Evaluating the impact of electronic Logistics Management Information Systems (eLMIS) and electronic Immunization Registries (eIR) in low- and middle-income countries

HONDURAS

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Objectives

- Background to research and tool introduction
- Context of use of the tool
- Research study
- Findings
- Recommendations
- Limitations
Background to the research

- The research forms part of a multi-country evaluation.

- **Topic**: The impact of electronic immunization registries (eIR) and electronic logistic management systems (eLMIS) in low and middle-income countries.

- **Project duration**: 2020 – 2022

- **Countries evaluated**: Guinea, Honduras, Rwanda and Tanzania.

- **Evaluation team** (Rwanda): The Centre for Impact Innovation and Capacity Building for Health Information and Nutrition (CIIC-HIN), the University of Bocconi, MM Global Health Consulting.

- **Data collection** (Rwanda): Feb/March 2022

- **Sponsors**: Funded by the Bill & Melinda Gates Foundation (BMGF) and co-sponsored by the World Health Organization (WHO) and Gavi, the Vaccine Alliance.
• **Tool selection:** Bespoke tool operating in Microsoft Windows. SINOVA contains modules for Export/Import of data to facilitate the exchange of information between SINOVA systems, using compressed XML files to exchange media to facilitate sending and receiving data via internet. The tool can be used with or without internet.

• **Scale:** SINOVA implemented nationwide at regional and municipal level (Integrated Health Centres – CIS), but not at local/rural level (Primary Health Care Units (Unidad de atencion primaria a la salud - UAPS)

• **Implementation:** Stepped implementation approach, encompassing a pilot phase in the 2 Regions of Francisco Morazan and Comayagua (2012-2013) and a stepwise implementation to other regions (2014-2019). Monitoring and evaluations activities carried out at every step to identify barriers and facilitators of implementation and inform further developments of the tool.

• **Integration and interoperability:** The SINOVA links to the infant’s National Identification Number (NIN) as the unique identifier, although challenges identified due to lags in requesting/generating the NIN. Interoperability with the Civil Registry and Vital Statistics (CRVS) System is not possible.
Use of SINOVA at different levels

Facility level

- Health workers complete paper-based records. Records are then either digitized directly at the facility or sent to other facilities/to the region for being digitized.
- Low level local facilities Primary Care Units (UAPS) mostly do not have access to SINOVA data as they lack basic IT infrastructure and mostly rely on paper records. Integrated health centers (CIS) at municipal level more likely to directly digitize data into SINOVA and use the system.
- For both CIS and UAPS focus is primarily on data recording rather than use to inform decision making; and feedback loops from higher level are rare.

Regions

- EPI Supervisors follow-up on health center reports and identify gaps in the information transmitted.
- Data is used for monitoring operations and in limited fashion to support supervision.

Central

- EPI/Statistic department of the MoH oversee documentation, notification and registration of immunization-related data at all levels of the health system.
- It collates and analyzes data obtained from the lower levels; disseminates data and summary reports.
**Theory of change (summary)**

The ToC serves as the foundation for an evaluation framework used to guide the interpretation of the key findings from this evaluation.

| Vision | Reduce morbidity and mortality from VPDs by enhancing equitable access to vaccines and strengthening immunization delivery within PHC (IA 2030) |
| Mission | Improve immunization program performance (equitable coverage and system efficiency) by sustained use of the eIR |
| Strategic outcomes | 1. Functioning eIR as part of a broader health information system  
2. Improved immunization data quality  
3. Increased use of immunization data for decision-making  
4. More efficient, affordable, and sustainable eIR use  
5. Increased stakeholder satisfaction and engagement |
Evaluation framework

Ecosystem
- Governance
- Human capacity
- Infrastructure
- Financing

Implementation
- Training & Support
- Costs

Tool
- Design
- Functionality (User Experience)

Impact (output indicators)
Affordability & Sustainability
Research questions

- Has the implementation of the e-Tracker improved immunization service delivery? [Impact]
  - To what extent does the system comply with established norms and standards? [Tool]
  - What were/are the barriers and opportunities for implementing it in the country? [Ecosystem, Implementation, Tool]
  - What is the impact of the e-Tracker on the national immunization program (e.g., cost saving, efficiencies, timeliness, coverage)? [Impact]

- What is the short- and medium-term economic (i.e., costs) and financial (i.e., expenditure) impact of rapidly implementing and scaling-up the systems in the whole country? How affordable and sustainable is it? [Impact, Affordability and Sustainability]

- How interoperable is the e-Tracker with other RHMIS modules and the civil registration system? [Ecosystem, Tool]

- How can new evidence on tools and technologies, modalities, and governance of the e-Tracker inform further investments in other countries from domestic sources, health financing institutions and technical partners for its sustained operation? [Ecosystem, Impact, Affordability and Sustainability]
Methodology: Programmatic impact evaluation

• A mixed methods approach involving both quantitative and qualitative methods.

• Analysis of the impact of SINOVA on the performance of the immunization system in terms of input, process, and output indicators. For the latter:

• Impact on drop out rate of Pentavalent vaccine (only one with multiple doses in use since several years)

• The absence of the link with the civil registry prevents SINOVA having any impact on Zero Dose Children

• The performance was compared between health facilities which use the full SINOVA setup (electronic and paper) and those that use only the paper forms.

• Evaluation aimed to identify and explore discrete factors critical for the successful implementation and scale-up of SINOVA

• Descriptive analysis of primary data generating uni- and bivariate frequency distributions and summary measures.

• Qualitative review of open-ended questions focused on the challenges and enabling factors of the use of the tool.

• All analyses were performed looking at the urban/rural, type of centres (CIS/UPAS) and regional stratification.

• Analysis of the time series of the dropout rate between Pentavalent 1st and 3rd dose for the period 2016-2020 for 34 of the 45 CIS surveyed. The number of years when the dropout rate declined was calculated and compared between CIS that used SINOVA in its electronic form in addition to the paper version and CIS that used only the SINOVA paper.
# Methodology: Economic impact evaluation

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Design &amp; development and roll-out expenditure for implementing SINOVA</td>
<td>Routine operating costs related to the management of immunization data using SINOVA</td>
<td>Difference in the operating costs of managing immunization data with SINOVA as compared to the previous system</td>
<td>Financial sustainability of maintaining the continuous operations of the systems, using domestic resources</td>
<td>Simulated impact on costs of a complete paperless registry</td>
<td></td>
</tr>
</tbody>
</table>

| Type of analysis | Descriptive analysis of pilot costs -(2 regions) – Extrapolation to national scale | ABC analysis – subgroup analysis by type of HC (CIS, UAPS), digitizing vs non-digitizing HCs, centralized versus non-centralized | ABC analysis using a before and after comparison. | Extrapolation of cost to entire country; descriptive and comparative analysis. | Simulation |

| Source of data | Secondary sources (Financial data from MoH/EPI) | Survey, Secondary sources | Survey, Secondary sources | Macroeconomic data (International Monetary Fund - IMF; WHO; country report indicators) + Secondary sources | Based on previous analyses |

ABC: Activity based costing; CIS: Centro Integrado de Salud (Integrated Health Centre); UAPS: Unidad de Atención Primaria en Salud en Salud (Primary healthcare unit); MoH: Ministry of Health; EPI: Expanded Programme for Immunization
## Activity-Based Costing (ABC) — Activities at HCs

<table>
<thead>
<tr>
<th>Activity - HC level</th>
<th>Description of the activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child registration on paper (SINOVA-1)</td>
<td>Entering details and data regarding a new child registration using SINOVA-1 forms</td>
</tr>
<tr>
<td>Digitization of SINOVA-1 forms</td>
<td>Periodically digitizing data from the paper forms SINOVA-1 into the SINOVA software</td>
</tr>
<tr>
<td>Organizing outreach sessions</td>
<td>Preparation for the delivery of immunizations in outreach settings</td>
</tr>
<tr>
<td>Defaulter identification</td>
<td>Reviewing registry to identify children who missed appointments, establishing list of defaulters.</td>
</tr>
<tr>
<td>Defaulter contacting</td>
<td>Contacting defaulters to remind caregivers of the need to get their children vaccinated, either by phone, or through other means, such as exploiting community volunteers or health promoters, or by directly visiting the child household</td>
</tr>
<tr>
<td>Identifying performance gaps</td>
<td>Reviewing data to find performance gaps (such as not being on track for reaching coverage goals)</td>
</tr>
<tr>
<td>Generating and transmitting SINOVA-2</td>
<td>Collating nominal vaccination data into aggregated forms (SINOVA-2) and transmitting them to higher administrative levels</td>
</tr>
<tr>
<td>report</td>
<td></td>
</tr>
<tr>
<td>Stock-out emergency replenishment*</td>
<td>Vaccine resupply from the region health offices due to a local stockout of routine vaccines for children under 5 years of age.</td>
</tr>
</tbody>
</table>

*This activity was considered only for the estimation of the cost impact of taking up SINOVA compared to the previous paper-based system, and not for the calculation of the routine operating costs of managing immunization data with SINOVA.
## Activity-Based Costing (ABC) — Activities at ROs

<table>
<thead>
<tr>
<th>Activity - HC level</th>
<th>Description of the activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digitization on behalf of healthcare facilities</td>
<td>Digitizing data from SINOVA-1 forms into SINOVA Software on behalf of healthcare centers that do not have a computer</td>
</tr>
<tr>
<td>Checking performance gaps</td>
<td>Reviewing data to identify health centers in their administrative area with performance gaps (such as not being on track for reaching coverage goals)</td>
</tr>
<tr>
<td>Collecting SINOVA-2 forms from HCs and transferring them to the central level</td>
<td>Collecting aggregated SINOVA-2 forms on paper from health centers</td>
</tr>
<tr>
<td>Digitizing and submitting SINOVA-2 forms to central level</td>
<td>Digitizing SINOVA-2 forms on behalf of healthcare centers that do not have a computer and transmitting them to higher administrative levels</td>
</tr>
<tr>
<td>Doing support visits to the healthcare facilities</td>
<td>Conducting support visits to the healthcare facilities to monitor and evaluate data collection and management or to address performance issues</td>
</tr>
<tr>
<td>Doing training activities</td>
<td>Conducting training activities on the use of SINOVA or other systems/processes for data generation and reporting</td>
</tr>
<tr>
<td>Maintenance of facilities equipment</td>
<td>Providing maintenance services to HCs for IT equipment</td>
</tr>
</tbody>
</table>
Identifying a comparator:

• For both the programmatic and economic analysis comparisons were made between facilities where SINNOVA software was implemented (Digit. HFs) and facilities where it was not (No Digit. HFs)

• Further subgroup analyses were done for Centralized vs. Not Centralized facilities and by type of facility (CIS/UAPS)

• For economic analysis we also consider the subgroups of HCs 'physically transporting' SINNOVA data on a data carrier (e.g., USB drive) and those not doing it (i.e., either sending data electronically or not sending it at all)

<table>
<thead>
<tr>
<th></th>
<th>CIS (N=47)</th>
<th>UAPS (N=33)</th>
<th>All HCs (N=80)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centralized facilities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>11 (23.40%)</td>
<td>10 (30.30%)</td>
<td>21 (26.25%)</td>
</tr>
<tr>
<td>Yes</td>
<td>36 (76.60%)</td>
<td>23 (69.70%)</td>
<td>59 (73.75%)</td>
</tr>
<tr>
<td>Missing</td>
<td>0 (0.00%)</td>
<td>0 (0.00%)</td>
<td>0 (0.00%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Modality with which data is digitized and transmitted</th>
<th>CIS (N=47)</th>
<th>UAPS (N=33)</th>
<th>All HCs (N=80)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digitizing HCs</td>
<td>23 (48.9%)</td>
<td>7 (21.2%)</td>
<td>30 (37.5%)</td>
</tr>
<tr>
<td>Physical transport</td>
<td>9 (19.15%)</td>
<td>3 (9.09%)</td>
<td>12 (15.00%)</td>
</tr>
<tr>
<td>Transmit electronically</td>
<td>14 (29.79%)</td>
<td>4 (12.12%)</td>
<td>18 (22.50%)</td>
</tr>
<tr>
<td>Not digitizing HCs</td>
<td>24 (51.1%)</td>
<td>26 (78.8%)</td>
<td>50 (62.5%)</td>
</tr>
<tr>
<td>Physical transport</td>
<td>22 (46.81%)</td>
<td>24 (72.73%)</td>
<td>46 (57.50%)</td>
</tr>
<tr>
<td>No physical transport</td>
<td>2 (4.26%)</td>
<td>2 (6.06%)</td>
<td>4 (5.00%)</td>
</tr>
<tr>
<td>Missing</td>
<td>0 (0.00%)</td>
<td>0 (0.00%)</td>
<td>0 (0.00%)</td>
</tr>
</tbody>
</table>

* Of electronic data on a data carrier
** Not digitizing HCs bring paper forms to other centres to be digitized
Sampling

- **Purposive sampling**
- **8 Regions, 80 Health Centres (HCs) per Region**
- **Stratified to have balanced sample by:**
  - The type of primary health facility providing immunization, CIS and UAPS,
  - Whether centralized or de-centralized HCs
  - Urban or rural location of the HC
- **Inclusion criteria:**
  - HCs with a catchment population (infants <1 year of age) greater than 150 children;
  - HCs that could be accessed from the RO;
  - HCs where vaccination services took place during the period of data collection.
Use of SINOVA electronic

- 30 of the centres surveyed (37% of the sample) use SINOVA digital & paper - of those 18 transmit data in electronic format (23% of the sample) and 12 physically transport the data to the next level
- MDC and Intibuca the regions with highest utilisation rate of SINOVA digital & paper / Atlantida, Comayagua and EL Paraíso with the lowest (as consequence of the mix of centres using the tool)
- UAPS have a lower rate of use of SINOVA digital & paper (22%)

3.2 ¿Este establecimiento de salud utiliza el SINOVA digital?

<table>
<thead>
<tr>
<th></th>
<th>Digit</th>
<th>No Digit</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIS</td>
<td>48%</td>
<td>52%</td>
</tr>
<tr>
<td>UAPS</td>
<td>22%</td>
<td>78%</td>
</tr>
</tbody>
</table>

CIS includes also Policlinicos
## Ecosystem

### Governance and policy
- The country demonstrated limited political engagement in the roll-out and use of the tool, and does not have a well-established strategic framework, and a coordinating body for digital health.

### Human capacity
- Significant gaps exist in competency and resourcing

### Standards & interoperability
- SINOVA operates as a stand-alone system not integrated with the Civil registry of Vital Statistics (CRVS).

### Infrastructure
- Intermittent access to electricity, limited access to internet (only 30% of the workers responded positively), as well as limited availability of hardware (only 43% of the workers have access to PC) are inhibiting factors for the use of the EIR.
Competency levels

Only about half of the respondents are proficient in using SINOVA tools (electronic and paper) to support decisions on children missing vaccinations.

Centres operating SINOVA signal insufficient capacity building in relation to their work needs.

The gap appears bigger for centres that digitize.

50% of respondents to basic questionnaire indicate basic or limited IT Competencies (gaps bigger in centres that do not digit and in UAPS).

85% of respondents indicate that the user guide are useful and supportive.

Most centres did not receive any update of the training material after the roll-out of SINOVA.
Understanding of roles and responsibilities and training needs

The level of understanding of roles and responsibility and adequacy of competency are low across all centres.

Need for training is highlighted by 77 of 80 centres.

The needs span across all matters: data registration, data analysis, dissemination.
Feedback from the regional level

The feedback process is primarily centered on the data quality and completeness (>80% of centres) and less on the follow-up on defaulters (only 58% of centres receive the latter with slightly lower % for electronic centres and UAPS) El Paraiso e Intibuca much more active in the feedback while Copan and Santa Barbara much less (20-30%) 78% of the centres receive feedback on a monthly basis or more frequently

4.27 ¿Recibe este establecimiento de salud aportaciones/recordatorios del nivel superior en apoyo al proceso de seguimiento? (N=80)

- 53% Digit
- 47% No Digit
- 0% No soy seguro

6.5 ¿Recibe usted comentarios o retroalimentación del nivel superior sobre sus informes de datos de vacunación? (N=80)

- 80% Digit
- 14% No Digit
- 2% No
Supportive supervision is generally available particularly in centres that digitize

However 43% of respondents indicate not having received support from their supervisor in the use of SINOVA (paper and electronic) and 56% not having sufficient technical support

Supervision occurs mostly on a monthly or quarterly basis
Level of satisfaction with SINOVA

% of positive answers (CB 7.1 thru 7.6)

- Level of satisfaction is high across all metrics
- No major differences among centres depending on their status of use.
- Only exceptions:
  - Speed - the centres not digitize and not transmitting have low satisfaction level (result of the double work for nothing in exchange)
  - Confidence that data will not be lost that is lower for centres that do not digit and transmit
Planning for immunisation sessions

• All centres have a target population for RI and campaigns

• LINVI and INE are the main sources for defining the target population, SINOVA plays a minimal role.

• 65% of respondents indicate using SINOVA (either electronic or paper) regularly to plan RI immunization sessions, 60% for campaigns
Defaulters follow-up

4.19 ¿En qué herramientas se basa el proceso de seguimiento de los niños pendientes?

- All centres have a process in place to follow up on defaulters and to notify parents of upcoming immunization sessions or delays.
- Nonetheless LINVI remains the main tool for those tasks with very limited use of SINOVA and almost no use of SINOVA electronic.
- The process of defaulters follow up is judged effective irrespective of SINOVA (only 2 centres mentions of the SINOVA process out of 80 centres as a factor having impact).
- At the same time, majority centres indicate that SINOVA process is helping making the process more efficient; centres digitizing more than centres that do not.
- The availability of the contact data is overwhelmingly seen as the main value added (it is in the paper version though) and in few cases the easy of access via the electronic tool.

4.25 ¿Cree que la aplicación de SINOVA ha hecho que este proceso sea más eficaz? (N=80)

- 90% of centres digitized and 70% believe that SINOVA has made the process more efficient.
- 10% of centres did not digitize and 30% do not believe that SINOVA has made the process more efficient.
The overwhelming majority of the centres believe that the introduction of SINOVA processes has led to data quality improvements:

- 2/3 indicated data more complete
- 1/3 indicated a more robust process with reduced risk of mistakes

Centres that do not digit have a slightly less positive view.

Nonetheless, centres that do not digit indicate problems in data consistency between LINVI, SINOVA-1 and SINOVA electronic.

Lack of personnel and lack of electronic tools are listed as the main drivers most likely influencing the ability of performing consistency checks and implement appropriate QA/QC.

5.5 ¿Cree que la introducción de SINOVA ha mejorado la calidad de los datos? (N=80)

- 97% 2/3 indicated data more complete
- 82% 1/3 indicated a more robust process with reduced risk of mistakes
- 3% Centres that do not digit have a slightly less positive view
- 10% Nonetheless, centres that do not digit indicate problems in data consistency between LINVI, SINOVA-1 and SINOVA electronic
- 0% Lack of personnel and lack of electronic tools are listed as the main drivers most likely influencing the ability of performing consistency checks and implement appropriate QA/QC
Impact on process efficiency (recording of nominal data)

- **SINOVA causes duplication of data-entry efforts**
- **60% of the centres indicate that the new process based on SINOVA is slower because many more data to input**
- **27% of centres fully electronic indicate a faster process – no specific insight on the drivers are provided**
- **No major difference between regions**
- **UAPS reported a higher proportion of centres with slower process**
Use of SINOVA data for decisions

• 75% of the centres use SINOVA data (paper or electronic) to support decisions

• 78 out of 80 centres have tools to monitor vaccination performance
  - The largest majority is paper based
  - 1/3 of centres that digit uses also electronic tools

• The roll-out of the electronic features seems not to have changed practices in the monitoring of performance with the same proportion of centres digiting and not digiting using SINOVA sourced data (electronic or paper)

• Nonetheless, 57 out 60 centres indicates that the process has improved following the system roll-out because SINOVA allows:
  - Access to better information
  - Better tracking of defaulters and follow-up
  - More precise definition of target populations

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7.8 ¿Se utilizan los datos de SINOVA en este proceso? (N=80)

<table>
<thead>
<tr>
<th>Digit</th>
<th>No Digit</th>
</tr>
</thead>
<tbody>
<tr>
<td>26.67%</td>
<td>24.00%</td>
</tr>
<tr>
<td>73.33%</td>
<td>76.00%</td>
</tr>
</tbody>
</table>

7.2 ¿Las herramienta que permita seguir los resultados de las actividades de vacunaciones electrónico o en papel?

<table>
<thead>
<tr>
<th>Digit</th>
<th>No Digit</th>
</tr>
</thead>
<tbody>
<tr>
<td>66.67%</td>
<td>93.75%</td>
</tr>
<tr>
<td>33.33%</td>
<td>6.25%</td>
</tr>
</tbody>
</table>
Impact on drop-outs

- No significant trend can be visualised by looking at drop out rates stratified by use of SINOVA
- The result was expected in view of the limited use of SINOVA electronic in the follow-up activities (LINVI is the reference), rare activation of a feedback loop from regions aimed at supporting defaulters follow-up and the fact that SINOVA paper forms are just a replacement of existing forms
Findings

COSTS
The extrapolated financial expenditure to implement SINOVA in the whole country amounted to USD 2,443,689.

- The total financial expenditure of the pilot implementation of SINOVA amounted to USD 378,972 (Two regions, Comayagua and Francisco Morazan).
- In the pilot phase, Staff and IT equipment absorbed 79% of overall costs.
- IT equipment fully funded by external donors. Staff salaries paid by Honduran MoH.
- Implementation assessment and supervision activities 28.2% of overall costs whereas training accounted for 14.5%.
- Honduras MoH and External donars covered 20.5% and 79.5% of total financial expenditure of the pilot implementation of SINOVA.
- System development costs low and accounting for 4% of the overall cost (possibly underestimated).
The annual routine cost of performing immunization data management activities using SINOVA was estimated at USD 2,628 (95% UI USD 2,267; 2,986) for CIS and 1,933 (95% UI USD 1,587; 2,278) for UAPS

- Child registration (paper + electronic registration) was the costliest activity, accounting for 30.7% and 28.9% of the total cost for CIS and UAPS respectively
- The largest cost input was personnel, accounting for 86.1% of the total cost per health center on average
- Differences between CIS and UAPS mainly for defaulter identification, child registration and defaulter contacting
  - Possible reasons: Larger target population of CIS
  - Higher coordinating role of CIS with respect to also performance of UAPS in their territory
SINOVA use increased the annual costs of managing immunization data of USD 490.7 (95% CI USD 370.5; 567.8) per facility per year compared to paper registry alone.

- Digitization of nominal immunization records into SINOVA accounted for approximately +365 USD per facility per year (386 USD for CIS and 343 USD for UAPS)
- Also, child registration on paper more costly compared to previous paper-based system (+147 USD per facility per year; USD 206 for CIS and 88 for UAPS)
  - This is due to changes in SINOVA-1 forms compared to previous forms with more information on vaccinee added to the form
- Impact on costs of digitization depending on how data is digitized and transmitted
  - Higher costs for facilities physically transporting electronic records to the higher admin level. Costs of managing immunization data
- Not relevant difference in cost impact between CIS and UAPS or centralized and not centralized facilities
- No avoided costs thanks to SINOVA were identified
Affordability & sustainability

The cost of managing immunization data with SINOV A of USD 3.1M represents about 8.6% of the total budget allocated to routine immunization activities.*

* estimated at USD 35.7M

Extrapolated cost of SINOV A at national level

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>PAPER-ONLY COSTS (USD)</th>
<th>SINOV A (USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child registration on paper</td>
<td>295,062</td>
<td>449,879</td>
</tr>
<tr>
<td>(SINOV A-1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digitization of SINOV A-1 forms</td>
<td>0</td>
<td>624,219</td>
</tr>
<tr>
<td>Generating and transmitting</td>
<td>358,958</td>
<td>358,958</td>
</tr>
<tr>
<td>SINOV A-2 report</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organizing outreach sessions</td>
<td>487,098</td>
<td>487,098</td>
</tr>
<tr>
<td>Defaulter identification</td>
<td>253,683</td>
<td>253,683</td>
</tr>
<tr>
<td>Defaulter contacting</td>
<td>594,054</td>
<td>594,054</td>
</tr>
<tr>
<td>Identifying performance gaps</td>
<td>342,844</td>
<td>342,844</td>
</tr>
<tr>
<td>Total</td>
<td>2,331,699</td>
<td>3,110,734</td>
</tr>
<tr>
<td>Δ vs paper based</td>
<td>0</td>
<td>779,036</td>
</tr>
</tbody>
</table>
Simulation of transitioning to Fully electronic system

- Operating costs slightly reduced should SINOVA be implemented in all facilities (CIS and UAPS), reducing costs of digitization of immunization data
- Potential for savings much higher if legacy paper processes are eliminated (SINOVA-1 and SINOVA-2 forms)
  - A fully electronic scenario would be moderately cheaper than the paper-only system
- These results do not consider potential savings from a broader use of SINOVA to support HCW activities
- For a fully electronic scenario to be achieved, investments would be needed to further improve IT literacy and enable stable, secure, and safe data generation and use.
Summary of Findings and Limitations
Summary of Programmatic Findings

• The goal of the SINOVA process and tools roll out was primarily to improve reporting

• SINOVA has been rolled out partially (only 30 centres digitize locally out of 80) in a hybrid fashion (with electronic and paper components)

• Legacy systems (LINVI) and upgrades of the legacy systems (SINOVA-2 paper) are still in use and remain the backbone of the vaccination program data system – the use of the electronic data from SINOVA is very limited

• Planning for vaccination activities (routine and campaigns) and follow-up on defaulting children does not leverage SINOVA electronic

• The major improvement of the implementation of the SINOVA process is the availability of contact information for the families of the children and a process that helps improving data quality.

• The absence of a link to the civil registry, the weakness of the feedback from regions in relation to defaulters tracking and follow-up and the lack of SINOVA electronic in the majority of the centres hinder the ability of impacting drop-out rates and fully prevent impact on Zero-Dose Children

• The majority of centres indicate that a migration to a fully electronic system can be effective and impactful if the appropriate conditions (internet, electricity, personnel) are created
Summary of Economic Findings

- The extrapolated financial expenditure to implement SINOVA in the whole country amounted to USD 2.4 million. 79.5% was covered by external donors.
- The annual routine cost of performing immunization data management activities using SINOVA was estimated as USD 2.6k for CIS and USD 1.9k for UAPS.
- The extrapolated annual cost of managing immunization data with SINOVA in the whole country amounted to USD 3.1 million, excluding digitizing costs by HCs on behalf of other HCs, compared to USD 2.39 million with previous paper-based registry use (+33%). No avoided costs thanks to SINOVA on the immunization system were identified.
- Operating costs slightly reduced should SINOVA be implemented in all facilities. Savings (compared to paper-based) if paper processes are eliminated.
## Summary of evaluation findings

<table>
<thead>
<tr>
<th>Ecosystem</th>
<th>Strengths</th>
<th>Challenges</th>
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<tbody>
<tr>
<td></td>
<td>• Initial high commitment</td>
<td>• Unstable political environment</td>
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<td></td>
<td>• Intention to have a nationwide uniform system</td>
<td>• Limited internet access</td>
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<td>• Insufficient hardware at peripheral level (exp at UAPS) (?)</td>
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<tr>
<td>Tool</td>
<td>• Trustworthy and user-friendly tool</td>
<td>• Duplication of information flows</td>
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<td></td>
<td></td>
<td>• Limited interoperability with other information systems tools</td>
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<td></td>
<td></td>
<td>• Use of SINOVA primarily by data managers (not by vaccinators)</td>
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<tr>
<td></td>
<td></td>
<td>• Updating issues</td>
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<tr>
<td>Implementation</td>
<td>• Adequate computer literacy and access to IT support</td>
<td>• Limited IT training and maintenance</td>
</tr>
<tr>
<td></td>
<td>• Access to hardware (computers), where it was foreseen</td>
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<tr>
<td></td>
<td>• Low customization costs (4% of total implementation costs) (possibly underestimated)</td>
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<tr>
<td>Impact</td>
<td>• Improved perception of data quality</td>
<td>• Paper registry considered most trust-worthy data source</td>
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<td></td>
<td>• Improved quality in decision-making at district level</td>
<td>• Estimated increase of total annual cost for immunization data management in Rwanda by 33%</td>
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<tr>
<td>Affordability &amp; Sustainability</td>
<td>• Transition to fully electronic is simulated to be cost-saving, provided infrastructure and capacity building elements are in place (and hybrid system is overcome)</td>
<td>• Parallel use of the SINOVA with paper registries unlikely to be cost-effective</td>
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</table>
Limitations

1. The sample of 80 HCs and 10 Regional offices coupled with the purposive sampling strategy may have impacted the external validity of the findings.

2. The data collected both for the programmatic and economic components consist primarily of perceptions reported by HWs are therefore exposed to different types of biases.

3. Recall bias was especially relevant in the cost impact analysis comparing the SINOV A and the previous paper-based registry system. However, for key activities it was possible to distinguish between paper processes and electronic processes.

4. Drop-out rates were available only at district level (CIS) and only for a 5 years time series. No information about timeliness of vaccination could be accessed.
Recommendations
In general, the goal of improving performance of the immunization program and reducing the workload of HWs requires an increased use of the electronic data generated by SINOVA as a tool to inform daily work activities of HWs at all administrative levels, including HCs.

To fully exploit the potential of SINOVA, a shift is required from SINOVA being focused mainly on data recording and reporting to it being positioned as a tool used to support data-driven decision making at all levels. To achieve this goal several actions are recommended.
Recommendations (II)

- Remove infrastructural barriers to implementation (e.g., intermittent electricity supply and limited internet connectivity)

- Assess staffing and training requirements for the successful functioning of SINOVA at all administrative levels, as well as appropriate financial planning and budgeting.

- Ensure sufficient levels of maintenance of IT equipment and technical assistance, especially at HC level, through adequate budgeting and the development of standard operating procedures.

- Design and implement a cloud-based version of SINOVA, that allows data entry and access in real time

- Assess the feasibility of establishing a link between SINOVA and the Civil Registration and Vital Statistics (CRVS) system