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for every child

CRVS platforms

Key Findings for Practitioners

Glossary

API Application Programming Interface
CRVS Civil Registration and Vital Statistics
DPG Digital Public Good
FHIR Fast Health Information Resource
HMIS Health Management Information System
ICT Information Communication Technology
LMICs Low- and Middle-Income Countries
NGO Non-Governmental Organization
OCR Optical Character Recognition
SDGs Sustainable Development Goals
TCO Total Cost of Ownership
UNLIA United Nations Legal Identity Agenda

Content

1. Overview

About

This publication is for international development practitioners, both in programme and ICT divisions, who wish to understand and implement digitalised civil registration and vital statistics (CRVS) programmes. These findings highlight a selection of CRVS platforms. The platforms were selected after due consultations with stakeholders on existing CRVS offerings. Conducted by UNICEF (via a 3rd party vendor), the review assessed the functional and non- functional aspects, as well as maturity, of CRVS products.

The scope of this publication has limitations related to a) the exclusion of home-grown solutions and b) reliance on self-reporting by the vendors.

This publication is relevant to UN, government, and NGO actors. It is intended to guide planning, budgeting, technology selection, and implementation strategies. It is also intended to support planning and programme operations design that are fit for purpose and uphold value, feasibility, and sustainability principles.

Background

CRVS systems are k
Development Goals (S

- Improved child mo
- Better education (S
- Gender equality (S
- Decent work (SDG
- Reduced inequaliti
- Justice (SDG 16)
- Partnership (SDG 1

An effective CRVS syst
vital life events - inclu

Birth registration is a f
Civil and Political Right
births, the legal existe
a wide range of civil, p

Furthermore, a depend
data that is robust, incl
assist policymakers de
resources for social pr
to underserved areas.

The UN Secretariat ha
related handbooks an
meets these requireme

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2. CRVS Digitisation Needs and Challenges

Digital technologies offer unique opportunities to improve CRVS systems. Pages 8 and 9 show a diagram of an ideal, integrated CRVS system.

Opportunities

CRVS Digitisation

A: Preliminary
1. Define a Long-Term Visi CRVS Digitisation
2. Develop a Business Cas CRVS Digitisation
3. Ensure legal framework place to support Digitisati

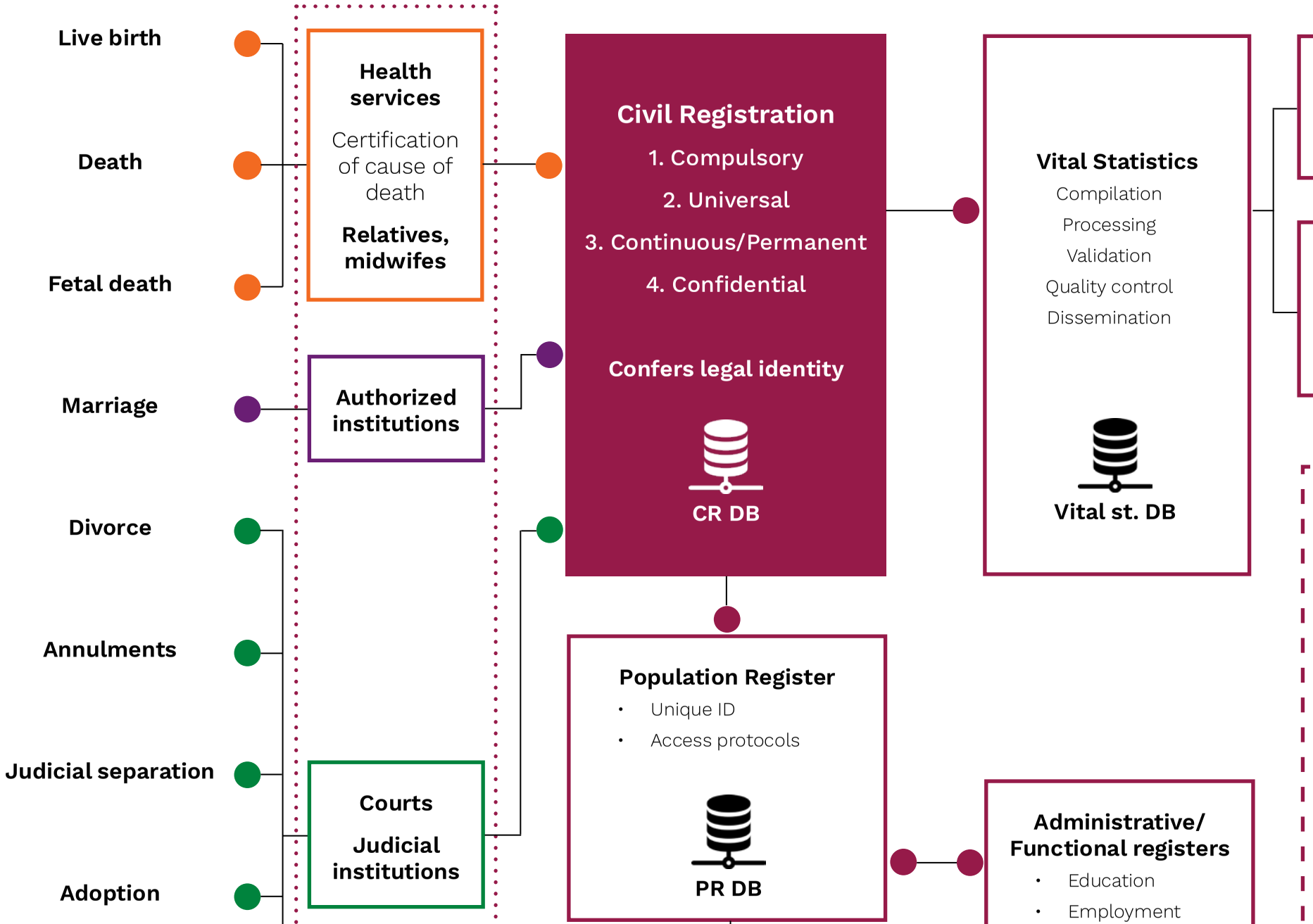
Adap

Comprehensive guida analysis of business p be found in resources Digitisation Project Life

Challenges

CRVS digitisation can portion of civil registra deteriorating books. Th

Civil Registration, Vital Statistics and Identity Management



Once the CRVS digital system is up and running, there can be obstacles to capturing digital data accurately at the point-of-registration, as well as production of vital statistics from national databases dynamically updated with data from local registry offices.

Furthermore, the process of digitising CRVS systems may face an implementation hurdle as decision-makers may not anticipate sufficient tangible benefit in the near term to justify the project. Sustainable investment for CRVS systems relies on creating a stronger business case based on buy-in for the long-term advantages of digital infrastructure. This includes highlighting benefits that can be gained, such as improved accuracy, efficiency, and accessibility of data. All of these ultimately lead to more informed planning, decision-making, and resource allocation.

One way to counter common challenges is to use a systematic methodology for organising and prioritising product requirements at the onset of a CRVS digitisation project. This approach can play a key role in the development of product specifications. Strong specifications meet the needs of all stakeholders, including the decision-makers. These validated specifications also help ensure that the most critical requirements are given the highest priority. Understanding priorities in turn feeds into a detailed and realistic plan for how the project will be designed and implemented.

Requirement Hierarchy is one such product methodology. It begins with the high-level requirements. These feed into the user and then the system requirements. The benefit is to avoid starting with technical solutions that need to fit into a context.

Requirements Hierarchy Methodology

High-Level	**Business Requirements**	**Why is the project needed?**
User-View	**User Requirements**	**What do stakeholders need the system to do?**

3. Assessi
Digital I

Success in a CRVS di
employed. It is crucia
supporting a digital CR
pilot is at a sub-nation
so there is a path to s

Some key factors to be
project include:

- **Legal and regula**
  support the digitis
  related to data priv

- **Human resource capacity.** Sufficient human resource capacity must be available to implement and maintain the digital CRVS system. This includes having the necessary technical expertise, training, and capacity building for staff involved in the system.
- **Digital infrastructure.** The digital infrastructure must be sufficient to support the implementation of the digital CRVS system. This includes ensuring the necessary hardware, software, and network infrastructure.
- **User requirements.** The user requirements of the digital CRVS system must be understood and incorporated into the design of the system. This includes considering the needs of end-users such as civil registration officials, medical professionals, and the general public.

Understanding these opportunities and limitations enables the identification of suitable CRVS platforms that can be implemented in a digitisation project. This ensures that the technology chosen is relevant to the country's specific circumstances and increases the likelihood of the project's success.

Assessment of core functional and non-functional requirements in CRVS platform

Both functional and non-functional requirements are important to consider when selecting a CRVS digital platform, as they help ensure that the platform meets the needs of its users and provides a satisfactory experience.

Part of the requirements of a CRVS platform should be its configurability or customisability, unless it is built from scratch for a specific country. No two countries have the same legal, operational or procedural frameworks on the functional requirements.

Checklist of CRVS pla

- ☐ Notification
- ☐ Declaration
- ☐ Validation
- ☐ Registration
- ☐ Corrections and Ar
- ☐ Certification
- ☐ Archiving
- ☐ Sharing data
- ☐ Performance mon

Non-functional requ
characteristics of the
relate to how it is buil
steps involved in civil

Checklist of CRVS pla

- ☐ **Interoperability.** E
systems using app
verification of inpu
- ☐ **Scalability.** E.g., p
software systems)
- ☐ **Portability.** Cross-
- ☐ **Performance.** Mo

- **Availability.** Maximum 12hrs downtime per year; online/offline access.
- **Traceability.** Track and record changes to data by system and users.
- **Usability.** Intuitive and attention-grabbing design; prompts; viewable headers, labels and any software control values on page.
- **Flexibility.** Extensibility and configurability options; dynamic forms that can be edited with ease.
- **Archiving.** Capacity to archive all documents and legacy records permanently.
- **Data extraction.** Ability to extract/import non-personally identifiable information from the system in a non-proprietary format.
- **Messaging.** Capability to send automated messages to clients with reference numbers.
- **Data.** Quality checks; format support of date, time, currency, number; disaggregation by age, sex, location; registration by time frames; UN recommended core data items; interactive dashboard
- **Audit.** Logging of all activities and changes; permanent archiving; search logging; critical database tables changes logging.
- **Authentication.** Role-based authentication required to access the system.
- **Location.** Record of registration centres, unique IDs, location and geo-codes.
- **Language.** Multi-language support.
- **Security.** Unlimited roles, access levels; end-to-end data encryption; secure login and authentication; Two-factor authentication (2FA); role-based permission; no record deletion; data encryption plan; Multi-factor authentication (MFA); password storage; hardening standards; encryption of data at rest and in-transit; threat model; verification of secure components; generalized API developed with security

Checklist of CRVS dig

- System is interope using appropriate information syster
- Source code is lice available on a publ
- Documentation requirements.
- System is designe
- System is designe principles as defin

Software maturity model

A maturity model can be a useful tool for organizations when selecting a solution. It provides a framework for assessing the capabilities and readiness of a particular option. A maturity model typically includes a set of defined levels or stages, each representing a progressively higher level of capability or maturity in each area, providing insights into the solution's strengths and weaknesses.

The use of a maturity model when selecting a CRVS digital platform facilitates well-informed decisions about the most suitable solutions for project requirements.

CRVS platform maturity categories

Global utility	Country support	Software maturity	Human resources
Scalability Country utilization Community governance CRVS business requirements Licensing and source code accessibility Open source Total cost of	Governance & leadership User documentation Software productization Network of solution providers	Adherence to best practices for digital development Adherence to privacy and applicable laws Security and privacy Interoperability & data standards Multi-lingual support Software roadmap	Capacity for solution maintenance & support Capacity building

Deployment a

Scaling up a CRVS d
consideration of variou

- **Business objectiv**
with the country's
- **Technology.** Evalu
gaps or limitations
infrastructure, so
volumes of data, us
- **Resources.** Budge
human resources,
scale of the projec
- **Stakeholders.** Ide
and benefits of the
- **Process.** Identify th
determine how the
scale. Ensure that
scalable.
- **Data.** Determine th
analysed, and used
- **Risk managemen**

Assessing total cost of ownership

While making the choice of the solution to procure, it is important to consider the Total Cost of Ownership (TCO), which extends well beyond the initial costs of setting up the CRVS digital platform selected.

Estimating the TCO involves considering all of the costs associated with the project over its entire lifecycle. This includes both direct and indirect costs. A direct cost is a specific expense that is just for the CRVS project, such as a software license. An indirect cost includes the more general resources that must be pulled to make the project work, such as IT staff time. TCO will examine hardware and software expenses, implementation and integration costs, maintenance and support costs, and any ongoing operational expenses.

It is important to note that the cost of implementing CRVS systems is highly dependent on the technological infrastructure of the country and the extent to which the CRVS process mapping has been completed. Consideration of the different scenarios that a country might face when embarking on a CRVS system is key to understanding how the cost structure will vary. This includes, for instance, accounting for the cost of establishing a CRVS system in a country without an IT unit in the CRVS authority, versus in a country with an existing national IT agency.

Additionally, it is necessary to factor in the time and resources required to complete the CRVS process mapping, which can take up to two years in practice. In sum, there is a need for an appropriate TCO estimation model to be developed for each country's unique scenario in order to ensure the most effective implementation of a CRVS system.

Steps to estimate

1. **Define the scope** identify the specific
2. **Identify the dire** implementing the services required f
3. **Estimate the indi** project, such as tra and any operationa
4. **Calculate the tot** estimate the total
5. **Consider the retu** benefits of the pro and cost.
6. **Review and updat** in the project scop the estimate regul

OpenCRVS, one of the p
a tool to support TCO

4. CRVS D

UNICEF has conducte
existing digital CRVS so
CRVS solutions agains
within the scope of a
UNICEF country office
collected from the sho

Methodology

The CRVS Digital Sol
comprised of 5 core s

Step 1: Identify availa

- Review a subset of
- 15 potential CRVS
- 5 solutions both c
as viable

Step 2: Measure level

- Questionnaire co
functional) to achi
- Information collec
solutions.

Step 3: Observe live d
to the core requirem

- The assessment t

Also, under consideration in the analysis was whether the CRVS solution is a Digital Public Good (DPG), or has high potential to become a DPG. The Digital Public goods Alliance (DPGA) defines Digital Public Goods (DPG) as "open-source software, open data, open AI models, open standards, and open content that adhere to privacy and other applicable best practices, do no harm by design and are of high relevance for attainment of the United Nations 2030 **Sustainable Development Goals** (SDGs)." Of the platforms reviewed here, DHIS2 and OpenCRVS are DPGs. DGIT, EveLIN, and HERA are proprietary, although DGIT shares its code with its partner governments.

CRVS Platforms listed in this section were those that provided sufficient data in response to UNICEF assessments, based on criteria as outlined in the previous section. They also fulfil most, and sometimes all, of the requirements of a Digital Public Good. For a full list of Core Functional and Non-Functional requirements assessed, please see the Appendices at end of this document.

From a compliance perspective, all platforms below work out-of-box to support a majority of functional and technical (non-functional) requirements of a CRVS digital system. Each platform can also be configured within certain parameters to meet specific programme needs. Configuration level of effort ranges from light to medium depending on the type of functionality required.

Below is a summary of key findings:

- The eCVRS market is fragmented with no clearly recommended solution. No solution has reached multi-country adoption.
- The Total Cost of Ownership (TCO) varied widely, between US$270,000 and US$61.5 million. The variance is largely due to some solution providers not considering all required cost drivers.
- Implementation of interoperability or data standards between eCRVS and other solutions like Health and Identity is inconsistent.

DGIT

Overview

Digital Governance In
national ID platform bu
and replaced with gov

DGIT is available under
beneficiary governme
version. Furthermore,
support the continuou

Technical Analysis

Stren
Developed as a generic CR identity integrated solutio
Can undertake all day-to- online and offline mode
Adheres to 8 out of 9 Prin Development
Fully implemented in two being rolled out in a third budgets are available in pu
Already aligned to the UNI integrated CRVS and ID m

DHIS2

Overview

First released in 1996, DHIS2 is a robust, open-source web-based platform for data collection, management, and analysis. DHIS2 is the world's largest Health Management Information System (HMIS) platform. 3.2 billion people (40% of the world's population) live in countries where DHIS2 is used as a Health Information Management System.

Technical Analysis

Strengths	Weaknesses
Well-grounded solution and widely used in health sectors in many LMICs, including sending notification of vital events from health facilities to external CRVS systems Comes with open license and provides source code freely Can function in both offline and online mode Adheres to all the Principles of Digital Development Supports interoperability through fast health information resource (FHIR) data standards and other integration tools. Reported lowest Total Cost of Ownership (TOC) among all solution providers Transferring ownership to a government can be done without much upfront capital investment	Lower levels of compliance with functional core requirements, particularly around registration and validation Is yet to evolve as a core CRVS software, although has been tried out in a limited way in Liberia

Country deployments: Liberia (in progress).

Considerations

EveLIN

Overview

EveLin is a proprietary
for vital records and st

A French civil registry s
market. The EveLIN is

Technical Analysis

Stren
High level of compliance v non-functional core requi
High state of readiness fo functions of registration
Supports a number of dat FHIR for interoperability
Deployed in France in ove population from 50000 to and in the Overseas Territ
Solution available in differ arrangements: • Buying a product with benefit of product & s an MCO contract • Buying a turnkey solu own the source code • Co-develop the soluti code, and build capac
Offline and Online version

OpenCRVS

Overview

OpenCRVS is an open-source, standards-based software for civil registration that is designed to work in low resource settings. OpenCRVS is a DPG.

Technical Analysis

Strengths	Weaknesses
High level of compliance with core requirements 84% of the mandatory core requirements available 'Out of the box' signifying very high state of readiness All the basic registration functions are available 'Out of the Box' and most of them can work in both offline and online modes Open-source license made available and source code is publicly available Supports data standards including FHIR for interoperability Very high level of security features Adheres to all the Principles of Digital Development	Covers birth and death registration. Marriage and divorce registration modules will be available in release 1.3, planned for May 2023. Adoption will be available in 2024 based on demand for country implementation. Relatively new platform without large scale implementation references.

Country deployments:

Pilots and field tests: Bangladesh, Niue, Nigeria, Cameroon.

WCC (HERA)

Overview

HERA is a proprietary
birth, death and marr
international best prac

HERA integrates with c
Functional Registers (s
addition, it supports th
systems, as recomme

Stren
Functions of registration c both offline and online mo Modules can be all impler one at a time, starting with module Cloud-based or on-premi possible It supports the OSIA for in DHIS2 system and for inte Willing to deliver the sourc Currently implemented in initial stage of implementa Data is encrypted in trans

Country deployment

5. What ne

Recommenda

When considering proc
a platform that is alre
projects. By doing so,
has been refined throu
reliable product.

In contrast, unproven s
issues or unanticipat
platform can help mir
of the digitisation proc

Sometimes the implen
party IT services firm.
services partner/supp
implementations. Sele
and uses the digital C
better outcomes than

Finally, when selecting
is or soon will be a DP
contextual factors, inc
before deployment.

Benefits of selecti CRVS expertise

- Increase the likeli requirements and
- Gain more effectiv

CRVS RFP example deliverables

Deliverable / Activity
1. Inception Report. Detailed planning document specifying how each activity will be executed. This will include a comprehensive work plan.
2. Functional & Technical Design Documentation. Detailed design documents for the digital CRVS system, including details of how the application architecture promotes a flexible, scalable, secure and cost-effective development approach.
3. Prototype. Working prototype that demonstrates required functionality that can be field tested by end-users.
4. Hardware and Operating System Requirements. Clearly defined hardware and operating system requirements needed to support the digital CRVS system.
5. System Integration. Integration software that allows the integration of the digital CRVS system with XXX, as per the defined requirements.
6. Application & Integration Testing Plan. Detailed plan for all system testing including component, application, integration and user acceptance testing (UAT).
7. Application & Integration Test Scripts. Comprehensive test scripts that will be used to test the digital CRVS system in isolation and with other systems.
8. Application & Integration Testing & Report. • Conduct component, application and integration tests (including test environment setup) • Support UAT (lab and field). • Detailed write up of the outcomes of all tests, including resolution plans for outstanding bugs/ issues and fulfilment of acceptance criteria.
9. User training. Insert description of required training, to which audience etc.
10. User Manual. Comprehensive and easy to read user manual in English and [OTHER LANGUAGES] including screenshots
11. System documentation. Comprehensive technical documentation including: • Coverage: Code that is and is not documented is easily identifiable.

12. Field Pilot & Report **Period of Limited Deplo** • Deployment of all ap • Monitor the end-to- application compon • All application comp
13. Deployment & Repo **Deployment period wh** • Deployment of all ap • Monitor the end-to- application compon • All application comp
14. Support and mainte required.

Conclusion

Choosing a CRVS digital solution best suited to a country's deployment context is a complex decision. This summary of findings aims to help streamline this process and to suggest the key questions to answer throughout the process.

For additional information, please contact UNICEF at the details below for updates to this publication, and/or for technical advice.

- **Child Protection** - Programme Group at **childprotection@unicef.org**
- **Digital Centre of Excellence** - Information and Communication Technology Division at **dcoe@unicef.org**

Appendices

Core functional requirements assessed

Administrative

- The system must be able to create, edit, delete system user
- The system must be able to define, assign and revoke system permissions for user(s)
- The system must allow task management feature for users, such as grouping applications by completion/pending status
- The system must support various processes at the local registration office (entry of forms, manage approvals, identify gaps, etc.)
- The system must allow user management (create, update and deactivate system users and assign permissions from those users)

Alerts

- The users are alerted on notifications, declarations received
- The system must be able to automatically detection and alert on duplicate records and provide options for merging or removal of records

Amendment

- The system should allow changing/editing of records name change/correction, address change/correction, based on necessary documentation

Certification

- The system should allow internal process for submission and approvals
- The system must be able to generate QR codes to verify legitimacy of the certificates
- The system must allow users to print paper forms and certificates for clients

Client features

- Clients must be able to create and submit declaration form remotely using a client portal
- The system must allow clients to upload documents and certificates or link online

- The system must
defined parameter
- The system must
registrations, issue
- Reports to have 2
and area of catchn
- Reports to be prep
as applicable

Data Sharing

- The system must a

Messaging

- The user must be
notifications, confi

Registration

- The users must be
- On completion of
registration form in
- The pop-up box th
must allow the use
- The users must be
- The system is abl
records
- The users must b
amendment and c
- The system must b
automatically on c
- The system must p

Searchability

- The user must be a
fields, such as, ID n

Validation

- The system must be able to validate submitted documents as proof using QR codes, bar codes, holograms, picture/selfie matching photo IDs, valid date of documents, etc
- If the system identifies errors validation with notification, declaration data for consistency, completeness, errors. The system must prompt the user to update specific fields
- The system must allow to accept or reject messages (eg notification/declaration from other sources) based on automated validation or user action for corrective action
- The system must allow registration agents to raise corner cases via the system so they can be logged and tracked to resolution
- The system must be able to validate submitted data against same items of information in accompanying documents

Core non-functional requirements assessed

Archiving

- The system must be able to archive all documents, including legacy birth and death records permanently

Audit

- The system must log all activities, changes, amendments by user, place and time.
- The system will keep the log of all changes for at least 6 months, and then archive it.
- No user can change the log of changes, not even the System Administrator.
- The system should log all the searches performed by the user and the individual data accessed / viewed by the user. The logged information should include the user ID, machine ID, timestamp and respective information (search criteria, etc.)
- All changes (including inserts and updates) to critical database tables are to be written to an audit table, recording the user initiating the change, the time and date of the change, and the before and after values.

Authentication

Data

- The system must b
  completeness and
- The system must
  currency, number,
- The system must
  age, sex and locati
- The system must
- The system must b
- The system must
  managers to unc
  subsequently ide
  accordingly

Data extraction

- The software must
  identifiable inform

Error handling

- All written softwar
- Error and warning
  completely as pos
  identifier of the err
- All error and warni
- Critical error shall

Flexibility

- The system must
  or functionality
- Allow for flexible c
- The system must b
  added and remove

Interoperability

- The system must be able to conduct verification of input data with 3rd party sources

Language

- The System must be able to provide multi-language support

Learning

- Allows training to be provided through the product, minimizing the need for in-person training and providing flexibility to training approaches and the release of new features.

Location

- The system must maintain a record of all registration centers with their unique IDs, location and geo-codes

Messaging

- The system must be able to send automated messages to clients regarding notifications, confirmations of submissions, when to travel to office to collect certificates etc. with reference numbers

Performance

- The system must be able to perform as load (users and transactions) increase following microservice design.
- The system transaction response to user data entry should be minimum 2 seconds (turn round time) and maximum 5 seconds (turn round time) on an online workstation
- The system must allow users to monitor system availability and performance
- The system can sync data with the main server (in case of offline use)
- The system can auto generate global unique IDs (GUID) (alpha, numeric), linked to a national ID
- The system must track and record all changes (update/add/delete) to the data by system and by users
- The solution must create person centric records and ability to search and view vital events of a person
- The system transaction response to user search should be minimum 2 seconds (turn round time) and maximum 5 seconds (turn round time) on an online

Scalability

- The system must b
  of users/accesses,
- The system must
  different sources t
- The system's techn
  to support project
- The system must b

Searchability

- The system should
  number, name, bir

Security

- The system must
  data entry, editing
  officers, registrars,
- The system must b
- The system must b
- The system should
  to access and visib
- The system must p
  of password reset,
- The system must
  unlock
- The deletion of rec
  be flagged or mark
- All changes (includ
  written to an audi
  date of the change
- The solution provid
  that can use one o
  generation (e.g., pu

standards should be used for all hypervisors, operating systems, web servers, database servers, network devices and other components of the solution.

- The solution provider should ensure that key controls are in place to facilitate encryption of data at rest and in-transit. The same controls should be in place for the data stored locally in the offline workstations. A data encryption plan should be included in their proposal that aligns with current global best practices. In addition, the solution provider should develop "a threat model" where all the possible threats are defined, distinguished and treated with priorities.
- The solution provider needs to demonstrate that their supply chain has robust controls to address specific threats to the integrity of hardware and software products throughout the product life cycle. The end goal is to provide a product that has been designed, developed, and delivered with integrated security at every phase of the product life cycle. All the components used (open-source libraries or third-party dependencies) that will be used in the proposed CRVS solution should be verified as secure. While compliance is not required, ISO 20243 can be used as a reference point with regards to the required control framework
- The solution provider shall provide a generalized API that is developed based on security best practices (e.g., OWASP Top 10 or equivalent), including key considerations for encryption, authentication, authorization, data validation, audit logging, quotas/throttling, data validation, audit logging, API gateways, etc.

Traceability

- The system must track and record all changes (update/add/delete) to the data by system and by users

Usability

- The use of the tool should be easy and intuitive in order to reach users with different levels of computer use experience.
- The system should be able to capture the user's attention and motivate them to interact with it, exploring and benefiting from all its features.
- The system should be able to generate prompts for users on actions or document verifications
- The system must provide the option on every page of CRVS system to view the headings, menus, labels, and any software control values on any page

UNICEF works in
disadvantaged ch
every child, every
we do whatever i
potential, from e

Graphic design: Mire


Acte de naissance N°