets that must be obtained from other sources, such as population projections.

Although the subprocesses (Re)design ouputs and (Re)design collection are included in this phase, the actual formats for the outputs and the instruments for data collection will be designed and finalized in the Build phase when more technical deliberations take place between the CRO and NSO. Similarly, the subprocess Design processing and analysis, though included as a part of the (Re)design phase, will be implemented in the actual Processing phase.

(Re)Build



"This phase builds and tests the production solution to the point where it is ready for use in the live environment. The outputs of the Design phase are assembled and configured in this phase to create the complete operational environment to run the process" (Choi, 2021)[37]. In countries where the vital statistics are already being compiled, this phase is about rebuilding and testing the production process based on the new design. The introduction of a new digital civil registration system may also necessitate rebuilding the existing system of production and dissemination of vital statistics. While the first three subprocesses are about the development and improvement of data collection, processing, analysis and dissemination, the last three will focus on testing the end-to-end production process before starting the actual production. In this phase, the NSO will have to implement a number of activities that support the production of vital statistics (see GAMSO in Annex 2). These activities fall under two main categories—capability development and corporate support. Activities falling within capability development areas include planning capability improvements and developing capability improvement. Corporate-support activities are tasks such as managing quality, human resources, finances and IT[38].

4.1 Reuse or build collection instruments: In this subprocess, specifications of the data collection instruments are built based on the specification created in the (Re)Design phase in order to start using them during the Collect phase. It has been explained in the subprocess *3.6 (Re)design collection* that the collection instruments include the format in which the statistical data are transmitted from the CRO(s) to the NSO. Variations in design of the instruments and their considerations have also been discussed in subprocess 3.6. Since the data will be collected within and transmitted from the domain of the civil registration system, the collection instruments not only have to be designed but also must be built via a consultative process at the technical level between the CRO and NSO. Wherever required, the health ministry must be brought into the deliberations. In countries where the contents of the data collection instruments do not have to be changed, they may still have to be redesigned and rebuilt when an online system of registration or digitisation is going to be implemented based on a redesigned business process. The collection instrument for the regular information on the count of birth and death as a part of performance monitoring also has to be built. For a manual or semidigitised CRVS system, a separate format has to be designed and built for collection of the basic counts of vital events. But for an online system, the required data can be extracted from the electronic file that contains the registration data. This subprocess also includes preparing and testing the contents and functioning of data collection instruments.

4.2 Reuse or build processing and analysis components: The subprocess *3.7 (Re)design processing and analysis* focused on developing the rules and routines for coding, editing and imputations for cleaning of statistical data, along with the processes and rules for validating results before they are released to the public. In this subprocess, the actual software is developed and tested on a sample data set to ensure that all the coding and editing rules work as the design specifies. In countries where no major changes in the content and process are contemplated, many of the existing components will be reused. These processing and analysis components will be used in the Process and Analyse phases.

4.3 Reuse or build dissemination components: The subprocess *3.5 (Re)design outputs* focused on designing the three outputs—a) a basic count of vital events registered at regular intervals, b) an annual vital statistics tabulation plan, and c) microdata. In this subprocess, all the aforementioned outputs will be built using suitable application software or tools and tested for efficacy. The NSO may want to prepare a dummy vital statistics report based on a sample of data from a province or city for the previous calendar year. The report can include all the dummy tables designed as part of the tabulation plan

37. See page 16.

38. See GAMSO: Figure A. Annex. Activity areas, activities and examples of activities in the GAMSO (Willis-Núñez & Choi, 2021).

developed in the Design phase. The results of the dummy exercise can be reviewed by the NSO's technical support team before being recommended for use in the actual production process. The actual production of dummy tables using sample data will be done in subprocess *4.4 Test production systems*. The format, media and the tool to be used for dissemination of microdata will also be built and tested in this subprocess.

4.4 Test production systems: This subprocess tests the interactions and logical linkages between all the assembled components to ensure that the whole production solution works in a coherent way. The end-to-end testing of the production solution can be based on either a dummy data set or actual data obtained from one or more provinces or cities. The testing will begin from the point at which the data are received at the NSO and end with the production of all tables included in the approved tabulation plan. The technical support team or any other authorized group of technical experts within the NSO will not only have to sign off on the new programs and routines for each of the individual components of processing and analysis, but also will have to approve the whole production solution and recommend its use for the actual production. The testing should also ensure that the confidentiality procedures are in place, particularly when the data are electronically transmitted from the CRO to the NSO.

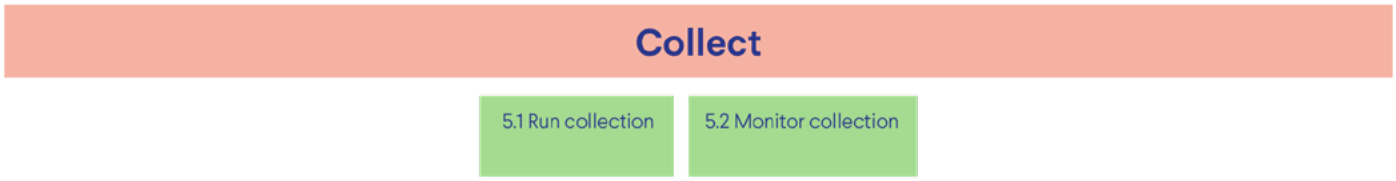
4.5 Test statistical business process: This subprocess is about pilot-testing the entire statistical business process, starting from the data-collection stage at the registration center using the newly designed data collection instrument, to transmission from the CRO to the NSO, and then processing and analysis. This can be done by collecting small-scale data through selected registration centers and transferring them to the NSO for data processing and analysis using the newly designed processes. Since the data collection instrument used at the registration center includes information to be used by the civil registration system for legal purposes, its testing must be undertaken jointly by the CRO and NSO. The health ministry should also be part of the consultation in case the notification is also used as an instrument of data collection. Following the pilot, it may be necessary to go back to a previous step and make adjustments to collection instruments, systems or components.

4.6 Finalize production systems: Activities in this subprocess will include a) producing SOPs and technical documentation, and b) training users of the system, including management. The CRO, NSO and health ministry must jointly develop the SOPs on collection and transmission of data for use of the local registrars and other civil registration functionaries. The SOPs will also include a detailed explanation of the relevance, as well as the concept and definitions, of all the data items included in the newly designed data collection instruments. The technical documentation will include a detailed description of all the components of the processing and analysis features, such as the rules for coding, editing and validation of tables. Training materials will be developed for all registration functionaries, including the local registrars, staff in health facilities/centres responsible for issuing notification, and NSO staff. An online registration system, if implemented, will require retraining the existing registration staff at the local level on the use of computers or mobile devices for data capture. Registration functionaries at all levels will need training to work on the new system. The introduction of new technology may also require designing and implementing special training sessions on change management.

CHAPTER 5

Phase 2 Collect, Process, Analyze and Disseminate

Collect



In this subprocess, the VSBPM moves from the Change work phases into the Ongoing work phases as referred to in Figure 2. In this phase, the actual data collection begins in the field using the redesigned data collection instruments followed by transmission of statistical data to the NSO. Data processing will be done in the next phase. Although the preparation for the transition into a live environment would have been completed in the previous phase, in terms of building and testing all the components as well as training staff, it will be extremely crucial to keep a close watch on the performance of each of the components when the first batch of data from the CRO(s) start flowing into the NSO in a live production environment. Monitoring data collection is a very important element of the collection phase.

5.1 Run collection: In this subprocess, the actual data collection is implemented. This will include a) collecting data at the local registration center using the redesigned instruments, and b) collecting statistical data by the NSO from the CRO using the newly designed format. The NSO in the (Re)Build phase will be ready to start receiving data from the CRO for production of vital statistics. The pilot testing of the newly designed statistical business process is completed in subprocess *4.5 Test statistical business process* using a small data set obtained from a few registration centers. In this subprocess, the new CRVS system will transition to a live production mode. The collection of data using the new instruments will have to be implemented throughout the country either simultaneously, or be phased in, depending on existing resources. The NSO will also start receiving statistical data in the new format from the CRO. Ideally, it will be important for the NSO to process and analyze the first batches of live data it receives to make sure all components of the production solution are working to its satisfaction. Countries that were already producing vital statistics are likely to face some disruption for the year in which the newly designed system is introduced unless the switchover is made simultaneously in all registration centers on Jan. 1. The annual vital statistics are produced for a calendar year, and starting data collection after that could limit the scope of statistical outputs[39] if two different (old and new) collection instruments are used within the same calendar year.

5.2 Monitor collection: The NSO would already have designed and built a monitoring system to ensure that the data from all the registration centers are received either directly or through the CRO(s) at the subnational or country level. The NSO has to not only monitor the receipt of data from the above-mentioned registration offices, but also must identify registration centers within their jurisdictions whose data have not been included for the specified period. In fact, the CRO(s) both at the national and subnational levels should be responsible for ensuring that all the registration centers within their jurisdiction provide the statistical data on time and for following up with the defaulters. In case of an online registration system or data obtained from the CRO in electronic form, it will be easier to monitor receipt of data online from each registration point. This online system can use the geographic location code to identify the defaulting registration centers. The NSO, based on the above-mentioned process, should follow up with the CRO to clear any reporting backlogs. If even one registration center is left out, the statistical record will be incomplete, and the number of vital events will be underestimated, reducing accuracy. Registration centers that have not registered even a single event should provide nil reports.

39. The statistical data items introduced in the data collection instruments cannot be used to prepare new tables for the year, as listed in the tabulation plan. The NSO has to continue producing tables from the previous version of the tabulation plan. In fact, the data processing rules and routines may also have to be adjusted to process the dataset received for the part of the year based on the previous collection instrument.

Process

In this phase, the input data is processed and prepared for analysis in the next phase. The input data is coded, classified and cleaned up using editing and imputation rules. It is then converted into data files that can be analyzed and disseminated as statistical outputs. The frequency in which that data will be processed will depend on the frequency of data flow into the NSO. In countries with online registration systems, the statistical data are also likely to be transmitted to the NSO as events happen and can therefore be processed daily or weekly. Since in most instances the statistical output is produced annually, the analysis is conducted after the cutoff date[40]. Countries producing monthly or quarterly statistical outputs will have to process data accordingly.

6.1 Classify and code: In this subprocess, the data items relevant for statistical purposes are classified and coded. The classification and coding rules are already designated in the subprocess *3.7 (Re)design processing and analysis* as a part of the (Re)Design phase and were tested and finalized in phase 4 *(Re)Build.* Some of the classifications are already preprinted into the data collection instrument and pre-coded. For example, sex of the newborn or the deceased may be classified as male, female or other with the codes 1, 2 and 3, respectively, and are printed on the data collection form. Similarly, other statistical data items, such as educational qualification and occupation of a newborn's mother and father, may be pre-coded and printed on the data collection form. For online registration systems, or for systems in which data are entered on a computer in an offline registration center or at the district/province level, the computer-assisted codes could be generated. It is highly likely that in a newly designed system, the NSO will receive the statistical data set only in electronic format, with all relevant data items already classified and coded in the subprocess *5.1 Run collection.*

6.2 Review and validate: This subprocess validates the input data received from the CRO. The data are reviewed according to the predefined validation rules and routines to identify potential problems, errors and discrepancies such as outliers, nonresponses and miscoding. The validation can be run in batches of data sets as and when they are received by the NSO, or annually after the specified cutoff date. In the case of online registration or data captured through a computer, some of the validation checks will be integrated into the data entry module to guard against obvious inconsistencies. For instance, the system could automatically refuse to accept a date of registration that precedes its date of occurrence. In addition, the computerized data collection module may not allow blank entry for any of the data items. The statistical data transferred to NSOs in electronic format is likely to be available in coded form and is expected to be fairly clean. Thus, processing the data may not require heavy editing and imputation. However, for systems that receive data recorded on paper and entered into a computer by the NSO, the onus of classification and validation shifts entirely to the NSO. While this subprocess is concerned with detection of actual or potential errors, any correction activities that actually change the data are done in subprocess *6.3 Edit and impute.*

6.3 Edit and impute: In this subprocess, data are edited and imputations are made using a rule-based approach. This will be applied to data found to be incorrect, missing or inconsistent. The incorrect and missing values in the data set will be imputed following a logical set of rules. After the editing and imputation of the dataset for a specified period (usually a calendar year) is complete, the data file will be finalized in the next subprocess. It is important to systematically document the extent and nature of imputations and corrections made while cleaning up the data. This is an important document for disclosure of quality of data, which if approved by the appropriate authority in the government, is released as an addendum to the vital statistics report. This document can also serve as feedback to the CRO with regard to the nature and extent of mistakes or inconsistencies in the data collected at the time of registration. Some very common mistakes should be identified and included in the training curricula of the registration functionaries as part of the module on the quality of registration data.

40. See detailed discussion on the cutoff date in subprocess *2.5 Decide periodicity of data collection.*

6.4 Finalize data files: In this subprocess, the results of all other subprocesses will be brought together to prepare a microdata file, which will be used as the input to the Analyze phase. This file will later be used in the Disseminate phase for preparing the output for release of unit-level data.

Analyze

In this phase, the statistical outputs are produced using the clean data file prepared in the Process phase. The statistical outputs will mainly be in the form of tables designed and approved in subprocess *3.5 (Re)design outputs*. These tables will be approved for release only after proper validation checks are applied. If the tabulation results fail the validation tests as defined by subprocess *7.2 Validate draft tables*, the NSO must return to the Process phase to recheck the editing and imputation logic and ensure that no bias has crept into the statistical outputs. Wherever necessary, technical notes and commentaries will also be prepared for better explanation of the tables. The tables produced will not just include aggregates of variables by characteristics or geographical levels but will also include rates and ratios, for example, crude birth rate, age-specific death rate, sex-ratio at birth, etc., wherever relevant.

7.1 Prepare draft tables: In this phase, the draft tables will be produced in accordance with the tabulation plan designed in the subprocess *3.5 (Re)design outputs*. Most of the tables will be simple aggregates of vital events by various characteristics and by geographical levels; for example, number of deaths registered by sex, age-group, by place of occurrence, and by place of usual residence. Cross-classified tables as proposed in the tabulation plan are also prepared—for example, live births by place of usual residence, age, and educational attainment of the mother. There are also tables derived from the basic tables of aggregates, using data from external sources. For example, crude birth rate and crude death rate are also provided as part of the analysis for which the denominator of mid-year population is derived from population projection data obtained from the NSO[41] .

7.2 Validate draft tables: In this phase, the NSO will assemble a team of experts to validate the draft tables. The team may comprise demographers, epidemiologists and other statisticians, including those working in the office. The team will develop rules and templates for validating each of the tables. It will also develop parameters for measuring quality and then assess the tables to make sure they comply with those parameters. The team will also use the quality disclosure document produced in subprocess *6.3 Edit and impute* as part of its quality review. The team members will also use the domain knowledge that they gained through their experience working in this area if and when required. The validation team will prepare a detailed technical note containing observations for each of the tables before either signing off on them or recommending reexamination. The observations in the technical note will include, among other items, quality notes for each of the tables.

7.3 Finalize outputs: This is the final subprocess before the outputs are released into the public domain. This subprocess will ensure that outputs in the form of tables, graphs, figures, etc., and unit-level data files fulfill their purpose, are of suitable quality, and are ready for release. After the validation team has cleared the tables for release in the previous phase, the NSO should start collating supporting information, including interpretation, commentary, quality statements and other necessary metadata. The NSO should organize the prerelease discussion with the technical support team and other subject matter experts.

41. For further details on the standard tabulation list, see Annex II of the P&R—Annual tabulation programme of vital statistics compiled from civil registration data (United Nations, 2014a).

In this phase, the files for the unit-level data to be shared with the users will also be prepared as per the agreed-upon design. If only a sample file of unit-level data is provided, it should be weighted accordingly and shared with the users. If the validation team finds a serious quality issue with any of the variables and does not approve any table related to it, the raw data file should also exclude those variables.

Disseminate

The tools to be used for dissemination of outputs and their design formats will already have been finalized in subprocess *3.5 (Re)design outputs.* In this phase, the dissemination of the two main outputs—namely, the vital statistics tables and the unit-level data files—will be managed. The annual vital statistics report, which is the main output, will be drafted, and after being approved at the appropriate level, published for release in this phase. During this phase, the report will be disseminated via data release workshops and seminars as well as through other media. A system for managing user queries should also be established in this phase.

8.1 Produce dissemination products: In this subprocess, all possible dissemination products are created to meet user demands and needs. The design developed in subprocess *3.5 (Re)design outputs* will be used in preparing the dissemination materials. These materials can include printed publications, press releases, dashboards and websites. The annual vital statistics report, in printed or downloadable pdf form, is the main statistical product of the CRVS system. The handbook with standard templates can be used by countries for writing their vital statistics report (Vital Strategies, et al., 2020). The NSO will have to constitute an in-house team to draft this report, which will include all tables cleared by the validation team for release. The report will also contain information regarding the legal, organizational and management aspects of the civil registration system that the data originates from. It will also include the registration completion rates for vital events (births, deaths, marriages, etc.) (Vital Strategies, et al., 2020). The NSO should gather inputs on these aspects from the national CRO every year through a predesigned template. The NSO may also decide to upload main tables of the report in Excel format for users to download for analysis. Ideally, the report should have notes on the quality aspect of the data, including the degree of editing and imputation undertaken to clean up the data. This will ensure transparency and serve as quality assurance for the users.

8.2 Manage release of dissemination products: The annual statistical report will usually be presented at a special event to which members of the press, other important government functionaries, development partners, and NGOs working in the area are invited. This subprocess ensures that all elements for the release are in place, including the timing of the release. The minister in charge of the NSO, CRO or both can present the report at the function. The ministers should be briefed in advance and receive some key results from the report. Some of the report's key findings can be released in phases, in different forms and media, tailored to suit different types of clients. Usually, anonymized unit-level data files are shared with the users only on request through a registration process. The metadata should be embedded in the section of the data file for ease of understanding and use.

8.3 Promote dissemination products: In this subprocess, the dissemination products are actively promoted to ensure that they reach to the widest possible audience. The NSO may also hold a special seminar or workshop to discuss the results. This seminar or workshop, which will be more technical in nature, should include the data users who participated in the data users' meeting held at the beginning of the improvement process. This subprocess will also include tools for better managing the relationship with and targeting of data users. Other tools, such as websites, social media and blogs, will also be used to facilitate the communication process.

8.4 Manage user support: This subprocess entails managing relationships with users by creating a mechanism for receiving user queries and requests for services such as microdata access. The queries and requests should be recorded and regularly attended to and responded to by agreed-upon deadlines. These queries and requests also help the NSO better understand new and changing user needs. The NSO can also build and regularly add to a knowledge database or a "Frequently Asked Questions" page and make it publicly available.

CHAPTER 6

Data Quality Management

Quality management is defined in the GSBPM as an overarching process that applies to all phases of statistical business processes. There are several statistical quality management frameworks. Notable among them are the European Statistics Code of Practice, the International Monetary Fund (IMF) Data Quality Assessment Framework, the Recommendation of the Organization for Economic Cooperation and Development (OECD) Council on Good Statistical Practice, and the United Nations National Quality Assurance Framework (UN NQAF).

The UN NQAF and its principles and requirements are not mandatory, and countries may choose to follow their own national quality assurance frameworks. However, UN NQAF quality principles and requirements are strongly connected to the Fundamental Principles of Official Statistics agreed upon by UN member states and the recommendations on quality assurance.

Data quality management has to be built across all the phases of the VSBPM and be accompanied by a set of key indicators for measuring quality. These indicators play a fundamental role in understanding and managing the quality of vital statistics. Examples of indicators related to data quality management are available for reference in the publication *Quality Indicators for the Generic Statistical Business Process Model (GSBPM) - For Statistics derived from Surveys and Administrative Data Sources* (Version 2.0, October 2017) (United Nations Economic Commission for Europe, 2017). NSOs that have already established a national statistical data quality framework can adapt it for the quality management of collection and production of vital statistics from the civil registration.

Figure 7 depicts the generic business process for collecting statistical data in the civil registration system and transmitting it to the office that compiles and disseminates vital statistics.

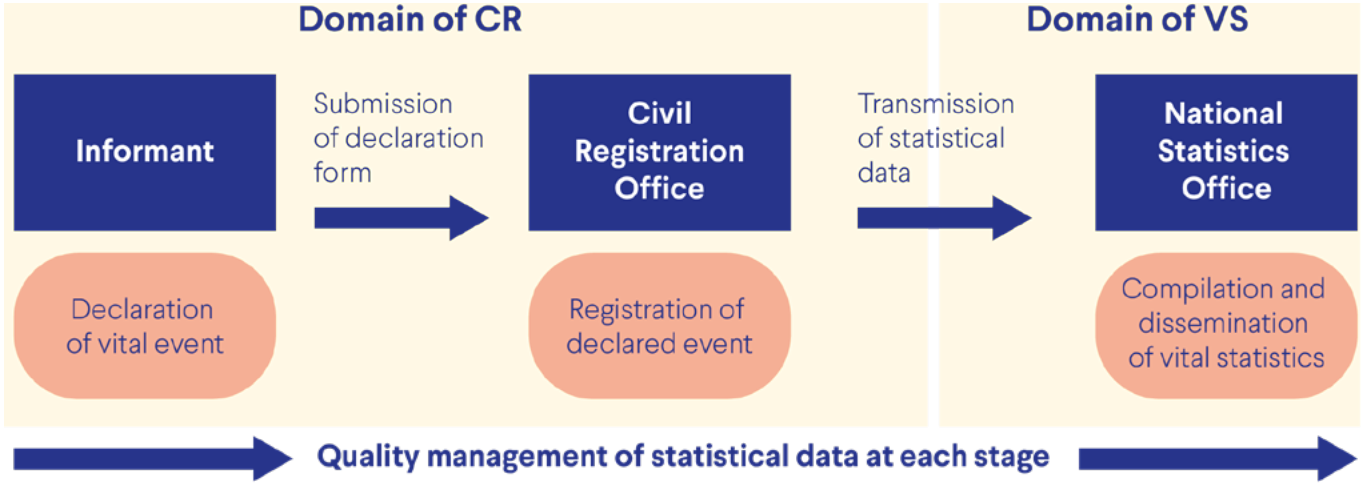


Figure 7: Generic business process of collection, transmission and production of vital statistics [42]

It is necessary to institute routine data quality management protocols as an integral part of the day-to-day operations of a CRVS system. Figure 7 underscores the fact that management of data quality has to begin well within the domain of civil registration, starting with the collection of data on vital events and its characteristics from informants for the purpose of registration. The quality management protocols should be set up at each step thereafter, until the vital statistics products are disseminated by the NSO. These protocols for data quality management in the CRVS operations have to be jointly and collaboratively built by the CRO and NSO and implemented in a coordinated manner. This necessitates the establishment of two-way routine communication mechanisms at various levels between these two institutions. The tables below illustrate the quality management steps to be instituted at three stages of the CRVS operations—declaration by informant, registration and processing.

42. In countries where notification forms received from health facilities/centres are also used for collecting some of the statistical data items, the figure will have to be appropriately modified to depict the health domain and the notification form issued from that domain. The quality management protocol will have to extend to the health sector as it becomes an important source of statistical data.

Table 12: Quality management steps at the time of declaration of the event by the informant

Quality issues	Quality management steps	Responsible agencies
Some statistical data items are not filled in Inconsistent data Unintended mistake by the informant	**a)** Active guidance to informant to fill in the declaration form correctly **b)** Local civil registrar (LCR) to ensure that the declaration form is filled out correctly **c)** Orientation training of LCR and other civil registration functionaries about the importance of statistical data items **d)** Active guidance to the staff in the health sector to fill in the notification form correctly **e)** SOPs for LCR and civil registration functionaries and staff of the health sector, wherever necessary **f)** Supervision mechanism and feedback **g)** Feedback from the NSO on the nature and extent of errors	NSO and CRO work together to implement each of the quality management steps

Table 13: Quality management steps at the time of registration of the event by the local civil registrar

Quality issues	Quality management steps	Responsible agencies
Some statistical data items are not filled in on the declaration form	**For online registration** **a)** Do not allow blank entry **b)** Do not allow inconsistent data entry; apply range checks or simple consistency checks—for example, the date of registration cannot be before the date the event occurs **For offline registration** **a)** Generate list of blank and inconsistent entries and check against the source document **b)** Correct errors wherever possible following data correction routines, and transmit the data for further cleaning by the NSO **c)** Identify common types of data entry errors and provide feedback to operators	NSO and CRO work together to implement each of the quality management steps

Table 14: Quality management steps for processing statistical data

Quality issues	Quality management steps	Responsible agencies
Blank data entry Inconsistent data Data entry mistakes	**a)** Develop and implement editing and imputation rules **b)** Ensure there is no bias introduced through editing and imputation **c)** Produce report on the nature and extent of any errors **d)** Provide feedback to the CRO and through CRO to the health ministry **e)** Common errors found have to be highlighted in the routine training program of LCR and other civil registration functionaries and health staff responsible for issuing notification	Data processing is the responsibility of the NSO The CRO should work with the NSO to build training modules on the nature of common mistakes in data collection and entry

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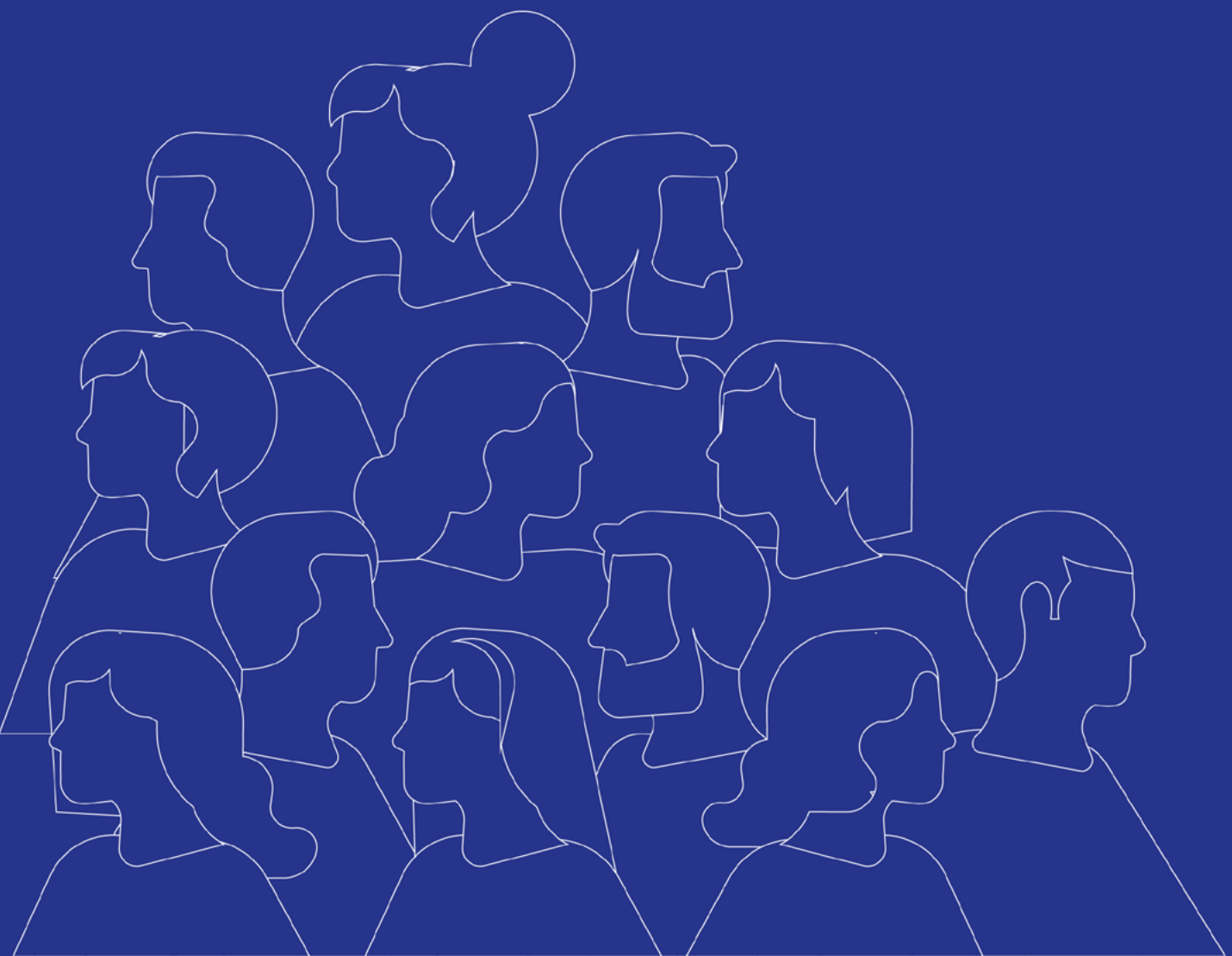

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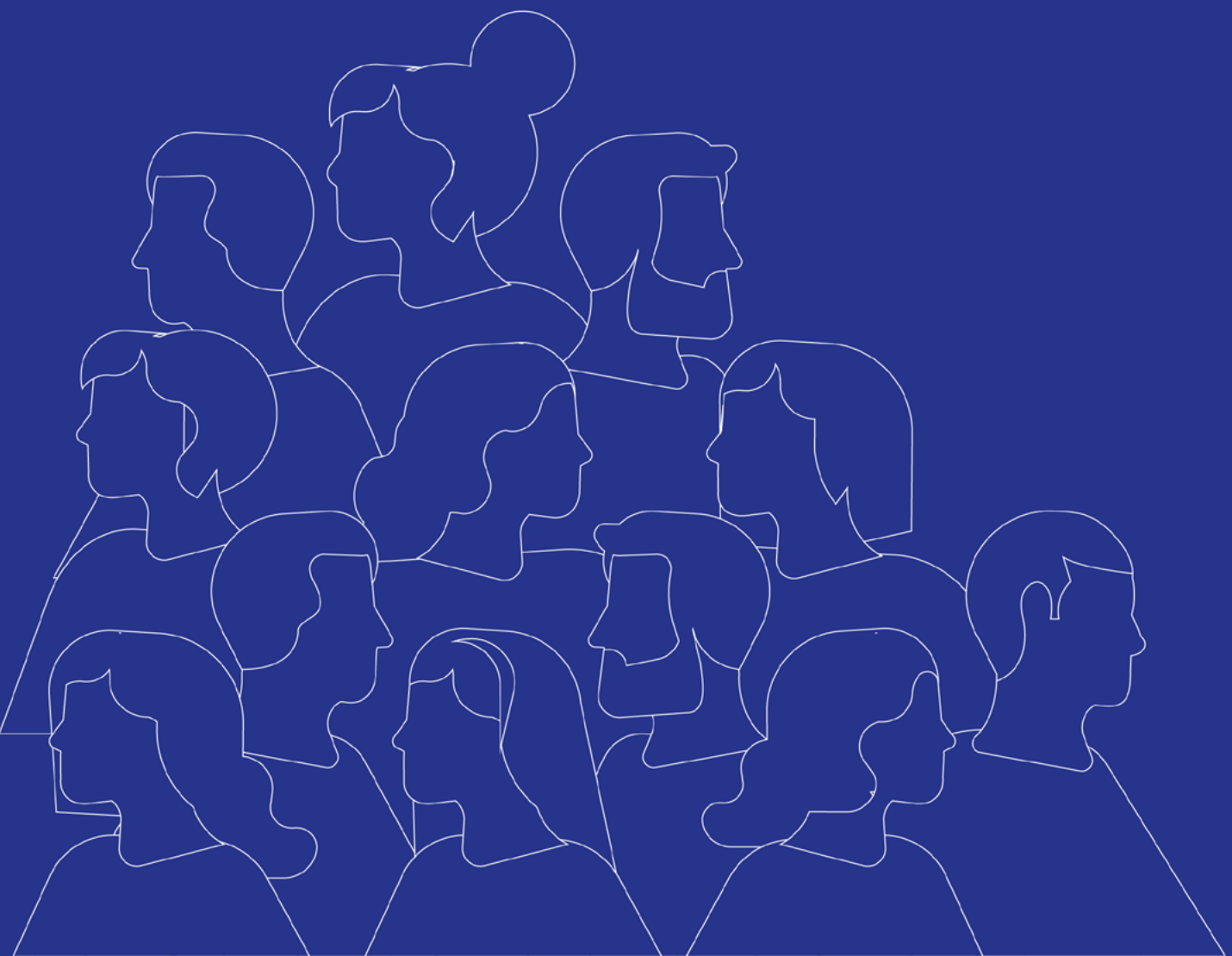
Annexes



Annex 1: Levels 0, 1 and 2 of General Statistical Business Process Model (GSBPM)

Specify Needs	Design	Build	Collect	Process	Analyze	Disseminate	Evaluate
1.1 Identify needs	2.1 Design outputs	3.1 Reuse or build collection	4.1 Create frame and select sample	5.1 Integrate data	6.1 Prepare draft outputs	7.1 Update output system	8.1 Gather evaluation inputs
1.2 Consult and confirm needs	2.2 Design variable descriptions	3.2 Reuse or build processing and analysis components	4.2 Set up collection	5.2 Classify and code	6.2 Validate outputs	7.2 Produce dissemination products	8.2 Conduct evaluation
1.3 Establish output objectives	2.3 Design collection	3.3 Reuse or build dissemination components	4.3 Run collection	5.3 Review and validate	6.3 Interpret and explain outputs	7.3 Manage release of dissemination products	8.3 Agree an action plan
1.4 Identify concepts	2.4 Design frame and sample	3.4 Configure Workflows	4.4 Finalize collection	5.4 Edit and impute	6.4 Apply disclosure control	7.4 Manage user support	
1.5 Check data availability	2.5 Design processing and analysis	3.5 Test production systems		5.5 Derive new variables and units	6.5 Finalize outputs	7.5 Manage user support	
1.6 Prepare and submit business case	2.6 Design production systems and workflow	3.6 Test statistical business process		5.6 Calculate weights			
	2.7 (Re)Design processing and analysis	3.7 Finalize production systems		5.7 Calculate aggregates			
				5.8 Finalize data files			

Annex 2: Brief descriptions of Generic Activity Model for Statistical Organizations (GAMSO) and General Statistical Information Model (GSIM)

Generic Activity Model for Statistical Organizations (GAMSO)

The GAMSO describes and defines activities that take place within a typical statistical organization. It extends and complements the GSBPM by adding activities needed to support statistical production (i.e., activities in the areas of strategy and leadership, capability development, and corporate support). Activities that are not directly related to the production of statistics and/or are executed at a management level are included in the GAMSO (e.g., human resource management and quality management activities carried out at the corporate level, such as development of a quality framework).

On the one hand, the GAMSO describes activities such as outlining what statistical organizations that produce official statistics do. On the other hand, the GSBPM focuses on the production process, describing in more detail how statistical organizations undertake the activity of statistical production. Figure A below provides the activity areas of the GAMSO.

Figure A: Activity areas of GAMSO

Examples of capability development activities include planning and developing capability improvements. Under corporate support, the activities would be managing quality, human resources, finances and IT.

Like the GSBPM, the GAMSO aims to provide a common vocabulary and framework. Greater value will be obtained from the GAMSO if it is applied in conjunction with the GSBPM.

General Statistical Information Model (GSIM)

The GSIM is a reference framework for statistical information, designed to help modernize official statistics at both national and international levels. It enables generic descriptions of the definition, management and use of data and metadata throughout the statistical production process. It provides a set of standardized, consistently described information objects, which are the inputs and outputs for GSBPM subprocesses. The GSIM helps explain significant relationships among the entities involved in statistical production and can be used to guide the development and use of consistent implementation standards or specifications.

Like the GSBPM, the GSIM is one of the cornerstones for modernizing official statistics and moving away from subject matter silos. It identifies around 130 information objects, including data sets, variables, statistical classifications, units and populations, as well as the rules and parameters needed for production processes to run (e.g., data editing rules).

The GSIM and the GSBPM are complementary models for producing and managing statistical information. As shown in Figure B below, the GSIM helps describe the GSBPM subprocesses by defining the information objects that flow between them, that are created in them, and that are used by them to produce official statistics. Inputs and outputs can be defined in terms of information objects and are formalized in the GSIM.

Greater value will be obtained from the GSIM if it is applied in conjunction with the GSBPM. Likewise, greater value will be obtained from the GSBPM if it is applied in conjunction with the GSIM. Applying the GSIM and the GSBPM together can facilitate the building of efficient metadata-driven systems and help harmonize statistical computing infrastructures.

Figure B: The GSIM information objects as input and output of the GSBPM subprocess

Annex 3: Annotated description of the technical note on production of vital statistics based on civil registration (prepared by NSO technical support team)

Introduction

For the purpose of providing technical guidance for building or rebuilding a vital statistics system, the NSO should establish a technical support team comprising officials from the vital statistics division/section as well as those dealing with data processing. This team should be convened immediately after the government decides to implement the CRVS Systems Improvement Framework. The team should conduct an internal review of the existing vital statistics system and develop necessary technical documents to guide the vital statistics improvement process and provide technical support as and when necessary during the implementation of the Assessment, Analysis and Redesign (AAR) phase of the CRVS Systems Improvement Framework. One of the objectives of the team should be to provide technical backup support to the officials representing the organization in the above-mentioned committees, and whenever required, to prepare all the necessary technical notes for the representatives of the NSO participating in deliberations in the various governance committees/ groups. The team should continue to guide and monitor the implementation of strategic and action plans for (re)building the (re)designed vital statistics system.

An annotated outline of the technical note to be prepared by the technical support team is given below:

Chapter I: Background

- Purpose of the technical note and contents.
- Methodology for preparing the note, which will mainly entail reviewing current processes along with international guidance and best practices, conducting a data users' meeting (if organized), and engaging in other external and internal consultations.

Chapter II: Current status (if the country already produces vital statistics)

- If the country is already compiling vital statistics based on a civil registration system, determine the baseline values for the following Key Performance Indicators(KPIs)[43]:
  - *If the country produces an annual vital statistics report, does it meet the quality standard, and is it produced on time?*
    - Baseline values will be determined for the following variables representing the indicators: a) percentage of missing data values, b) percentage of inconsistent data values, and c) percentage of civil registration records received by the NSO after the cutoff date.
  - *If the country does compile an annual vital statistics report, does it produce all the tables recommended by the UN?*
    - The number of tables produced for each vital event—for example live birth, fetal death (or stillbirth), death (and infant death), marriage.
- Develop as-is Business Process Maps at two levels[44]: a) collection of statistical data at the local registration centre and a map of its flow through the registration offices at the various levels to the NSO, and b) receipt of data in the NSO that ends up being disseminated as vital statistics.
- Is there a mechanism in place for monitoring the flow of statistical data from the civil registration system? If yes, is it adequate? Provide a brief description.
- Is there a mechanism in place for coordination of work between the CRO and the NSO at different levels? Provide a brief description.
- Is there a mechanism for providing feedback on the quality of statistical data from the civil registration system? If yes, is it adequate? Provide a brief description.
- Software used for processing statistical data—describe challenges, if any.
- IT infrastructure—describe its adequacy in terms of capacity to handle processing large volumes of data quickly.
- Describe the dissemination method and tools and their related challenges.

43. Thee KPIs are proposed to be used in the CRVS Systems Improvement Framework exercise.

44. It may be necessary to train some people in the NSO to develop BPMs using a modeler tool.

- Assess human resources capability to produce quality vital statistics on time.
- Include any other relevant items.

For countries that have not yet established a vital statistics system, this chapter will encompass the current status concerning existing policies and legal provisions that could either offer opportunities or hinder the production of vital statistics through civil registration. Additionally, the chapter should highlight any previous unsuccessful attempts made by the country to generate vital statistics and provide the reasons for their failure.

Chapter III: Proposed tabulations and data needs (for countries that already produce vital statistics and desire to improve the system, and those that do not produce vital statistics and desire to build a system to produce timely and quality vital statistics)[45]

This will include a list of proposed tabulations that the NSO would include in the vital statistics report based on the improved or newly designed vital statistics system. This proposed list of tabulations will be based on a review of data users' demands within the country and on international recommendations[46]. The statistical data items needed to compile the proposed tables should be identified. The level of disaggregation should also be decided. The following template can be used to compile the above information.

Table number	Tabulation	Data items required to be collected	Disaggregation*
Live birth			
LB1			
LB2...			
Death			
D1			
D2...			
Fetal deaths/still births			
FD1			
FD2...			
Marriage			
M1			
M2...			
Divorce			
DI1			
DI2...			

* Disaggregation may include sex, rural/urban, geographic level (province, district, subdistrict), place of occurrence of event, place of usual residence.

The tables and statistical data items recommended by the UN and others based on the demands of data users can be distinguished by using different signs or symbols. The type of disaggregation required should also be included.

A separate table may be prepared to provide information on use of the data that must be collected for legal and/or statistical purposes and to explain concepts and definitions. (The following template may be used.)

45. All the chapters hereinafter will be relevant for both types of countries—those that want to improve their existing vital statistics system and those whose leaders want to build one.

46. See Annex II, page 153 (United Nations, 2014a).

Data items	Relevant for birth, death or both	Legal or statistical information, or both	Explanation of concepts and definitions

The information, once compiled, can be selectively used for advocating with the CRO for inclusion in the registration data collection form[47] .

Chapter IV: As-desired Business Process Scenarios (including development of Business Process Maps

In this chapter, the NSO will develop different possible scenarios for collecting data and transmitting statistical data to the NSO for production of vital statistics. As-desired BPM should be developed at two levels, similar to the as-is maps (see second bullet in Chapter II) for each of the possible scenarios—for example, a) fully online registration, b) manual registration but with data entered in the district or province, and c) data received in manual form in the NSO[48]. The transfer of data from the civil registration system to the NSO will also depend on the length and depth of digitisation. The NSO should also propose the (re)design of the form for data collection for each scenario so as to ensure efficient transfer of statistical data from the registration centre to the NSO either directly or through CROs at different administration levels.

Chapter V: Mechanism for monitoring data collection

A data collection monitoring mechanism may be prescribed, depending on various scenarios as described in the previous chapter for ensuring the completeness and timeliness of vital statistics. The receipt of statistical data from each of the CROs expected to feed data to the NSO will be monitored through this mechanism[49]. The system should be able to track habitual defaulting registration centres/districts and provide feedback to the civil registration authorities for remedial actions.

Chapter VI: Human resources

Assess the number staff and the skill set required for exclusively working on this system and propose additional staff if necessary, with the necessary skill sets. The human resource requirement will be estimated and vary according to the scenarios. The requirement of external technical assistance, if required, should also be stated here. Specialised training needs may be identified and listed here.

Chapter VII: IT infrastructure and software requirement

The IT infrastructure required for processing of the data should be proposed here. The existing IT infrastructure within the NSO used for other statistical productions should be considered while proposing additional infrastructure. The software requirement should be assessed and proposed here and vary according to the business process scenarios. In case the existing software used for processing and tabulation of other data sets can be used here, it may not be necessary to propose procurement of new software.

Chapter VIII: Coordination

The guidance document on the CRVS Systems Improvement Framework, in addition to recommending the establishment of permanent committees for implementation of the Framework, also recommends constituting a NCT for guiding the implementation of the AAR stage and the development of the strategic and action plan. The NSO is represented in each of these committees. This section should clearly articulate the kind of specific role that the NSO needs to play in each of these

47. The data collection form can be the declaration form submitted by the informants or in some countries the copy of the register itself.

48. There can be several other scenarios depending on the level of maturity of the country.

49. The civil registration office here may or may not be a local registration centre. It can be offices at higher administrative levels from where the data is sent to NSO, which in some countries can also be the headquarters.

committees to ensure collection of timely and quality statistical data. The section should also highlight the need to enhance coordination at the province/sub-province level for timely flow of data.

Chapter IX: Data dissemination strategy

This will describe the strategy to be adopted in dissemination of vital statistics both in terms of methods and tools. These include a) a published report (mostly annual) in hard copies or pdf form on the portal; b) raw data for use for research provided digitally only on request or freely downloadable. Dissemination through a launch meeting and technical seminars with various data users/stakeholders can also be considered.

Chapter X: Quality management for collection, processing, tabulation and dissemination of vital statistics

The NSO will propose a quality management mechanism across the entire value chain of producing vital statistics. Quality management has to start from the point of collection from the informants and data entry/data transcription and end at the validation of tables. Indicators for quality management should also be developed and included in this chapter.

Chapter XI: Advocacy and communication

The key messages for advocacy and communication around the topic of civil registration-based vital statistics may be listed here. These messages may:

a) address evidence-based policymaking and planning, particularly in the health sector;

b) monitor SDG goals, targets and indicators;

c) convey its uniqueness in providing data on a continuous and permanent basis at the lowest level of geography for local level planning, implementation and monitoring of development programs; and

d) provide a foundational database for updating the population register, which in some countries is the basis for a register-based census.

Annex 4: Data items collected at the time of registration of vital events[50], their use for legal and/or statistical purpose, and an explanation of concepts and definitions[51]

Data items	Relevant for birth, death or both	Legal or statistical information or both	Explanation of concepts and definitions
Place of registration	Both	Both	Place of registration is the geographical location where vital events are registered. The information collected here is the name of the province and the district. The geographic codes are then assigned to the areas where the vital events are entered into the civil registration system. This helps identify specific registration offices for a variety of administrative purposes, including monitoring. The registration office is also identified as rural or urban. Information on vital events by urban or rural occurrence provides useful indications of whether there is a difference between vital events occurring in urban or rural areas in terms of pattern or impact. According to the law, vital events are usually registered at the place of occurrence, and therefore the places of registration and occurrence are synonymous.* Counts of the numbers of vital events by place of occurrence are useful for planning and evaluating various medical, health and social programs. For example, data on the number of live births by place of occurrence are useful when planning and evaluating medical facilities and workforce, and when it comes to monitoring the workload and performance of the civil registration system in each civil division.
Serial number of registration	Both	Legal only	This is an entry made by the registrar in the birth and death register separately. The register is opened on Jan. 1 and closes on Dec. 31 every year. The serial number is useful for reference and search purposes.
Date of occurrence	Both	Both	The date of occurrence is the exact date the event occurred, and should be expressed in terms of day, month and year. The date format should be pre specified. Total numbers of registered births, deaths and marriages should be based on the date of occurrence, which is the recommended basis for the time reference of all vital statistics tabulations.
Date of registration	Both	Both	The date of registration of a vital event is the day, month and year that the entry was made in the civil registration system. The differences in elapsed time between the dates of registration and dates of occurrence should be analyzed to provide insight into the lag between the occurrence of events and their registration. This will give some indication of the magnitude of delays in registration and provide insight into the underregistration problem.

* In some countries, registration is done at the place of usual residence of the mother in case of birth and of the deceased in case of death. In such situations, place of registration is not synonymous with place of occurrence.

50. Includes only birth and death events.

51. Based on Principles and Recommendations on Vital Statistics System (Revision 3) (United Nations, 2014a).

Data items	Relevant for birth, death or both	Legal or statistical information or both	Explanation of concepts and definitions
Place of usual residence	Both	Both	This refers to the place of usual residence of the mother in the case of birth and of the deceased in case of a death. The residence can be classified as being Rural or Urban. Data on the number of births and deaths by place of usual residence are useful for studying the geographical distribution of birth and deaths. Birth and death rates, which can be calculated at subnational levels, are important for program planning, evaluation and research in many fields of application, such as health, education, population estimates and projection, and social and economic policy. Data on births classified by both place of occurrence and place of usual residence of the mother are used to obtain information on whether mothers are giving birth in the same administrative areas as their residence. or whether they're traveling elsewhere. Data on deaths, by both place of occurrence and usual residence, are useful for interpreting mobility-related patterns of mortality.
Name of child	Birth	Legal only	This is self-explanatory. The name of the child must be written in full, including surname as declared by the parent(s). If the child has not been named and the law allows for insertion of a name later, this item should be left blank. This information is included in birth certificates.
Name of deceased	Death	Legal only	This is self-explanatory. The name of the deceased must be written in full, including surname as declared by the person responsible for the declaration. This information is included in death certificates.
Sex	Both	Both	Sex refers to the biological characteristic and is needed to describe a newborn child or a decedent. Data should be categorized into "male" and "female" and no abbreviation should be used. This information is included in the certificates. "Unknown" can be added in rare cases. Vital statistics disaggregated by sex serve various purposes. For example, data on live births by sex is used to calculate the sex ratio at birth. Unusual changes in the ratio of male to female births may indicate gender-biased registration problems, and an unusually high or low sex ratio at birth may indicate some degree of gender preferences in society. Infant deaths and deaths by sex allow analysis of mortality differences by sex.

Data items	Relevant for birth, death or both	Legal or statistical information or both	Explanation of concepts and definitions
Age at death**	Death	Both	An infant's age at death is collected so infants can be divided into age groups: under 24 hours; single days through 6 days; 7-13 days; 14-20 days; 21-27 days; 28 days to under 2 months; single months of life from 2 months to 11 months inclusive; and not stated. Age is an important factor in the study of infant mortality. The impact of biological versus environmental*** factors can be seen in terms of the proportion of infants who die shortly after birth (e.g., under 1 day, less than 1 week or less than 1 month) compared with those who survive the first month of life but die before attaining 1 year of age. These data are essential for the calculation of such key public health measures as the perinatal mortality rate and the neonatal mortality rate. Age at death of persons other than infants is collected so as to classify them into age groups as follows: under 1 year; single years to 4 years; five-year age groups up to 94 years; 95 years and over, and not stated. If recording by five-year age groups is not possible, efforts should be made to distinguish the following groups as a minimum: under 1 year (infants); 1-4 years (preschool age); 5-14 years (school age); 15-49 years (childbearing age); 15-64 years (working age); and 65 years and older (elderly). Age at death is usually used to calculate age-specific mortality rates, which are used to construct life tables and determine net reproduction rates. In conjunction with the other indicators of population change, age-specific mortality rates are useful for demographic projections by the component method. This information is included in death certificates.
Place of birth	Birth	Both	For home births, the exact address is recorded, and for births occurring in medical facilities, the name of the facility is entered. Such information is useful for verification and follow-up if required. This also provides information that helps track the progress of important public health indicators such as the proportion of institutional births.
Place of death	Death	Both	For deaths occurring at home, the exact address is recorded, and for deaths occurring in medical facilities, the name of the facility is entered. Such information is useful for verification and follow-up if required. The data compiled from this item provides an idea of the proportion of deaths occurring at home versus in medical facilities.
Type of birth	Birth	Statistical	Type of birth refers to whether it's a single baby or a multiple birth that the statistical report relates is reflecting. Each live-born infant is characterized as single, twin, triplet, etc., and the birth order with respect to any newborn siblings is specified (first of two, second of two, first of three, etc.). For each member of a multiple birth, the sex of the other member(s) is recorded. Statistically, information on type of birth serves two purposes: a) to study the trend of single, twin, triplet or higher-order births over time, and b) to analyze the impact of the type of birth on birth outcomes. Birth order is strongly associated with fertility level and birth outcomes. In addition to age-specific fertility rates, birth order-specific fertility rates are also calculated in some cases.

** The actual date of birth of the deceased is obtained wherever possible. The age is computed using the date of birth and date of death.
*** Deaths in infants who die shortly after birth are often due to poor quality antenatal and intrapartum care. This is the most high-risk period for infant deaths.

Data items	Relevant for birth, death or both	Legal or statistical information or both	Explanation of concepts and definitions
Attendance at birth	Birth	Statistical	The attendant at birth or delivery is the person who assisted the mother in delivering a live-born infant. The attendant is classified as a) physician, b) nurse, c) nurse-midwife, d) midwife, e) other paramedical personnel, f) layperson, or g) "not stated." Attendance at birth or delivery provides useful information on the utilization of medical facilities and resources. Statistics on live birth by site of delivery and attendant at birth are of great use in evaluating the need for medical services and for providing insight into patterns of infant mortality.
Date of birth of mother/father or age of mother/ father at time of birth	Birth	Statistical	Information on the date of birth of both the father and mother or, if not possible, their ages at the time of birth, is collected and classified into five-year age groups between ages 15 and 49, with terminal groups of under 15 years, and 50 years and over. Age of the mother for live births is a very important variable in fertility study. Age-specific fertility rates, for example, are used to calculate the total fertility rate, which can be compared with corresponding rates for other populations without the comparisons being affected by the differences between the groups in terms of age and sex.
Birth weight	Birth	Statistical	Birth weight is the first weight of the newborn immediately after birth. Birth weight is measured within the first hour of life, before significant postnatal weight loss has occurred. The actual weight will be recorded in the measuring unit prevalent in the country (kg and gram, or pound and ounce). Weight should not be recorded in groupings. Birth weight can provide information needed for the study of infant mortality and health during infancy and childhood, since low birth weight is associated with an increased risk of health and developmental problems during infancy and is highly correlated with infant mortality. Statistics on birth weight cross-classified by family socioeconomic measures—the level of education of the mother, for example—are particularly important bases for targeting subpopulation groups in need of prenatal care and medical services after birth.
Children born alive	Birth	Statistical	This includes all children born alive to the mother up to the time of the present live birth or of the woman's death (for females of childbearing age and over). The number recorded will include the present live-born child and all the other live-born children (sons and daughters), whether born in wedlock or not, and whether born of present or previous marriages, regardless of whether they are alive or dead at the time of the inquiry and regardless of whether they are living with the mother or elsewhere. In the case of multiple births, each live-born child is counted separately.
Date of first marriage/age at first marriage of mother	Birth	Statistical	Information on the date of first marriage or age at first marriage and date of birth or age of mother (in completed years) at the time of birth is used to calculate the duration of marriage. This is done at the time of statistical processing and not by the local registrar. The information on duration of marriage is used in the analysis of fertility. Depending on the type of analysis to be made, an inquiry may relate to either the "first marriage" or the "present marriage" of the mother.
Literacy status	Both	Statistical	A person is literate if she or he can, with understanding, both read and write a short, simple statement in any language. Otherwise the person is classified as illiterate. For a deceased person, this information is collected for anyone aged 10 years and above.

Data items	Relevant for birth, death or both	Legal or statistical information or both	Explanation of concepts and definitions
Educational attainment	Both	Statistical	Educational attainment of parents and decedents is the highest grade completed within the most advanced level attended in the educational system of the country where education was received. The UN recommends that the grades of education be recorded to correspond with the levels of education recommended by UNESCO. This way, they can be identified within each level to permit classification levels of education using the International Standard Classification of Education (ISCED 2011), recommended by UNESCO (UNESCO Institute for Statistics, 2011). Educational attainment, as one of the socioeconomic variables, adds value for analysis and forecasting of the occurrence of vital events. For example, birth and death statistics by mother's educational attainment allows for study of differentials in fertility rates and infant mortality rates by education of the mother. Social policies aimed at improving the educational levels of mothers can be implemented if there is found to be an association between the mother's education and fertility, and birth outcomes.
Usual occupation	Both	Statistical	Occupation of parents and decedents refers to the kind of work done during the calendar year preceding the year of occurrence of the vital event by the person employed (or performed previously by the unemployed), irrespective of the industry, the status in employment, and sector (as employer, employee, etc.) in which the person should be classified. Examples of typical occupations for the economically active are farmworker, teacher, bus driver, construction laborer, shop owner, etc. For those who are not economically active, typical occupations are homemaker, pensioner, student, etc.
Cause of death	Death	Statistical	Causes of death are *all those diseases, morbid conditions or injuries which either resulted in or contributed to death, and the circumstances of the accident or violence which produced any such injuries.* Symptoms and modes of dying, such as heart failure or respiratory failure, are not considered to be causes of death for statistical purposes. The cause of death to be used for primary statistical tabulation purposes is the underlying cause of death as recorded in the prescribed form. The underlying cause of death is defined as *a) the disease or injury which initiated the train of events leading directly to death, or b) the circumstances of the accident or violence which produced the fatal injury.* From the standpoint of public health and prevention of disease and premature death, it is important to understand the morbid process from onset to conclusion and to break that chain of events. The most effective public health objective is to prevent the precipitating cause from operating. For that reason, the underlying cause of death has been defined as the basis for mortality statistics by cause of death.

Annex 5: Examples of Key Performance Indicators for Monitoring the Implementation of VSBPM

Phases	Key Performance Indicator	VSBPM phase
Planning	Technical Support Team constituted	Planning stage
	Data users conference/meeting held, and suggestions/recommendations consolidated	Planning stage
Change work phases	As-is business process for collection and flow of vital statistics developed in collaboration with other stakeholders	Evaluation phase
	Key Performance Indicators for implementation of VSBPM developed	Evaluation phase
	Data needs for vital statistics finalized in line with the UN recommendations and confirmed for inclusion	Specify Needs phase
	Metadata and data standards developed for statistical data items finalized	Specify Needs phase
	As-desired process for collection and flow of vital statistics developed in collaboration with other stakeholders	(Re)Design phase
	Tabulation plan for vital statistics developed in line with the UN recommendations approved	(Re)Design phase
	Percentage of registration functionaries oriented on the importance of statistical data items	(Re)Build phase
	Rules and routines for coding, editing and imputations for cleaning of statistical data finalized and tested	(Re)Build phase
Ongoing work phases	Percentage of registration centres from where data received within the prescribed cut-off date	Collect phase
	Percentage of missing data by data variables	Process phase
	Percentage of inconsistent data by data variables	Process phase
	Number of tables produced out of the total of tables planned	Analyze phase
	Analysis of tables completed within the prescribed time limit	Analyze phase
	Annual Vital Statistics Report disseminated	Dissemination phase
	Dissemination workshop held	Dissemination phase