User's Perspective: Application and Utility of Weather, Climate and Water Information in Sustainable Development

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Growing Demand in Developing Countries

Since the 1990s the World Bank has invested in the modernization of hydrometeorological services as part of broader development support in sectors such as disaster reduction, agriculture and water resources management. As World Bank clients, low and middle income country governments are increasingly requesting technical projects and analytical work supporting the development and modernization of National Hydrological and Meteorological Services (NHMSs). Meeting these requests requires strong cooperation between scientific communities and financing systems to develop a more integrated approach to the financing, development and delivery of global to local weather, water and climate services.

The World Bank is currently determining how to improve its development assistance by increasing the availability of timely and relevant weather, water and climate information through NMHSs in client countries. In formulating a new business model to support the overall global weather enterprise, the World Bank and its partners will need to create more efficient investments at the national level as well as optimize the use of scarce public resources, engaging in innovative approaches such as public-private partnerships.

To improve the support, utilization, development mainstreaming and financing of NHMSs' services both within the World Bank and by client governments, better estimates of the socioeconomic costs and benefits of NHMSs, as well as the communication of the results, are needed. Concerned NHMSs and governments are in fact directly requesting support for such analysis of weather and climate services, for example in Central Asia, Nepal, Mozambique and Ghana.

Benefits of Reducing Risk

NHMSs' services provide decision-making support to both minimize socioeconomic risks (reduce negative impacts of extreme weather) and maximize potential opportunities (for example adapt crop management to increase harvests). World Bank socioeconomic analysis of NHMSs' services has generally thus far focused on the benefits of reducing weather and climate-related risks, albeit in a range of different sectors including those that face weather/climate risks as well as opportunities (for example in agriculture).

The prevention and reduction of disaster risk is needed for development to be sustainable and is cost effective in protecting past, current and future economic growth (WB & UN 2010). This is especially urgent due to increasing weather-related disaster risk as a result of climate change and poorly planned urbanization, among other factors. The focus on the NHMSs' benefits of reducing risk also recognizes that the "ability of NHMSs to meet national service needs is put to its most critical test when an extreme hydrometeorological event occurs" (WMO 2011).

NHMSs modernization should however be framed (and communicated) as a 'no regrets' strategy for climate risk management, aimed at maximizing positive and minimizing negative outcomes. The 'no regrets' (more realistically 'least regrets') aspect means taking climate-related decisions or action that make sense in development terms anyway, whether or not a specific climate threat actually materializes (IRI 2007). NHMSs rarely distinguish between routine daily verses extreme and infrequent event

forecasting, such that service improvements support day-to-day operations that reduce costs, while exercising the skills needed to cope with future extreme events (Rogers and Tsirkunov 2010).

Cost-Benefit Analysis in Sparse Data Contexts

The benefits of risk reduction are primarily avoided or reduced potential damages and losses, which are inherently complex to estimate. Disasters in essence are stochastic events and, as a consequence, most benefits of risk management are probabilistic and arise only in case of an event occurring. Accordingly, risk and benefits should be assessed in terms of disaster probabilities and corresponding consequences.

Often in the context of a developing country, even given a good understanding of the system as a whole, challenges arise due to lack of data, expertise and high resource demands. Uncertainties in projecting future climate conditions and thus the probability of climate-related hazards add additional complexity. The exposure of people, assets and the environment to a certain hazard can be difficult to quantify, and analysis should account for changes due to current and future socioeconomic, land-use and other trends. Socioeconomic vulnerability is a multidimensional concept encompassing a large number of factors that even in data-rich environments can be challenging to quantify (Kull et al, in print).

Yet despite these challenges, cost-benefit analysis of risk reduction in a development context can be performed with a certain degree of confidence. However attention needs to be given to the manner in which analyses are framed and conducted, which must be transparent and highly participatory with regards to the users of NHMSs' services. Consistent approaches and frameworks must be employed to identify and communicate (Moench et al 2008):

- The analysis methods employed.
- Key data, their reliability and sources.
- Externalities and how these are incorporated in the analysis.
- Assumptions and the basis on which they are made, which in data-sparse environments often have a fundamental impact on the results.
- Sensitivity analysis and their implications for the results. This is required to identify the factors that have the largest impact on whether or not investments in NHMSs deliver robust socioeconomic returns under the wide array of possible conditions likely to occur in the future.

Without the above, concerned governments and other potential investors have essentially no basis for evaluating the validity of the results. For example, in terms of the benefits of early warning, issues such as willingness to take action, warning reliability and potential costs of taking inappropriate action must be explicitly considered (Rogers and Tsirkunov 2010). Distributional aspects focused on identifying who will benefit must be considered in the analysis, especially in a development context (Kull et al, in print). For example early warning tends to benefit all segments of society, while preventive infrastructure (like flood embankments) has historically benefited primarily the richer segments (WB and UN 2010).

To further increase the robustness of cost-benefit analysis in a data-sparse context, if only ranges of potential benefits (and costs) can be estimated, the most conservative values should be employed (IFRC 2011). The results of a conservative analysis comparing the lowest potential benefits with the highest potential costs instill greater confidence for decision-makers.

Pragmatic Approaches

Due to the issues outlined above, as well as often resource limitations associated with project development budgets and timelines, pragmatic approaches to assess the socioeconomic benefits of NHMSs' services must be applied in developing countries. Within the World Bank's on-going efforts to

support the modernization of NHMSs, particularly in Eastern Europe and Central Asia, three independent yet complementary approaches have been developed and utilized (WB 2008).

Benchmarking is a simple approach to obtain information about damages caused by weather impacts. The method employs the available official statistics and expert assessment of the weather-dependence of a country's economy, meteorological vulnerability and existing NMHS provision, by first determining global benchmarks and then correcting these for the country-specific context (Tsirkunov et al 2008). Benchmarking only accounts for direct losses which although seen as a constraint, also results in a conservative approach to benefits estimation (as avoided indirect losses are not considered).

Sector-specific assessment uses specially designed surveys of experts from weather-dependent sectors to compile information on direct and indirect losses from hazardous weather events and adverse conditions, and estimate changes in the share of preventable losses and costs of protective measures due to more accurate and timely hydrometeorological information and forecasts. The data is used to evaluate the marginal benefits of NHMSs' service improvement for each weather-dependent sector and the integral effect for the economy (Tsirkunov et al 2008).

Customized sociological surveys, based on a contingent valuation approach, aims to assign a monetary value to weather forecasts and warnings financed as a public good and provided free of charge to households (WB 2008). While such information is not captured by the benchmarking and sector specific approaches, the risks of double-counting through multiple analyses must be closely monitored.

Importance of User Needs

The above approaches point to the importance of identifying user needs through participatory consultative approaches. As service benefits are in fact the meeting of user needs, their assessment is key to developing successful NHMSs business models.

Market based approaches link specific user needs to the value of weather and climate services. For example in India, Weather Risk Management Services (WRMS) charges PepsiCo's contract potato farmers 5% of their weather insurance premium (offered through a private insurance company) for weather data services, which amounts to $3.70/ha per year (IFAD and WFP 2010). While its services may be subsidized by utilization of data from the Indian Meteorological Department (IMD), this charged cost is based not only on assessments of cost recovery and target profits, but also on the realities and limitations of market willingness-to-pay.

As a counter-example, the Ukrainian Hydrometeorological Institute (UHMI) charges $6500 for 30 years of data per weather station. Domestic insurers however are not prepared to invest this especially to develop new products, so they are considering installing their own stations, with costs to be split between the insurers and their clients, leading to higher premiums (IFAD and WFP 2010). A public-private partnership that share benefits as well risks might be an approach for UHMI to take advantage of this potential business opportunity.

Looking Ahead

Action 11 of the Madrid Action Plan (MAP) highlights the need to develop methodologies and capacity for quantifying the socioeconomic benefits of NMHSs services (WMO 2007). This commendable goal has not yet been achieved, particularly in developing countries. The World Bank, through its programme on Strengthening Weather and Climate Information and Decision Support Systems (WCIDS), will continue to

support the MAP by further refining and developing the methodologies and capacities used internally and in partnership with government to assess NMHSs services' socioeconomic benefits.

It must also be noted that current efforts by the hydrometeorological community to better quantify the socioeconomic benefits of their services in not happening in isolation, with reference for example to broader European efforts currently underway through GEO-BENE[1] and EuroGEOSS[2]. As NHMSs do not operate in isolation, it is well worth considering participation in such broader multi-sectoral efforts.

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[1] *Global Earth Observation – Benefit Estimation: Now, Next and Emerging* (http://www.geo-bene.eu/)

[2] *A European Approach to Global Earth Observation System of Systems* (http://www.eurogeoss.eu/)