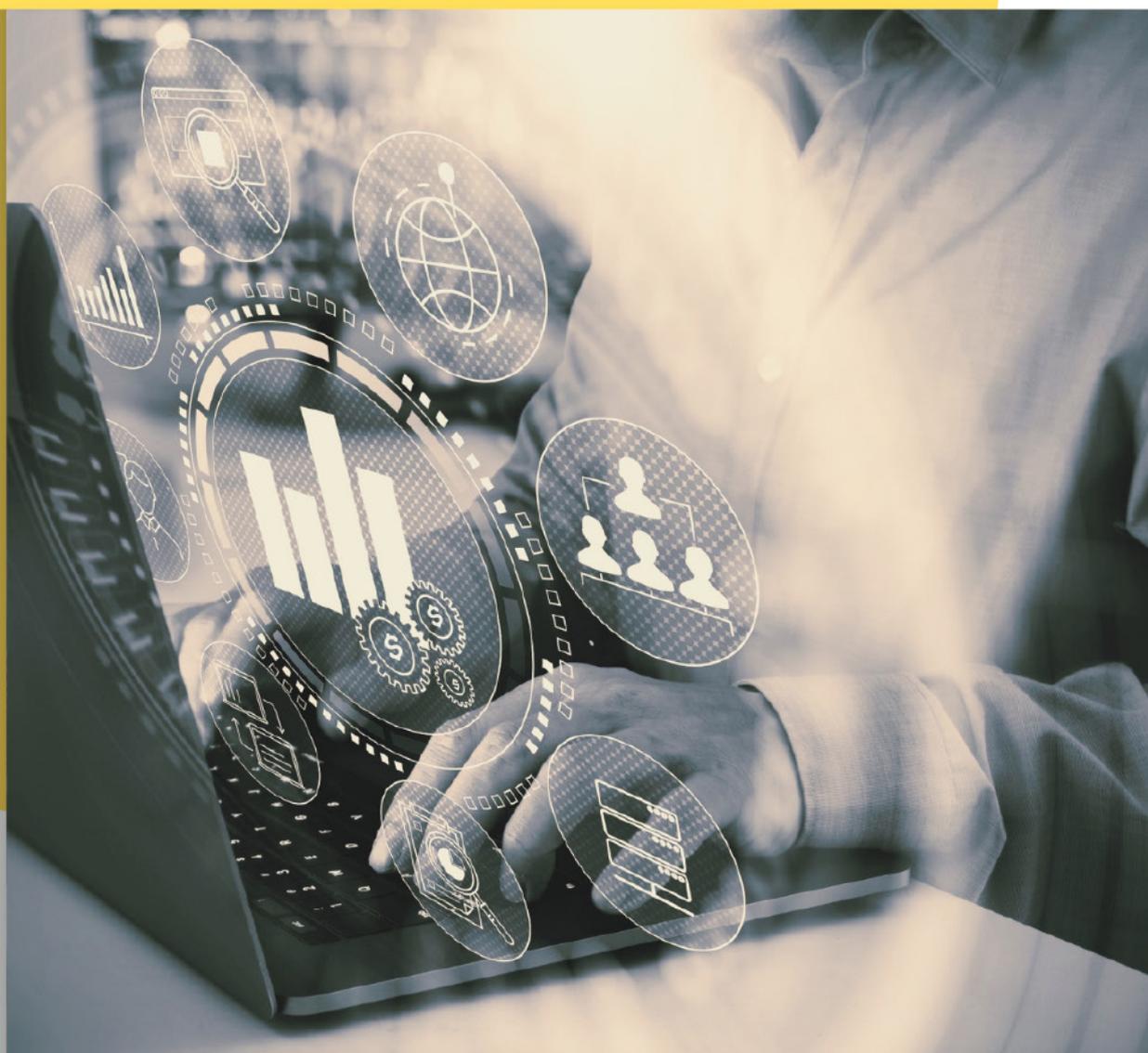




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# **COSTING ANALYSIS OF ELECTRONIC IMMUNIZATION REGISTRY IMPLEMENTATION**

Lessons learned and recommendations from Vietnam



IDEAL VIETNAM PROJECT



This case study was developed by the IDEAL-Vietnam project, a collaboration of PATH, the Vietnam Ministry of Health, the Vietnam National Expanded Program on Immunization, and Viettel, and authored by team members from PATH and the National Expanded Program on Immunization.

We hope this report will contribute to ongoing discussions about immunization logistics, and we welcome comments from interested parties.

This work was funded by a grant from the Bill & Melinda Gates Foundation. The views expressed herein are solely those of the authors and do not necessarily reflect the views of the foundation.

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# ABBREVIATIONS

EIR	Electronic immunization registry
IDEAL	Introducing Digital immunization information systems - Exchange And Learning from Vietnam
IT	Information technology
NEPI	National Expanded Program on Immunization
NIIS	National Immunization Information System

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# INTRODUCTION

## PROJECT BACKGROUND

In 2018, with support from the Bill & Melinda Gates Foundation, the Introducing Digital Immunization information systems: Exchange and Learning (IDEAL) project were launched by PATH to support Vietnam's transition to a paperless immunization registry system through the provision of technical support and to facilitate the exchange and sharing of lessons learned in Vietnam with other countries. The IDEAL project was designed to show what systems and supports need to be in place in order to shift Vietnam to a fully digital national platform.



## COSTING AND ELECTRONIC IMMUNIZATION REGISTRIES

The implementation of electronic immunization registries (EIRs) in healthcare settings around the world has been shown to improve data accuracy and timeliness, leading to better planning and evaluation from a project management standpoint.<sup>1,2</sup> This can ultimately mean stronger health outcomes for community members, particularly children.<sup>1,2</sup> However, the transition of a nationwide immunization information system from paper-based to digital has financial implications that come with software design, development, and deployment. There are also recurrent costs of operating the system, as well as cost implications for human resources for government staff using these systems.



Several costing studies of health information systems in general, and EIRs in particular, have shown EIRs to have likely cost benefits when compared with paper-based systems.<sup>3,4,5</sup> For appropriate planning, it is imperative to first make sure that EIRs are costed through a costing model, the method or framework for determining the total value needed to deliver a product or service successfully. In this case, costing tells an organization or government body how much money is needed to sustainably develop, implement, and operate an EIR. Planning for successful EIR implementation needs to involve the inclusion of a costing evaluation to provide cost data that will help governments and public health organizations sustainably transition to a digital model.



# BENEFITS OF COSTING

A key benefit of a costing model is that it provides data that can inform *decision-making on the sustainability* of implementing something like an EIR. It provides cost estimates the project can use to plan budgets that not only consider the initial phases, like the design but also plan for future improvements and system maintenance.<sup>1,2</sup> Recurrent cost needs of the project must also be factored in. For an EIR, this includes ongoing technical support and maintenance, the need for refresher training and training for new staff, equipment needs, and connectivity. Costing exercises can help project developers understand the ongoing

financial implications of running the system.

In line with sustainability, costing also considers the financial cost of maintenance of the EIR system itself. Once the implementation of the EIR begins and more and more users and profiles are added, updates and adjustments will be needed, which translates into further costs. There may also be costs like data housing that should be included in a costing model.<sup>1</sup> Using costing as a tool for planning can help to ensure sufficient resources are available from the beginning of the project.



# COSTING CATEGORIES AND PHASES

To plan effectively, costing models should consider the costs of each stage of the EIR development. This includes the costs of design and deployment phases, but it should also account for the initial deployment phase, which will allow for a smoother shift to scale-up, and the transition phase from paper to digital. The transition phase is particularly important, as it is the time when healthcare workers' workload is most likely to be increased if there isn't an adequate budget for human resources to support healthcare workers in the initial task of manually inputting paper-based records into the EIR.

Costing looks at all levels of implementation. Categories to be included in a cost model include, but are not limited to, administrative support, development, scale-up, hardware, software, network infrastructure, security, physical infrastructure, training, data servers, management and technical support, maintenance, human resources at the local level, communications, and monitoring and evaluation.<sup>2</sup>



# COSTING EVALUATION IN VIETNAM

As part of IDEAL, PATH, with the collaboration of key partners, conducted a costing analysis of Vietnam's EIR, the National Immunization Information System (NIIS). The goals of the study were to



Estimate the costs of developing and deploying the NIIS and the recurrent costs of the NIIS at provincial, district, and commune levels.

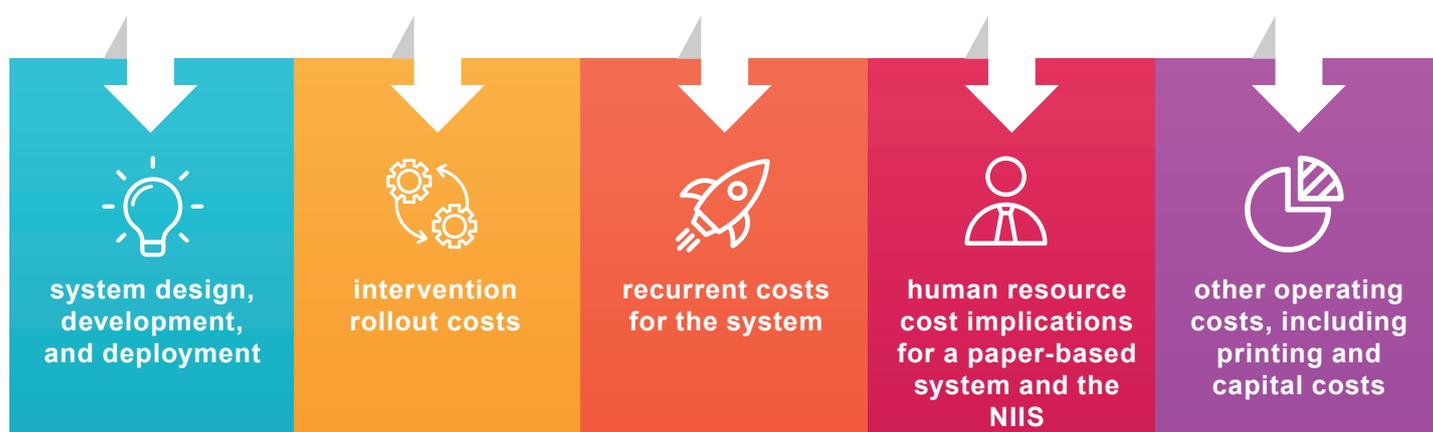


Compare the cost implications of eliminating the duplicative paper system by evaluating the costs of health care worker time use and operating costs with the NIIS versus the paper system.

This process has resulted in the collection of a set of recommendations and lessons learned for other public health entities and governments with similar socioeconomic contexts that want to measure the financial cost of developing and implementing EIR systems. The costing evaluation was used for advocacy efforts by showing the financial cost that comes with operating a paper-based system alongside the NIIS, highlighting the potential to save money by eliminating the paper system altogether.

Researchers from PATH and the National Expanded Program on Immunization (NEPI) collected data to estimate the costs to design, develop, and deploy the NIIS and also to compare the costs of paper-based record keeping to NIIS record keeping. Data were collected through expenditure record reviews and through primary data collection at 63 facilities, including health care facilities at all levels across Hanoi and Son La Provinces, as well as NEPI and Viettel offices. The data collection tools used for primary data collection were adapted from research that was conducted in 2018 in Tanzania and Zambia.<sup>6</sup>

In order to fit the Vietnamese context, the tools were modified, translated, and then field tested. Costing was divided into five categories:

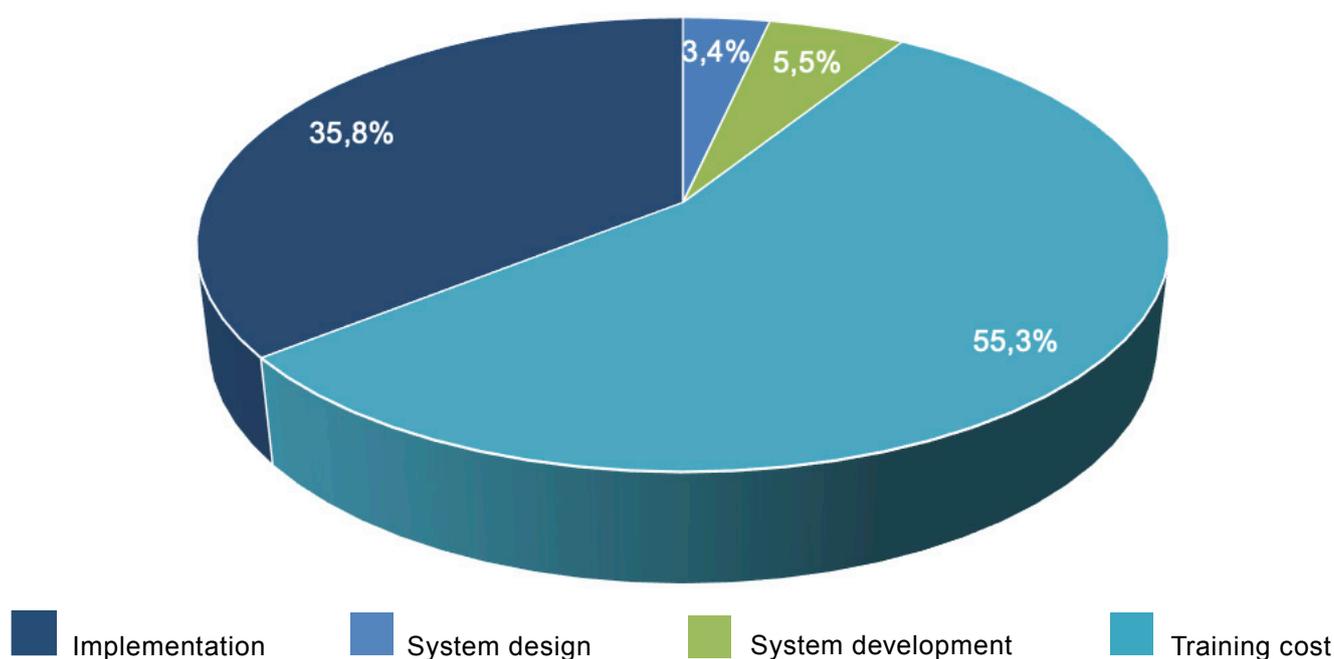


Cost categories 1 to 3 were estimated only for the NIIS, while cost categories 4 and 5 compared the costs for NIIS to the paper system.

# KEY PRELIMINARY RESULTS

Chart 1 estimates costing distribution for design, development, and deployment for all stakeholders and at all levels—central, province, and commune. Data were collected at the two project provinces of Hanoi and Son La. The results showed that costing for training (55.3 percent) took up the largest portion at the provincial and district levels. Supportive supervision for NIIS was usually integrated with other health programs during supportive supervision trips. Estimated costing for training at the provincial level (training of trainers for provincial and district staff) was roughly US\$41,000, and cascade training average costing for each commune was approximately US\$762. Average costing for commune deployment was US\$69, including labor cost for data input, internet, and investment in equipment (computers) for NIIS at commune health centers. Therefore, estimated cost for NIIS deployment on registering and managing one client on the system is US\$0.48.

**Chart 1.** Costing distribution among different activities (2015–2020).



The estimated cost per child for NIIS development and deployment was US\$0.48. This cost was significantly cheaper in comparison with the findings for the Tanzania and Zambia studies, which had costs of \$3.30 to \$3.81 and \$8.46 respectively <sup>a,6</sup>. It is important to note that one of the reasons for this cost difference could be that the Vietnam study sites already had much of the infrastructure in place to support a digital system. Having equipment like laptops and tablets readily available meant that they did not have as much upfront procurement costs. Also, connectivity costs are shared across programs in Vietnam, and internet and electricity are widely available at the commune level.

To ensure the system sustainability, the system budget plan needs to include all these costs from the beginning: operational, training and refresher training, and additional equipment.

<sup>a</sup> It is important to note that the Vietnam study analyzed over five cohorts while the Tanzanian and Zambian studies analyzed over three. Regardless of this, when adjusted to the same number of cohorts, the costs remained lower for the Vietnam study.

**Overall, the study showed cost savings for recurrent economic costs at commune health centers when using the NIIS instead of the paper-based system, while at the administrative level there were some incremental costs.** Introducing the NIIS does come with cost, but these are balanced by benefits such as vaccination timeliness and improved data quality. And, although implementation of the NIIS initially brought some additional tasks for health workers (at the beginning for back-dated data entry and during the transition of the dual system operation), the study showed savings in work time with the NIIS compared with the paper system in vaccine and supply management, vaccination subject management, immunization history tracking, and especially in planning for vaccination

sessions and report generation afterward. The NIIS also showed to improve the on-time immunization coverage. Therefore, it's clear that NIIS brings about many benefits compared to the paper-based system.

The costing results from the study were illustrated as costing per child in the system and costing per facility using the system. This format helps provinces and cities in Vietnam, as well as other countries, to consider developing and deploying EIR systems based on their own contexts. Countries with a higher population would have a lower average cost per child as the overall cost would be distributed in a larger population.



Through the process of interviews and examining self-reported financial costs, the research team found a series of **cost drivers**:



**NIIS development costs** were the highest portion of expenditure in Vietnam, and they would likely require hefty investment from other countries wanting to implement an EIR.



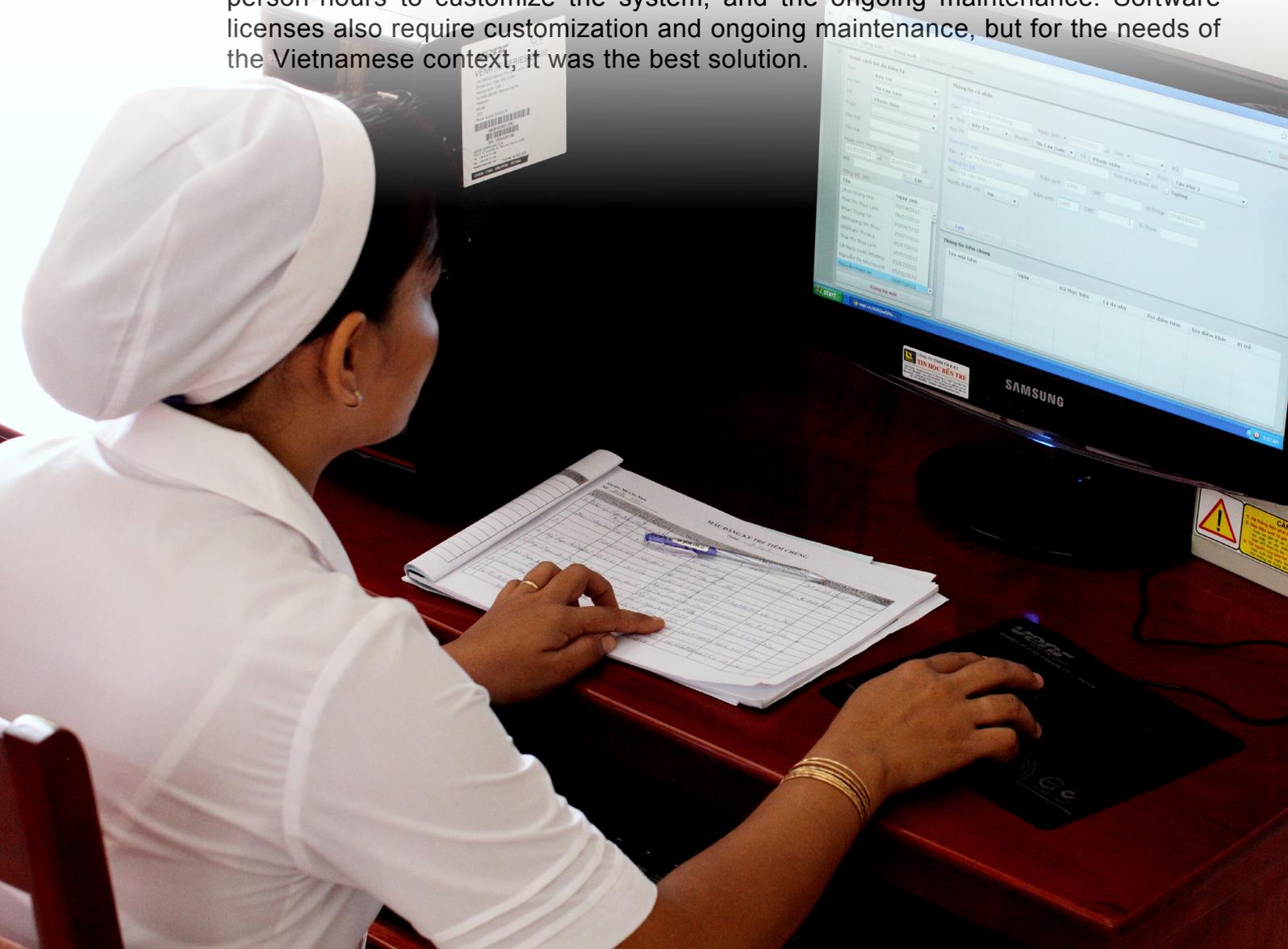
**The training and deployment process** in Vietnam had some cost advantages when compared with Zambia and Tanzania. For example, the earlier mentioned pre-existing infrastructure of internet, electricity, and IT hardware in Vietnam at the commune level meant there was no need for mass procurement of equipment in the initial phases. Increased access to internet availability and informational technology means that health workers in Vietnam were likely to have existing digital literacy, changing the **baseline training needs**. Also, in Vietnam equipment and connectivity costs are shared across programs, unlike in Tanzania and Zambia where immunization was the first program to turn digital.



**Labor costs** in the country of implementation should be considered, as this is a large portion of overall expenditure.



For Vietnam, the study found that purchasing a **software license**, as opposed to using an open-source license, was a necessary cost. Although there is a perception that open-source licenses may initially save money, it is important to consider the costs needed for adapting the generic tool to the country context, the significant person-hours to customize the system, and the ongoing maintenance. Software licenses also require customization and ongoing maintenance, but for the needs of the Vietnamese context, it was the best solution.



# LESSONS LEARNED IN COSTING AND RECOMMENDATIONS

**Costing models and data collection at all project phases.** Including costing models and data collection at the beginning of the planning process and continuing their use and reevaluation throughout all phases of the project would be the gold standard to enable the availability of costing data to inform decision-making at each stage of the intervention implementation. Collecting costing data related to EIRs at the different phases is important as it lowers the risk for incomplete or inaccurate costing data due to recall bias. In Vietnam, it was difficult to accurately estimate costs for the paper-based system because during data collection no facility in Hanoi or Son La still used only that system to operate. They had all already transitioned to the NIIS, and many of the health care workers with more detailed knowledge of the paper-based system had already retired or left the facility.

**Infrastructure considerations and recurrent costs.** When compared with the Zambia and Tanzania study, Vietnam has a much higher rate of electricity accessibility, equipment availability, and internet connectivity, which all presented a good opportunity to implement an EIR. Certainly, it lowered the cost in relation to investments in infrastructure network. It is important to remember that costs like internet, equipment, and new staff training are recurrent, require significant investment, and need to be built into implementation plans.

**Internet connectivity and informational technology (IT) knowledge.** In countries with good internet connectivity, it would be advisable to conduct remote trainings via the internet and

e-learning platforms. Staff turnover can be very high, especially in patient-facing positions, and internet trainings and e-learning can cut the costs of constantly training new staff in person. This should be seen as a high priority to support health implementation systems. Additionally, Vietnam found that, where appropriate, having younger health workers support other staff with IT matters could boost the facility overall.

**Local partnerships and resources for sustainability.** For Vietnam, having a long-term, sustainable partner like Viettel has been key to the success of NIIS implementation thus far. Viettel is a state-owned telecommunications company, and it has done pro bono work for NIIS deployment at every phase. Viettel worked with PATH and NEPI to develop the platform, served as a helpline resource for health care workers, and hosts the data on a server. Local buy-in ensures that the system will continue to be sustainable in the long term.

**Costing pilot.** To plan for the cost of a full scale-up to a digital system, modeling the costs through a pilot is necessary. This includes costing data collection activities across all stages. Details on the methodology PATH and NEPI used to pilot the NIIS scale-up can be found in [Vietnam's Scale-up from a District-level Pilot to a National-scale Electronic Immunization Registry \(EIR\)](#).<sup>7</sup> Costing from the pilot stage not only provides practitioners with a baseline idea on which to build subsequent phases, it builds a culture of costing from the outset of the project. This ensures that scale-ups are attainable and sustainable for the implementing partners.

In Vietnam, costing to compare the NIIS with the previous paper-based system was all done retrospectively four years after NIIS scale-up nationwide. This led to potential recall bias of respondents who either may not have remembered the full process or, due to high turnover, the staff interviewed may not have been working in the facility during the recall year. Instituting a cost analysis diary at the pilot level, to be implemented at all stages, would ensure the most accurate financial information is recorded and would systemize the use of the

diary, avoiding the potential recall bias seen in Vietnam's case for the cost estimates.

The cost of going digital. Transitioning to a fully electronic system will cost more, at least initially, because it costs to improve systems. However, the cost increase needs to be compared with effectiveness rates to accurately show the value for the money. Overall costs in Vietnam were much lower than in the Zambia and Tanzania study, as much of the infrastructure was already in place.



# REFERENCES

1. European Centre for Disease Prevention and Control (ECDC). Designing and Implementing an Immunisation Information System. Stockholm: ECDC; 2018.
2. Immunization Data: Evidence for Action. A Realist Review of What Works to Improve Data Use for Immunization, Evidence from Low- and Middle-Income Countries [précis]. Seattle: PATH, Pan American Health Organization; 2019.
3. Bassi J, Lau F. Measuring value for money: a scoping review on economic evaluation of health information systems. *Journal of the American Medical Informatics Association*. 2013 Jul-Aug;20(4):792–801. <https://doi.org/10.1136/amiajnl-2012-001422>.
4. McKenna VB, Sager A, Gunn JE, Tormey P, and Barry MA. Immunization registries: costs and savings. *Public Health Reports*. 2002 Jul-Aug;117(4):386–392. <https://doi.org/10.1093/phr/117.4.386>.
5. Mvundura M, Di Giorgio L, Vodicka E, Kindoli R, and Zulu C. Assessing the incremental costs and savings of introducing electronic immunization registries and stock management systems: evidence from the better immunization data initiative in Tanzania and Zambia. *The Pan African Medical Journal*. 2020;35(Suppl 1):11. <https://doi.org/10.11604/2Fpamj.supp.2020.35.1.17804>.
6. Mvundura M, Di Giorgio L, Lymo D, Mwansa FD, Ngwegwe B, Werner L. The costs of developing, deploying and maintaining electronic immunisation registries in Tanzania and Zambia. *BMJ Global Health*. 2019;4:e001904. <https://doi.org/10.1136/bmjgh-2019-001904>
7. Duong H, Dao S, Dang H, et al. The transition to an entirely digital immunization registry in Ha Noi Province and Son La Province, Vietnam: readiness assessment study. *JMIR Formative Research*. 2021;5(10):e28096. <https://doi.org/10.2196/28096>.

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