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Costs of Climate Information Services Development and Implementation

A stakeholder consultation survey to inform a cost-benefit analysis toolkit

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Climate change is increasing mean temperatures and has increased the incidence of extreme temperatures, heat waves, and drought across Africa (Trisos et al., 2022). In Sub-Saharan Africa climate change is reducing crop yields and productivity, and depressing economic growth.

Adapting to climate variability and change is essential to safeguard food security, ensure economic growth, and advance climate resilient development in Africa. Climate information services (CIS) can help societies adapt to climate variability and change. CIS involve the "production, translation, transfer, and use of climate knowledge and information in climate-informed decision making and climate-smart policy and planning" (Climate Services Partnership).

Key messages

- There is no standardized approach to cost CIS development and implementation, making it challenging to elicit CIS cost data.
- Different costs are realised by different CIS value chain actors. Costs also vary depending on CIS communication approach.
- Investing in higher upfront costs can enhance sustainability of a CIS project.
- Eliciting CIS cost data helped stakeholders identify implementation bottlenecks and consider new activity areas, potentially helping to move their CIS initiatives forward.

Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA) works to facilitate and scale the development of tailored CIS and climate-smart agriculture making it accessible to smallholder farmers in six target countries. However, the costs and benefits of providing CIS to smallholder farmers have not yet been well-documented. AICCRA is developing a methodology and toolkit to help stakeholders assess the public and private costs and benefits of CIS to provide economic justification for these interventions. This in turn is expected to improve investments in adaptation and ensure that limited resources are being spent effectively.

This info note presents findings from testing a first version of the costing component of the cost-benefit analysis toolkit. The info note presents the costing methodology, describes the CIS initiatives sampled, and summarizes the results from stakeholder costing interviews using this tool. The info note concludes with a discussion on CIS costing processes and offers refinements to the methodology. Information on the benefits component of the toolkit can be found in Kramer and Timu, 2022.

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Costing Methodology

The cost-benefit analysis toolkit breaks the costs of CIS programs into two categories: fixed costs (i.e., initial development costs that do not change with quantity of CIS developed and disseminated) and variable costs incurred over a year or seasonal cycle (i.e., implementation costs that might vary with level of CIS developed and disseminated). Fixed costs include the initial software design and development, the costs of training and engagement of meteorological services, and the value of office equipment used for CIS development and dissemination. The current value of equipment is generated based on original value, age (in years), and annual depreciation rates.

Variable costs include seasonal and CIS-based office supplies, overheads, and utilities, media promotion and awareness raising among CIS users, training of extension staff and CIS users, monitoring of CIS implementation including field visits, mobile and web app maintenance, data analysis and processing, and costs of dissemination, for instance of sending SMS (text messages) to farmers, or of organizing meetings with farmer groups to disseminate the advisories. Salaries and benefits of extension staff and other team members involved in providing advisories are also included under variables costs. The timeframe for CIS costing is one cropping season, which is on average equivalent to four months.

Data Collection

To test this methodology, we conducted a stakeholder consultation with AICCRA staff and affiliates with the aim of collecting cost data for CIS programs developed and/or implemented in the context of AICCRA. During initial interviews, we informed stakeholders of the scope, aims, and methodology, after which they were asked to fill out a CIS costing survey that includes the fixed and variable costs listed above. In total, we interviewed 13 AICCRA staff and stakeholders and received five completed CIS costing surveys. Data were collected from one national meteorological service, two CGIAR staff members, one software developer, and a representative from an implementing NGO. Three AICCRA-supported CIS initiatives were costed through this exercise as well as one estimation of fixed expenses from the perspective of a national meteorological service and another estimation of fixed expenses from the past experience of a software developer. The three AICCRA-supported CIS initiatives are briefly described below and cover programming in Ghana, Senegal, and Zambia.

AgDataHub

An AgDataHub is a digital CIS platform that creates an ecosystem of data and information to support various actors in the CIS data value chain (Dhulipala et al., 2022). The AgDataHub serves as a central repository providing data to end users in different formats. Several AICCRA target countries are implementing AgDataHubs. Data presented below pertains to the AgDataHub under development in Ghana.

In Ghana, the AgDataHub includes public and private (password-protected) datasets, spanning climate, socio-economic, and agricultural data. The Hub has built-in data visualizations that can serve as a dashboard for easy interpretation and also allows users to design their own data visualization tools and dashboards to facilitate data analysis. The Hub enables project teams to interpret data,

upload resources such as advisories, and includes a built-in messaging platform. The AgDataHub can also provide a platform to promote continuity and enhance sustainability after a program cycle is complete, serving as a central place to store data and contact information.

iSAT

The intelligent Agricultural System Advisory Tool (iSAT) is a climate advisory service that produces context-specific and real time climate and agro-advisory information through ICT (Joseph et al., 2022). iSAT aims to help smallholder crop and livestock farmers manage climate risks through timely location- and crop-specific forecast-based agro-advisories. iSAT uses a decision tree process to help users with decisions on crop and varietal selection, timing of planting and harvesting, and in-season input management. iSAT is being implemented in Senegal and Zambia. In Zambia, advisory information is communicated via SMS. In Senegal, iSAT shares weekly advisories using Interactive Voice Response (IVR) messages in local languages to registered users via Jokalante, a Senegalese Agritech company.

Results and Discussion

Table 1 and 2 identify the percentage of each cost category corresponding to total fixed costs (Table 1) and variable costs (Table 2) for the CIS cost estimate data collected. We did not include the direct costing data in the info note due to confidentiality considerations. The five CIS costing surveys are labelled as Example 1-5.

There were cost similarities between two of the CIS programs under implementation, however, there was notable variation when costs reflected national meteorological services or were derived from past CIS design experiences in other regions. The cost estimates for the national meteorological service had the highest total cost, due to the price and quantity of meteorological stations as well as vehicles. Given the age and multiple uses of these items, the true cost contributing to any one CIS is likely minimal. To conduct the analysis for this info note, the office equipment cost estimates were listed as the percentage used by the CIS initiative,

multiplied by the original value. No depreciation formula was applied due to incomplete data (which we will further discuss under methodological implications and depreciation), meaning that equipment costs were likely overestimated.

Other than the budget items of the national meteorological service, software design and development comprise the largest cost share of CIS implementation. Stakeholders remarked that most costs are incurred upfront due to the initial labor required to set-up the CIS software.

This exercise highlighted that different costs are realised by different CIS value chain actors, including private, public, and not-for-profit entities, and that CIS implementation requires a complementary ecosystem of services to function. National meteorological services provide, by mandate, a national public good whose true cost is not going to be fully reflected in the budget of a CIS program. The consultation interviews clarified that CIS rely on provision of public, but also sometimes private, climate information.

An important insight on the sustainability of CIS investments was raised during the consultation. One stakeholder explained that CIS can be hosted on a virtual private cloud-based server or a physical server. While cloud-based servers are less expensive initially, the need for continual annual payments requires sustained project funding to host the data. Whereas a physical server, which can be hosted by a government ministry, can enhance sustainability of the interventions after the project ends, acting as a durable repository. When hosted by government, the costs needed to run the electricity for the cooling system can be paid for using national budgets and there is a greater likelihood of having staff available with the capacity to manage a server. The stakeholder also emphasised the importance of having backup virtual private servers or backup physical servers to ensure that there is no gap in access or loss of data in case of a crash.

Variable costs varied widely, reflecting different CIS communication approaches. Only one of the CIS examples relied on extension staff and invested more heavily in awareness-raising and CIS user training, raising variable costs, despite only being implemented during the cropping season.

All CIS initiatives were using phone-based messaging systems for communication via SMS or IVR. Sending SMS as part of the CIS is an exceedingly cheap option, with the two estimates ranging from $0.001-0.002 per message. The figure for the IVR is considerably higher but the cost data suggests that software development comprised the majority of the upfront costs. SMS and IVR enable CIS programs to reach a larger number of beneficiaries and provide more frequent information and advisories. Stakeholders estimated that the SMS-based CIS could send 25,000 SMS/month whereas the IVR-based CIS sent 22 messages per beneficiary during the 2022 cropping season, amounting to nearly 60,000 messages.

Table 1. Fixed Costs of CIS Implementation

Cost Category	Example 1. National Meteorological Service	Example 2. Current CIS: Physical Server	Example 2. Current CIS: Cloud Based server	Example 3. Current CIS	Example 4. Estimation of Past CIS Design
Software design and development	21.9%	62.8%	72.5%	73.2%	50.0%
Training of meteorological services	7.3%	3.6%	4.2%	0.5%	37.5%
Office Equipment					
1. Computers	0.4%	1.2%	1.4%	1.4%	1.7%
2. Mobile devices and tablets	0.4%	0.2%	0.2%	0.4%	0.2%
3. Vehicles	13.7%			10.0%	
4. Motorbikes	2.1%				
5. Physical offices (rent vs own)	0.4%	3.6%	4.2%	2.5%	
6. Meteorological stations	52.6%				
7. Unspecified				12.0%	
8. Servers					
• Physical server	1.1%	10.0%			4.1%
• Cloud-based server			10.7%		6.4%
• Firewall for data security and system protection		5.9%	6.8%		
• Physical Storage nodes		12.7%			
Total	100%	100%	100%	100%	100%

Table 2. Variable Costs of CIS Implementation

Cost Category	Example 2. CIS Estimate: Year-round implementation	Example 3. Current CIS: cropping season implementation	Example 5. Current CIS: implementation period unspecified
Extension staff salaries		15.6%	
Office supplies	11.1%	0.2%	
Internet services	4.4%	0.5%	
Office utilities	4.6%	3.8%	
Extension staff training		3.1%	
Training supplies			
Monitoring of CIS	13.3%	0.5%	
Media promotion: Radio		6.2%	4.5%
Media promotion: Television			
Media promotion: Brochure		5.1%	
Social awareness-raising	6.5%	10.5%	
Transportation & accommodation	13.3%	3.5%	11.3%
CIS user training		48.2%	22.7%
Mobile and web apps maintenance	4.6%	0.7%	11.3%
Data analysis and processing	15.5%	0.5%	45.4%
Overhead administrative expenses	15.5%	1.6%	4.5%
SMS/IVR dissemination	11.1%	*Included in Table 1	0.2%
Total	100%	100%	100%

CIS Costing Process and Methodology

Despite a willingness to participate, and strong recognition of the utility of the exercise, eliciting the CIS costing data was challenging for a variety of reasons. At the outset, it was not clear that stakeholders had previously considered CIS costs using the cost categories or level of detail presented in the toolkit. Based on the data received, it was particularly difficult to capture the potential depreciation of fixed assets, such as office equipment. Some assets are bought new (e.g., servers) and others are core equipment of a national ministry's public good provision (e.g., meteorological stations). For the purposes of the cost-benefit analysis toolkit, a backend depreciation formula is likely to be more effective than requiring depreciation information to be elicited directly from stakeholders.

In subsequent revisions of the costing toolkit, it would be useful to work with CIS implementing stakeholders to align the toolkit with how project officers think about—and organize—budgets. Budget items could be re-ordered for greater ease of entry and to ensure unit counts are accurately identified. For instance, all costs that are incurred monthly, regardless of activity, can be grouped together, along with costs incurred per activity (such as trainings or field visits), as well as costs incurred per staff member and per participant (although this appeared to be rare). To facilitate ease of identifying number of units, there is also the need to specify the implementation parameters including number of beneficiaries, extension staff size, length of annual implementation (seasonally or year-round), and total number of trainings. In addition, open-ended questions can provide added context and nuance for the data collected, such as budget trade-offs and allocation decisions as well as implementational approaches.

Initially, the toolkit separated costs by type of information or advisory provided. However, CIS typically provide a bundle of information and advisories (such as weather information and advisories on varietal selection, planting and harvesting time, and/or soil, land, and water management), and these different types of information are not thought of as having distinct costs. Rather, the bundled information is considered as a lump sum within the CIS project budget. Lastly, the consultation and data collection revealed the need to include the cost of SMS or IVR dissemination as part of the costing methodology.

There were also unexpected benefits from the CIS costing exercise. One of the most insightful outcomes of this process was that it provided an opportunity to highlight the bottlenecks being faced by project officers and other stakeholders currently implementing CIS within AICCRA. For example, using the toolkit made stakeholders realize that budget estimates for servers as well as training and development costs were needed to advance implementation. In addition, having budget items laid out to such a high level of detail stimulated dialogue regarding areas where activities or resources could be directed or were lacking, such as in-season CIS monitoring.

FURTHER READING

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