MOBILE DATA COLLECTION: INTEROPERABILITY THROUGH NEW ARCHITECTURE

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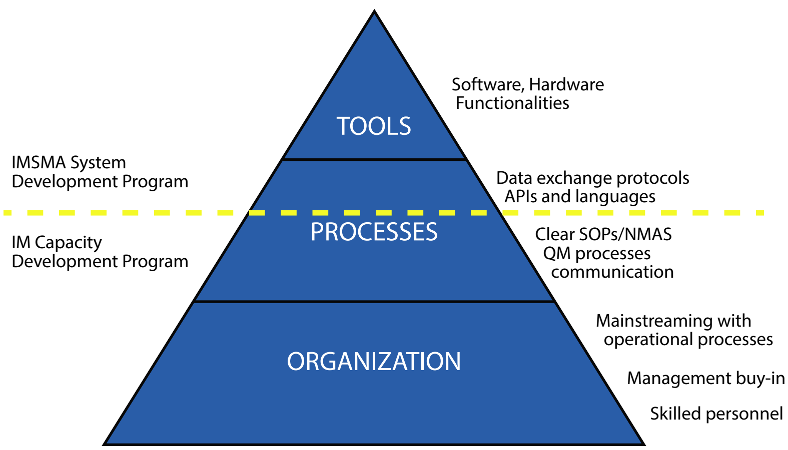

Figure 1. IM hierarchy of needs and GICHD information management support programs.
All graphics courtesy of GICHD.

Information management (IM) requires close collaboration between all parties in a mine action program and cannot be carried out in isolation. Effective IM involves tools as well as organizational processes that clearly define how different parties interact and function with IM. As depicted in Figure 1, without adequately defining processes through National Mine Action Standards (NMAS) and Standard Operating Procedures (SOP), even the most advanced and fit-for-purpose IM tools will lack the foundation to be effective.

Carefully integrating IM tools into the processes of an organization becomes increasingly important as more specialized tools become available. Recently, a number of applications were developed in the mine action community, many of them mobile data collection tools that address very specific requirements and needs.[1,2,3,4]

Mobile Collection Tools

The proliferation of mobile devices is increasing demand for mobile-based data collection solutions that bridge the information gaps in mine action programs. Operators and contractors in the field increasingly rely on mobile solutions to collect data about survey and clearance as well as other related activities.

The availability of easy-to-use software and development frameworks for common mobile platforms such as Android and iOS contributes to the proliferation of such tools. Designing a custom data collection form for a team being deployed to the field and making it available via mobile devices is a task that can be accomplished in a relatively short amount of time. Most tools can work offline and are able to synchronize data once an internet connection is reestablished.

The immediate benefit of using mobile data collection is real-time data sharing and analysis, and real-time tracking of deployed assets. It enables decision makers within mine action organizations to have quick access to information and make evidence-based decisions to implement and steer activities. Automatic georeferencing uses GPS functionalities built into devices and is another frequently mentioned benefit. Additionally, mobile data collection reduces the complexity of reporting by avoiding error-prone, double data entry (e.g., entering data via paper forms as well as manually entering data into a national information management system).

However, this synchronization with a central, national system presents a significant challenge. When different tools are used by various organizations to collect the same type of data, data is both stored in different locations, formats and technologies. In order to make informed decisions on a national level and preserve the data in the longer term, we must combine data into a single location. This requires robust data exchange mechanisms and standards.

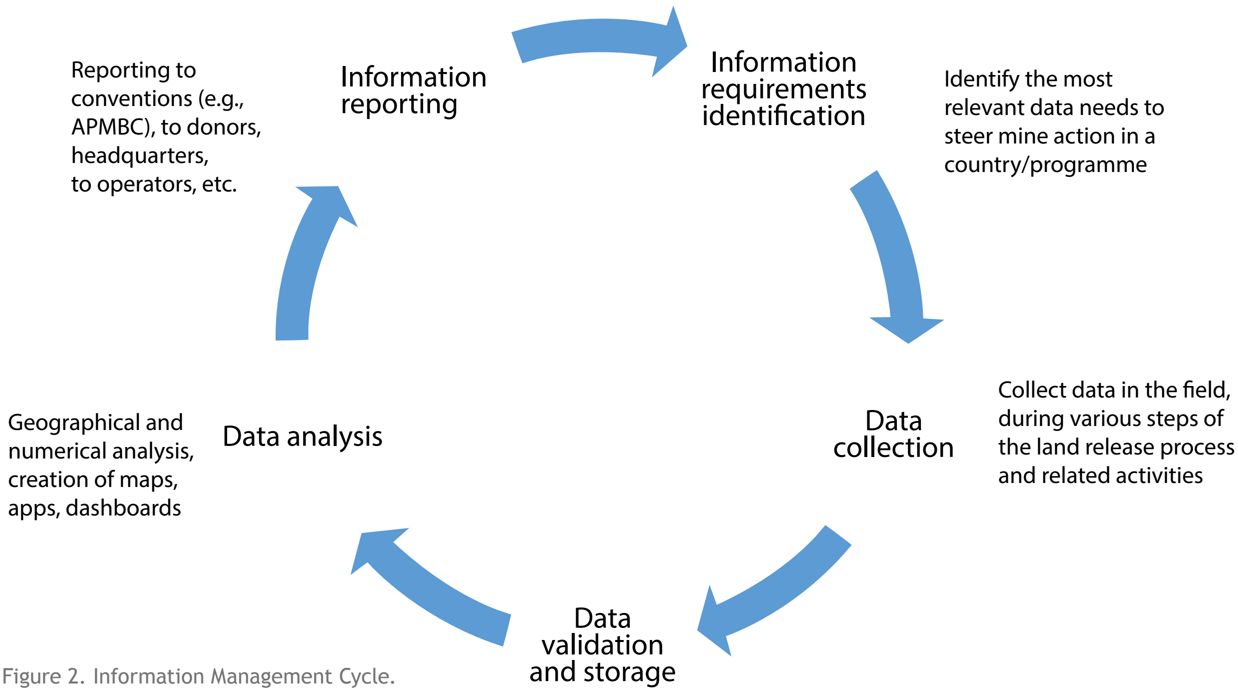

Figure 2. Information Management Cycle.

National Information Management Systems

As required by the national authority, many programs store country-wide mine action data in the Information Management System for Mine Action (IMSMA). Normally, data is collected by users in the field and sent to the national authority—either as paper reports, or digitally as Excel files or similar formats—and entered manually or imported into the central IMSMA database.

With so many different mobile data collection tools, there is an increased demand for a simple and robust data exchange functionality between said tools and IMSMA. One key element for data exchange is a common, well-documented data format that can be used to transfer data between two systems. For mine action, this requirement is addressed by the Mine Action Extensible Markup Language (maXML), which was originally developed in 2002 by identifying data that members of the mine action community are interested in sharing based on interviews and a review of various mine action information systems, standards and processes. It has been further developed since then by adding vocabulary that reflects the developments of the data that IMSMA contains. The maXML specification expresses these data as easily recognizable terms or words, and presents these terms in a structure that gives context to their meaning and intent. These terms and structure represent the maXML vocabulary. In most cases, the maXML vocabulary adheres to terminology used by the International Mine Action Standards (IMAS).

While the export and import of maXML are implemented within IMSMA, the current IMSMA^{NG} only partially addresses wider requirements for a seamless data exchange with third-party applications. In fact, national storage and validation of mine action data is only one step in the information management cycle (depicted in Figure 2) that IMSMA^{NG} must support.

The identification of information requirements—data collection, analysis and reporting—are addressed equally by the current IMSMA^{NG}. As it was originally conceived as a holistic tool, the ability to exchange data easily, while important, was not central to its design. Therefore no Application Programming Interface (API) is available to expose and leverage IMSMA business logic and functionality.

The emerging third-party applications mentioned previously cover specific steps of the information management cycle such as data collection via mobile devices or reporting through the Mine Action Intelligence Tool (MINT).[4] By focusing on one specific requirement, applications often outperform the **one-size-fits-all** IMSMA^{NG}, which must meet multiple requirements. Acknowledging these technological trends and new opportunities, GICHD initiated a new development cycle in 2015 focusing on IMSMA's role of data storage, validation and integration.

Motivation for Change

Regular updates to IMSMA are required in order to keep pace with evolutions in information technology. However, these updates also provide opportunities to rethink macro-level architecture and to take into account lessons learned from previous years, taking advantage of technological developments.

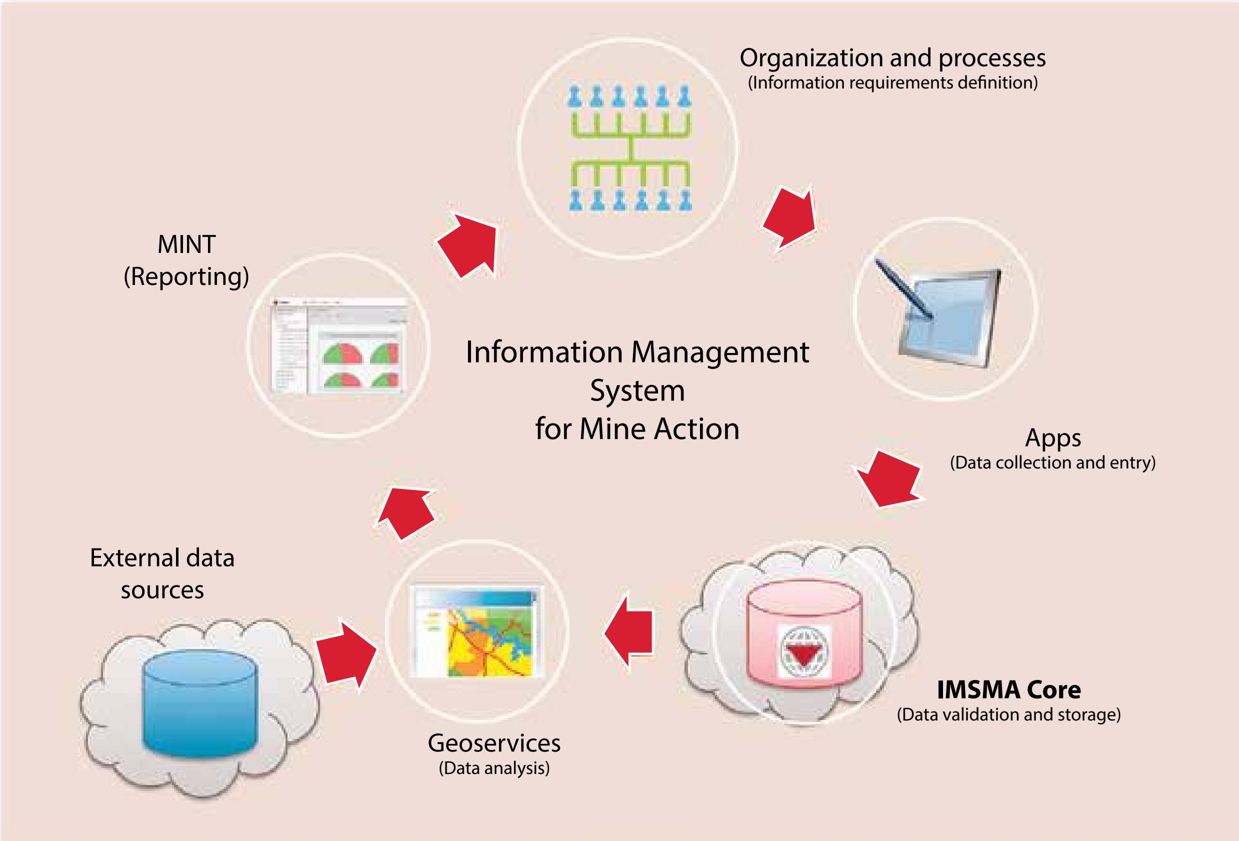

Figure 3. Vision of a future information management system for mine action.

With its adapted strategy and new development cycle, GICHD aims to address evolving and emerging requirements regarding user experience and interoperability with third-party applications. Moreover, GICHD will more efficiently employ off-the-shelf tools for mine action tasks. This will reduce costs and the need for specific technical system support, freeing up both GICHD and field IM resources to provide user-driven information products such as maps, reports and statistics.

In many programs, the core function of IMSMA is a platform to store and validate national data, while other functions such as data collection and analysis can be performed by specialized third-party applications. As a result, the current objective of the strategy is to strengthen this now-called **IMSMA Core** component and open it up for easy integration with data from a variety of sources. This will be achieved by defining an **IMSMA framework** including a revised maXML specification and an API allowing for seamless exchange of data and functionalities. In this sense, IMSMA should no longer be understood as a singular tool but as a system: a set of interrelated tools and processes that operate together to provide the sector with sound IM.

In IMSMA's new strategy, each step in the process can be carried out by a variety of standard or customized tools developed either by GICHD or by third-party developers provided these tools are interoperable, i.e., that they can communicate data between one another in a standardized and reliable manner. Figure 3 illustrates how this strategy supports all stages of the information management cycle. To accomplish this, GICHD will develop and maintain a robust mine action data exchange language—maXML and API—allowing for a standardized exchange of data and functionality between different tools in the system. In this way, GICHD seeks to foster and encourage an ecosystem of user-driven, interoperable, modular tools that can quickly leverage rapid advances in technology and more effectively put IM into the hands of mine action and relevant operational stakeholders.

The key objectives of the new IMSMA development strategy are

- To provide a common IMSMA framework under which a family of tools developed by different organizations for mine action can operate. This framework will provide an environment where different tools are compatible with IMSMA Core.

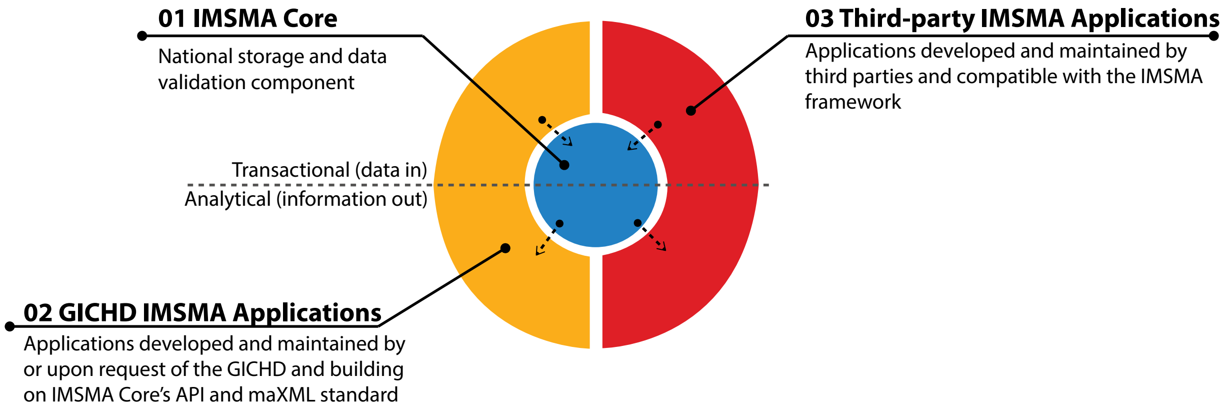

Figure 4. IMSMA applications.

- To design a data model that facilitates analysis of data through tools such as GIS and IMSMA MINT thereby contributing to more efficient planning of mine action operations and potentially other humanitarian sectors.
- To provide an IM system that is user friendly and requires minimal specialized training. This will free up GICHD's IM advisors to provide support on IM methods and will free up IM staff in partner organizations to focus on data analysis rather than technical issues.
- To facilitate easy and cost-efficient adaptation of IMSMA to evolving business processes.
- To reduce maintenance costs of custom-built tools in the future.

Implementation

While the development of IMSMA Core has only just started, the overall framework has taken shape, and tools for the various steps of the IM cycle have matured. Figure 4 specifies the vocabulary used for those applications, depending on their level of engagement with IMSMA.

- **IMSMA Core** refers to the central storage and data validation component with its data exchange functionalities.
- **GICHD IMSMA** applications refer to applications developed and maintained by or upon request of the GICHD and builds on IMSMA Core's API and the maXML standard.

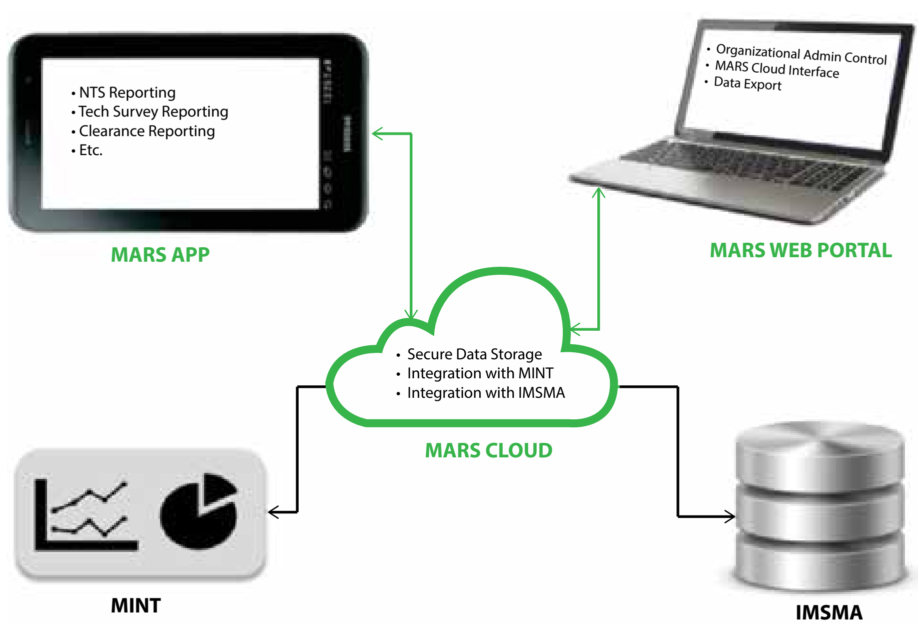

Figure 5. Overview of MARS.

- **Third-party IMSMA applications** refer to applications developed and maintained by third parties that are compatible with the IMSMA framework (i.e., they are able to exchange data with IMSMA Core and/or use the IMSMA Core API).

One example of a recently developed mobile data collection tool falling under the **IMSMA applications** category is the Mine Action Reporting System (MARS), which comprises three main parts:

- a field data entry mobile application (MARS Mobile)
- a web-based data management and administration portal (MARS Web)
- a cloud-based data storage (MARS Cloud).

After initial configuration via MARS Web, authorized users can collect data in the field using customized data entry forms or forms designed in IMSMA and imported into MARS. The mobile application allows GPS information to be captured as identifying points and polygons with a few finger taps. As soon as the mobile device is connected to the internet, the collected data is synchronized with the MARS Cloud and accessible for approval via the web portal. Finally, data collected via MARS can be imported into the IMSMA data repository and accessed via MINT for advanced data analysis and reporting purposes. As depicted in Figure 5, MARS is an example of an application integrated within the current status of the IMSMA framework and will be adapted as IMSMA Core and its API and data exchange capabilities mature.

Conclusion

The newly adopted IMSMA development strategy (2015–2018) aims at fostering better interoperability between the national storage component, IMSMA Core, and external applications such as mobile data collection. This interoperability will be achieved through an IMSMA framework that defines how various IM systems may interact. This development will take place in parallel to the maintenance and support of the current IMSMA^{NG} system that will continue beyond the development timeline of IMSMA Core.

See endnotes page 65

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Olivier Cottray joined the GICHD in January 2012, initially as the division's information services coordinator. As head of the information management division, he is now in charge of managing the team that provides information management capacity development and technical support to the mine action community. Prior to joining the GICHD, Cottray worked in humanitarian emergencies, running geographic information systems (GIS) support cells in U.N. and NGO field operations. Cottray completed a Bachelor of Science in geography and economics at the London School of Economics (U.K.) in 1998, and received a Master's in GIS and remote sensing from the University of Cambridge (U.K) in 1999.