



Bridging Real-Time Data and Adaptive Management: Ten Lessons for Policy Makers and Practitioners



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Summary

This policy and design lessons paper outlines key lessons about institutional preparedness, design, and implementation of interventions that seek to bridge real-time data systems and adaptive management principles. It draws on a year-long research program including literature reviews, key informant interviews, and case study research in Indonesia and Tanzania.

It is written for policy makers and practitioners who have the capacity and resources to decide if, when, and how to integrate real-time data systems and adaptive programs. The paper is intended as a guiding resource for these stakeholders. We have aimed to keep it as practical and accessible as possible. Information is organized into ten lessons in three categories: 1) how to institutionally and strategically prepare for the process of bridging real-time data and adaptive management, 2) how to design data processes and systems, and 3) how to ensure the use of data in different levels of decision making.

Many factors—including individual and organizational capacity, data quality, the political context in which programs work, and the culture and leadership surrounding data—shape how well real-time data can be integrated with adaptive management processes. Our overarching finding is that there is potential value in aligning the two areas more closely, because each seems to address a need of the other. Real-time data initiatives rarely factor in the social-political, cultural, and managerial considerations that are critical to their use in decision making; and programs utilizing adaptive management rarely have granular, disaggregated, time series data that can be used to apply different strategic approaches and adaptations. For this integration to take place effectively, however, appropriate enabling conditions and resources must be in place.

This integration should not be seen as a silver bullet to resolve the challenges of more adaptive and rigorous development programs—but rather as a new, unexplored, and potentially valuable addition to the toolkit for delivering better development outcomes through knowledge, information, and data.

Introduction: Integrating real-time data and adaptive management for improved development outcomes

Many processes can be used to apply what we are learning to improve what we're doing and how we're doing it. Adaptive management has the advantage of being well-suited to the uncertainties and the complex problems routinely encountered in the development sphere, because the approach explicitly builds in processes of testing, learning, and iteration.

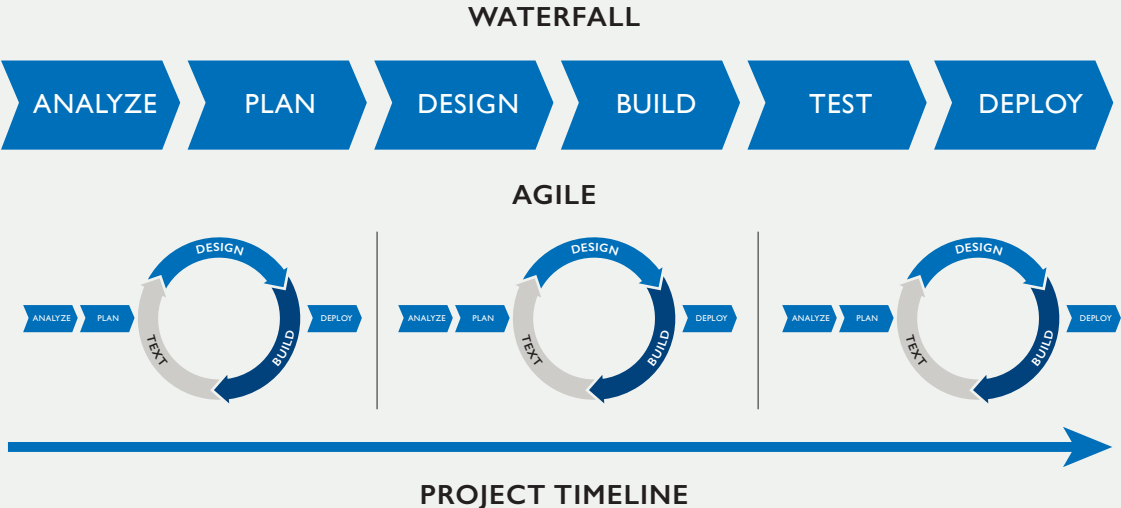
In international development, adaptive management is a process that should be grounded in three simple questions:

- What do poor and vulnerable people need to make their lives better?
- Are we helping and supporting them to get this?
- If not, what should we do differently—and how can we learn about what works in the process?

Effective adaptive management relies on high quality knowledge, information, and data that are in the right form, in the right place, and at the right time to inform decision making. Historically, aid-funded initiatives have relied on up-front designs and long project cycles, with data on performance and effectiveness only available at the end of a project—or, in some case, at a mid-review point. Gathering data throughout the project has been important, but only as a means to ensure efforts were on track. Monitoring was uniformly of poor quality and unevenly implemented, partly due to lack of prioritization and partly due to the cost and challenges of gathering good and timely data in usable form. Changes to the *what or how* of a project have often been viewed as admissions of failure and thus avoided.

This situation is not unique to international development; it was identified by many participants in a workshop to explore these issues in October 2015¹. In the software world, for example, a challenge has been to adapt from a traditional “waterfall approach” to an agile way of working. Many of the same issues have emerged in international development (see Box 1).

Box 1: The Waterfall approach versus the Agile approach.



The waterfall model involves one-off and up-front development of requirements and a plan, followed by implementation in sequence. This model has the virtue of simplicity. However, waterfalls cascade in one direction, so although the environment and customer needs often change during a project, this model doesn't encourage iterations to check against these.

By comparison, the agile model is based on multiple iterations of 'design, build, and test.' This is well established in the technology industry primarily because it is relatively easy to rewrite code. These principles are being applied outside of technological fields, but they point to a wider challenge. If programs are intended to be agile, but the processes that surround them are based on the waterfall model, projects are more likely to fail.

¹ On October 27-28, 2015, USAID, FHI 360's Mobile Solutions Technical Assistance and Research (mSTAR) program and the Institute of Development Studies hosted the Learning to Adapt workshop in London. The workshop was facilitated Ben Ramalingam and brought together 31 leading thinkers and practitioners in adaptive management to discuss how real-time data systems can facilitate adaptive programming and aid decision-making. The diverse set of actors included representatives from the UK's Behavioral Insights Team, Itad, the International Rescue Committee, USAID, DFID, ODI and others.

In recent years, insights from a wide range of fields including political science, systems and complexity thinking, human-centered design, behavioral economics, innovation management, and agile programming have raised the question of whether we can improve and accelerate the quality and speed of learning feedback loops. This requires changes in how programs are designed and implemented, how data and information systems are thought about and operationalized, and how decision making is supported and enabled.

This policy and design lessons paper looks specifically at how the availability of more dynamic and timely data can drive better adaptation in development programs. It is part of an overall project examining whether and how these two approaches can be better integrated—thereby avoiding some of the issues faced by both.

Useful definitions and concepts

Many aid initiatives could benefit from analyzing sets of data showing progress through time. Some initiatives have the potential to collect and act on real- or near-real-time data. Such projects remain rare, due to both technology issues and internal processes. In some cases, real-time data is not possible or would not even be helpful. However, improvements in the frequency of data collection and greater focus on internal processes for reviewing and acting on data is often both possible and desirable. The pertinent question is not whether data are collected in **real time** (i.e., immediately) but rather whether data are collected at the **right time**—i.e., the right moment/s to make sense of what is happening and to be able to adapt what we are doing.

Our background research shows that real-time data initiatives can support more adaptive decision making and management in several ways, including:

- To identify where performance is being achieved and where it is not (i.e., analyzing parallel interventions, to show which are working or where course correction is needed in real time)
- To highlight and map emerging individual and group needs, interests, and opportunities (in a given sector, area)

Box 2: Key definitions

For the purpose of this study:

Real-time data initiatives are those that employ digital technologies (computers, tablets, mobile phones, sensors, etc.) and specialized software applications to enable and accelerate the collection, sharing, management, analysis, and reporting of data with the aim of informing more rapid, timely, and effective decision making.

It is important to distinguish among real-time data, real-time data systems, and real-time data initiatives. Specifically:

- **Real-time data** is the information generated by the different technologies.
- **Real-time data systems** are the specific combinations of technologies and processes designed to generate, share, and manage real-time data.
- **Real-time data initiatives** are projects or programs of work that seek to apply real-time data systems within specific contexts. For the purposes of this study, these contexts are development and humanitarian efforts in developing countries.



Real-time data

Adaptive management (or adaptive programming) relates to a broad combination of approaches, tools, techniques, and processes that enable responsive, flexible, and novel decisions to emergent phenomenon and approaches to development interventions, both at the tactical and the strategic level. The premise of adaptive management is that decisions and actions can be adjusted as contexts and problems become better understood through a process of “learning by doing.” Adaptive management is particularly well suited to more complex program or reform processes and typically follows a cycle of problem assessment, program design, implementation, monitoring, evaluation, and adjustment.



Adaptive management

- To spot unexpected behaviors, incidents, or patterns (e.g., conflict shifts or health behavior changes)
- To reallocate resources more quickly in response to outcomes or trends (e.g., changing targeting of cash transfers in humanitarian settings)
- To generate new insights and ideas about a specific process, issue, or challenge
- To support strategic reflection about overall program direction and effectiveness
- To inform new discussions about the purpose and ambition of organizations or alliances

While productive links between real-time data and adaptive management make intuitive sense, these are rooted more in theory than in practice—at least for development interventions. A key question for real-time data systems (and for all data systems) is whether the data generated are acted upon. And a key question for adaptive management is whether adaptations are evidence-based, rather than opinion-based and arbitrary.

A central finding from our research is that the needs and opportunities facing the “real-time” data and adaptive management communities are indeed linked. This paper provides some concrete suggestions about how to bring better data collection and more adaptive management processes into better sync with one another. It draws on available theory, evidence from the literature, recent case study research, and extensive experience of consortium members and their wider networks. It is designed to help data systems designers, monitoring and evaluation specialists, and key decision makers see the big picture. It sets out frameworks, practical tips, and other considerations development specialists can apply in their current work both to plan and implement better adaptive management processes.



Freddy Feruzi

Overview of lessons

Based on four case studies conducted (two in Tanzania and two in Indonesia) and a synthesis of broader research and practitioner experience, this paper lays out ten crucial lessons for preparing, designing, and using real-time data systems for adaptive management. These lessons illustrate how the real-time data and adaptive management communities can come together to put in place the systems, processes, and enabling environment required to realize the power of real-time data to enable adaptive management.

Institutional readiness

Lesson 1: Identify needs and align incentives among and across policy and implementing actors.

Lesson 2: Align goals with existing human capabilities and invest in developing and capitalizing on these capabilities in the future.

Lesson 3: Develop realistic ambitions—start from where you are.

Data and system design

Lesson 4: Determine what type of data, collected at what frequency, is appropriate for the issue and context.

Lesson 5: Determine how real-time data can be integrated into existing design processes and decision mechanisms.

Lesson 6: Ensure the quality of data matches different stakeholder needs.

Lesson 7: Design real-time data initiatives for adaptive management to be consistently agile.

Use of data in adaptive decisions

Lesson 8: Facilitate regular reflection on and interpretation of collected data from different perspectives.

Lesson 9: Build networks of champions who undertake and promote data-enabled development decision making.

Lesson 10: Work to strengthen data culture and data leadership.

Lessons on institutional readiness

Lesson 1: Identify needs and align incentives among and across policy and implementing actors—and build networks of champions

The value of integrating right-time data and adaptive management practices may seem intuitive and attractive in theory but can be incredibly difficult in practice. Common structures and incentives found in the international development sector—often developed decades ago and calcified through both formal policies and informal norms—can pose significant hurdles. The strong dominant tendencies are towards top-down designs and approaches that specify all activities, inputs, and outputs upfront. The resulting programs often struggle to adapt and change in the face of the complex systems and reform processes they encounter.

It is therefore critical to first examine the authorizing policy and implementation environment within which a program will operate and identify needs that an integrated approach to real-time data and adaptive management could help address. Staff and stakeholders can then become invested in the design and deployment of the approach, because it tangibly addresses felt needs or pain points faced in their day-to-day work—rather than being just a flavor-of-the-month exercise.

The first step is to examine the professional motivations and individual information needs of stakeholders across the program delivery chain. Implementers, for example, may want concrete, actionable beneficiary feedback, to

determine where and how to invest limited resources. Program decision makers or government policy makers may need empirical evidence to advocate for more resources to continue an effective program. Engaging stakeholders early in the design of a data system, and asking them to articulate what data they need and how it can help them in their day-to-day work, is critical to build the institutional support necessary to develop and sustain these initiatives and maximize their value.

This needs to be done in a politically smart way, with an understanding of existing incentives and institutional dynamics. If staff at different levels face few incentives to admit or respond to failure—or to alter decisions based on data and feedback—then a better data system will itself have little effect. Incentives need to be created to facilitate not just more real-time or right-time data collection, but more real-time and right-time decision making. Programs need to be designed with an eye towards the potential for unintended effects—especially the introduction of program disincentives. If the wrong indicators are chosen and programs start optimizing towards them, they can confuse achieving the indicators with successful interventions.

Care must be taken to ensure that real-time data systems do not increase burdens on frontline workers, thus limiting their autonomy and ability to be flexible and responsive. Making data demands on individuals and groups with less power than the stakeholders who design a system can easily be disempowering. In the worst cases, this can lead to real-time data systems being perceived as tools for accountability rather than for learning. Such a perception seldom creates the space for adaptation and flexibility. Real-time data systems can be developed to lower the burdens on frontline workers and provide them with decision support, and such systems show great promise. But particular attention needs to be given both to the systems themselves and to the initiatives in which they are housed.

Adopting these approaches may require new tools, new processes, and new ways of thinking. Developing and maintaining them require, in turn, organizational investments of time and resources.

Lesson 2: Align with existing human capabilities—and invest in developing and capitalizing on these capabilities in the future

To be successful and sustainable, new organizational processes or systems must be appropriate to the capabilities of involved staff. This is certainly true for real-time data systems and adaptive management processes.

In the short-to-medium term, exercises such as institutional ethnographies, capacity assessments, and business process mapping can help organizations develop holistic and grounded understandings of their current capacities. The design of data systems and related processes should not only consider the feasibility of use by current implementers, but also by those who may inherit and use the systems in the long-term. These may include different actors with different sets of technical expertise, operating within different infrastructures, and having different resources. For example, governments in low-resource settings frequently inherit systems developed by western contractors.

Yet many development organizations and public agencies have not sufficiently invested in or nurtured the technical capacities necessary to support the effective use of data and technology. Institutional policies and/or career trajectories may actually discourage the development of such capacities. Therefore, over the longer term, development organizations must invest in recruiting and rewarding relevant technical expertise (e.g., related to technology development, data analytics, and systems design) while re-orienting their cultures to ask questions data can answer and to act on the information. This is not to say all capabilities must be built and retained in-house. Doing so may not be cost-effective. But at a minimum, development organizations need technical staff who can help programs accurately assess the opportunities and limitations of data and technology, adapt design and administrative documents to account for these considerations, assess the technical

skills and cultural fit of third-party product or service providers, and monitor contracted technical work to ensure high-quality and cost-effective delivery.

Many development donors and public agencies in developing countries have made limited investments in these skill sets; as a result, data initiatives fall short of their potential. Moving forward, it is important both to design initiatives that align with existing capabilities and to ensure there is sufficient investment in deepening these skills in the future.

At the same time, while core data and technological skills are important enablers of real-time data systems, there is a danger of giving primacy to technologies and approaches and insufficient attention to both the human factors that enable and support adaptive management and the wider infrastructural considerations on which successful technological deployments rely. Institutional factors as diverse as reporting and results frameworks, performance reviews, and procurement rules can all be enablers or barriers to use of real-time data for adaptation.

Real-time data systems, like all data systems, are only as good as what goes into them, and what goes into them is only as good as the people involved and the individual, group, and organizational capacities that enable these systems to be used for gathering, sharing, and using data. These capacities in turn cannot be effectively mobilized without appropriate behaviors, processes, supporting cultural norms and values, and perhaps most importantly, resources—not just in terms of money, but in terms of time and space. If these are not aligned to support adaptive management processes, they can significantly constrain the ability to act on data, however accurate is.

Any real-time data system therefore needs to be placed within an enabling culture for adaptive management that places high value on the potential uses of real-time data, on its collection, sharing, analysis, and application, and promotes a climate of creativity, free flow of ideas, and questioning of assumptions at all stages of decision making.

Lesson 3: Develop realistic ambitions—start from where you are

A key principle of integrating real-time data with adaptive management is to develop realistic goals for the effort at the outset. For the most part, new programs must deal with and navigate existing contexts. Aiming for an ideal-world alignment between real-time data and adaptive management can easily give rise to the adage “perfection is the enemy of the good.” It is important to develop expectations and ambitions based on where a program starts.

Specifically, before embarking on any effort to bridge real-time data and adaptive management, the starting points for the issue, the team, the organization, and the context in question must be clear. Without a clear sense of starting points, it is all too easy to set unrealistic goals and then claim failure—when in reality goals should have been considered more carefully. Clarity at the outset will also help ensure lessons are learned about what was achieved, and why, and are fed back to improve the effort. Box 3 suggests several different scenarios for bridging real-time data and adaptive management. A light-touch self-assessment can enable initiatives to understand their starting points and then set realistic goals for how integrated their efforts will be. For example, data systems gaps may be addressed through resourcing in activity design, while the lack of a learning and adaption culture implies substantial interventions at the institutional level.

Lessons on data and system design

Lesson 4: Determine what type of data, gathered at what frequency, is appropriate for the issue and context

After building a strategy for institutional support, the first step in the actual design of any faster data system or adaptive management process is to understand the nature of the program context and the development challenge being addressed. This allows stakeholders to determine what types of data—and at what granularity and frequency—may be useful. The process should also consider what other sources of data can be paired with the real-time data system to provide more useful analysis.

Box 3: Illustrative levels for bridging real-time data and adaptive management

Level 1: The existing data system reinforces existing program assumptions and ideas and works to limit the space and scope for adaptation.

Level 2: The data system is flexible, iterative, and responsive, but culture is not conducive to understand or make use of the system for program adaptation.

Level 3: The data system is in place but there is a mismatch between the developers of the system and the dominant culture, and relationships and linkages between decision makers and data experts are inadequate.

Level 4: The mindset, assumptions, and ideas for adaptive management are present, but the data system is not fit for purpose so adaptations are not data-driven or credible.

Level 5: A learning culture is in place and used to question, challenge, and contribute to an iterative program, and the data system is enabled and supports different levels of adaptation.

- **If the development challenge is relatively well defined**, accompanied by proven theories of change, investments in real-time data systems can improve the quality and timeliness of decisions that need to be made and help optimize program delivery (known as single-loop learning)
- **If the development challenge is relatively well defined**, accompanied by proven theories of change, investments in real-time data systems can improve the quality and timeliness of decisions that need to be made and help optimize program delivery (known as single-loop learning) If the development challenge is less defined, and theories of change need to evolve and develop, the design of real-time or right-time data systems should support questioning of the problem definition and assumptions underlying an intervention/program design (also known as double-loop learning)

- **Real-time data systems also enable development outcomes to benefit from the interplay between single-loop and double-loop learning** and can be designed to engage both. Effective feedback loops can provide insights into whether an intervention is failing due to poor execution or to ineffective design; trendlines in the data can show the impact of different confounding factors (regional, economic, etc.) on a given strategy or the impact of different strategies employed.

Delivering medicines to rural facilities in one country, for example, may be primarily an exercise in tactical optimization (single-loop learning)—assuming that institutional processes and transportation infrastructure in the country are functioning relatively well. In this case, a more standard supply-chain management information system that tracks the volume, timing, and movement of products may be sufficient. This system could help flag missing products, delays, or missing deliveries—helping pinpoint where and how efforts are faltering and what to do about them. If the data are generated by the system or a transaction (data exhaust) rather than reported, the actual workings of the system can be seen and issues of data quantity and quality are often greatly reduced.

Tackling Ebola across West Africa, on the other hand, requires real-time data on disease surveillance, response efforts, and other factors that influence how and how quickly the disease is spreading and/or being contained—and then data packaged in a variety of formats for the broad range of implementers and governments concerned. Since the range of factors contributing to the recent Ebola outbreak was not well-known at the outset, gathering data on the disease and response efforts was critical, as was qualitative (particularly ethnographic) research on why communities responded (or not) to different efforts—an example of double-loop learning.

Different types of real-time data can provide additional value in the context of strategic shifts. When real-time data is in the form of data exhaust, it is less susceptible to bias since it is produced passively—providing an

accurate but narrow view of the context in which it is generated. This can be combined with self-reported or observed data to triangulate information and produce a more accurate analysis of an intervention. Additionally, real-time data systems that bring in non-traditional voices, such as citizen feedback, can provide perspectives that are rarely solicited in formal reporting. For example, UNICEF worked with the Ministry of Health in Uganda to combine feedback generated from 300,000 citizens in their U-Report system with data reported by 67,000 health workers in mTrac² to better understand quality of service provision in quarterly bottleneck reviews—incorporating patient voices in formal information management systems for the first time.

The National Population Commission of Nigeria effectively blended single- and double-loop learning within a national civil and vital registration system (CVRS) supported with real-time data. SMS-based reporting was used to check if the number of children registered in a catchment area matched the predicted number. Deployment significantly increased registration. Each of the states in Nigeria was able to implement its own strategy for registering children (whether at the health facility, at the household, at a special registration facility, etc.) and data from the system was used to select which strategies worked best and prioritize areas to improve annually. The analysis looked at costs, distance from facilities, economic class of beneficiaries, and many other factors. Tactical optimization helped the program “do things right” and the annual analysis process helped the program ask which intervention model was “the right thing to do.”

Several frameworks have been developed to help identify the nature of a given problem and can be used to understand data implications. One of the most well-known is the Cynefin framework, which identifies a set of five likely “problem types”: simple, complicated, complex, chaotic, and disorder (where it is unclear which of the other four types are predominant). The type of problem being tackled shapes related data needs and likely responses to data and has significant implications for the design of any real-time data system to support adaptive management (see Box 4).

² https://www.unicef.org/esaro/ESAR-PMR_Uganda_2017.pdf

Box 4: Making sense of problems with the Cynefin approach

The Cynefin framework was developed in the early 2000s at IBM to help managers, policy makers, and others reach decisions. It sorts problems into four categories, defined by cause and effect relationships (Snowden and Boone 2007):

- **Simple problems** have clear cause-and-effect relationships that are easily discernable to everyone. Approaches to resolve these problems require straightforward management and monitoring. Monitoring must be regular, to pick up if the nature of the problem changes over time.
- **Complicated problems** may have multiple “right answers.” Although a relationship between cause and effect may be clear, it may not always be easily discernable. These problems may require testing multiple options and wider data analysis and expert advice to correctly identify the “right solutions.” The danger of groupthink or bias among experts requires steady data flows to check assumptions and ensure ongoing effectiveness.
- **Complex problems** do not necessarily have “right answers,” nor do they necessarily have clear cause and effect relationships. It is often easier to identify in retrospect why something happened—by looking at instructive patterns in data. Probing, testing, and experimentation are required for potential solutions to emerge.
- **Chaotic problems** are characterized by cause and effect relationships that are impossible to determine because they are constantly shifting. These problems require rapid response, based on data to spot emerging patterns that can help prevent future crises and identify potential opportunities for action.

This thinking has been adapted further in the Learning to Adapt Framework, to help understand the nature of many development problems better. The framework compares the level of knowledge about a given context and the level of knowledge about causation (i.e., whether an intervention will work). The framework helps illuminate the nature of the problem as well as the level of complexity of the context. A simple or complicated problem existing in a complex setting may require a more adaptive approach or have different data needs than one existing in a simpler context.

For example, when working on a problem where there is good knowledge of the context and of a promising intervention, then traditional linear programming (i.e., a command and control model) may be a good choice. But when working in an environment that is not well understood, or is inherently unpredictable (such as a humanitarian setting), but with good knowledge of interventions that have been successful in similar settings (e.g., cash transfers), then replicating such interventions and rapidly adjusting them based on user feedback or contextual changes may be a better choice.

If operating in a situation with both low knowledge of the context (or it is highly unpredictable or complex) and low knowledge of causation (i.e., what has worked well in similar situations), then adaptive management can help identify and refine strong solutions. That is, stakeholders need to be able to test, iterate, adapt, and learn in order to identify emergent solutions.

Lesson 5: Determine how real-time data can be integrated into existing design processes and decision mechanisms

As shown in Box 4, adaptive management models are especially valuable when dealing with complex or even chaotic situation—where there is no easily measurable set of data to monitor regularly. The need is to spot trends and patterns across a range of data and use fast feedback to inform iteration and action. In such contexts, identifying the potential of real-time and digital data systems is key.

Each of the “problem areas” identified in the box above presents different needs, opportunities, and challenges for bridging the decision-making <> data-use divide. The key message here is that real-time data can be helpful with different kinds of problems—its value lies beyond rapid optimization through ever-shorter cycles of planning and control. Indeed, the value of a real-time system is in its ability to contribute to adaptive management, where it can increase the need for judgment and insight, by regularly generating information that the program team and stakeholders need to strive to understand. Too often, real-time data systems can place more emphasis on data collection and less on data use and action; an adaptive management model requires reversing this emphasis. Put another way, data may happen in real time, but understanding seldom does.

Moreover, better data **use** must be a goal at the design stage of the data system itself. To ensure data can and will be used to improve program design and decision making, it is critical to first identify the design mechanisms and decision points or processes where data can be integrated. Then, it is important to understand what information is currently being used to design programs or make technical decisions (and the perceived value and limitations of that data), and to analyze the specific format and content of this information.

This allows system designers to identify what information to collect and, just as importantly, how to frame and present it in a way that is valuable to decision makers. Selecting the appropriate presentation (how

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it is formatted, structured, and designed) and delivery (the channels through which it is shared) is critical to ensuring data is used. It is important to decrease the barriers to adoption by mimicking, to the extent possible, existing presentation and delivery norms.

There is often a temptation to develop data dashboards with sophisticated analytics. But if decisions are being taken in computer-less meeting rooms while referring to printed reports, system designers should create data platforms that are optimized to perform customized analysis (based on fields or questions defined by program designers), and to print them in ways that are most appropriate to the decisions being taken. This may mean custom reports with data disaggregated based on facilities or services funded by a program (versus, say, beneficiaries’ demographic data) or assessing the program against higher-level frameworks (e.g., based on indicators set out in a national strategy).

Lesson 6: Ensure quality of data matches different stakeholder needs

There are clear trade-offs between the characteristics of real-time data and the needs of quality management. Specifically, raw data often needs to be cleaned and verified if it is to be of value; at the same time, this can slow the flow of data and lessen potential value. It is important to weigh the value of speed against other factors. Adaptive management in complex situations often requires interpreting a variety of data to spot changing and emerging trends. Instantaneous data may not be necessary for instantaneous decision making; each program needs to identify the right decision points and speed of feedback necessary to deepen understanding of the problem it tries to address. Right-time, quality data may be the priority, rather than a strict model of real-time data.

Moreover, real- or right-time data are often collected by individuals and groups with ongoing access to the populations or the phenomena in question—this may include frontline workers, volunteer community members, citizen reporters, or target groups themselves. Decision makers may not fully trust the involvement of these actors for a variety of reasons. Even following data cleaning and verification, data collected by them may be less trusted and therefore less likely to be taken seriously as a direct guide to decision making.

Processes for checking data quality must be combined with processes of integrating and aggregating data to provide the basis for meaningful data analysis. While these latter processes can be undertaken in automated fashion, human intervention is needed to make sense of the data and to interpret patterns that may be beyond the scope of a digital system.

Lesson 7: Real-time data initiatives need to be designed to be consistently agile if they are going to meet the needs of adaptive programming

Because adaptive management processes are built on regular, fast cycles of analysis, action, reflection, and adaptation, any data systems they rely on may also need to be agile and capable of improvement over time. Real-time data initiatives contributing to adaptive programs must inevitably undergo course corrections and changes to better align with the human, social, and technological processes that come together in different ways over the course of an intervention.

It can be helpful for a real-time data system to be built around a method of prototyping, with scope for experimentation and learning built in—to avoid getting locked into a rigid or too narrow set of data points that preclude opportunities to assess relevant but not immediately obvious trends.

One good example of an agile approach to a real-time data system comes from the Birth Registration program in Tanzania, which uses mobile real-time data systems to enable faster, cheaper, and more comprehensive child birth registration. This SMS-based birth registration system was developed by the Government of Tanzania, the Registration Insolvency & Trusteeship Agency (RITA), UNICEF, TIGO, and VSO. Information about newborns can be entered into a phone by a nurse or village/ward executive officer and sent via SMS to a centralized receiving server hosting a database. This allows certificates to be issued the same day as registration. Availability of real-time data has implications for planning and budgeting at numerous levels and within several departments—including health, education, and social protection.

A range of important agile decisions were identified in implementing this system in the following categories:

- **Technical changes**—identifying where phones weren't working; upgrading "dumb phones" to smart phones after realizing the former couldn't easily be used for data entry and texting; improving the app to deal with "time outs" and providing unique identifiers to each data entry point; surfacing connectivity issues due to poor signal coverage
- **Operational changes**—expanding the registration points to include ward executive offices, identifying areas with low rates and undertaking further campaigning to drive registration
- **Capacity changes**—identifying areas where staff were too busy to use the system and then investing in additional staff resources and increasing training from two to three days
- **Communication changes**—realizing that key messages around the age of children had been misunderstood and changing the messaging accordingly; changing campaign channels to target mosques and churches and promotional channels such as radio and entertainment groups
- **Behavioral changes**—using the dashboard "leaderboard" to incentivize better performance, creating a climate of friendly competition and peer pressure between different villages, wards, and regions

In some cases, these changes were enabled by data generated by the registration system itself. It provides an example of how real-time data can contribute to decision making of a tactical nature. The system produced signals that there were potential issues and a need for adaptation. For example, the problem of poor uptake levels (**operational change**) was evidenced through registration data in specific target areas. The system itself provided the signal that there was a problem. However, it did not collect granular information about why there was an issue. Depending on the context, this was found to be due, variously, to phones not working, connectivity issues, or overburdened staff. The real-time data system signaled that there were potential issues, and more in-depth work and analysis was then needed to understand and interpret those signals, explain the implications, and support appropriate decisions.

Lessons on data use in program management

Lesson 8: Facilitate regular reflection on and interpretation of collected data, from different perspectives

Many real-time data systems are not created with a view to catalyzing systemic change or triggering profound questioning of assumptions. They are not, for the most part, systems to underpin deliberation and reflection, but instead are systems to inform immediate, transactional decisions. Indeed, often issues that fall outside the specific scope of what algorithms can read or what programs are tasked with capturing can disappear in the process of "structuring" and "cleaning" data. For complex problems, tracking patterns outside a narrow scope can be very important. For example, for a real-time data system on flooding, a digital app may not necessarily process serious concerns about housing—despite the inter-connectedness of the problem/need.

All other things being equal, it is going to be easier to automate for underlying phenomena that either happen or do not (was a child born or not, did a flood happen or not) than for phenomena that are more complex (how underweight is a child? how interested are farmers in better prices for fertilizers?) Analysis for more granular and multi-variable phenomena will inevitably be more challenging—but feasible. In particular, specific triggers from the core real-time data stream, however constituted, could be used to catalyze the wider investigation for supplementary and supporting information.

Thus, using real-time data to support programming requires a mindset and culture of looking at the data from multiple angles and perspectives. It will strongly benefit from a culture that empowers those who have access to the data to act upon it. It can enable a cross-disciplinary approach whereby domain experts, data analysts, frontline implementers, and others come together to interpret and make sense of the data.

Lesson 9: Build networks of champions who undertake and promote data-enabled development decision making

To allow initiatives seeking to bridge real-time data and adaptive management sufficient space to experiment and to demonstrate results, it is important to recruit champions from donor as well as implementing bodies who both undertake and promote data-enabled development decision making. Typically, these are people who may, for one reason or another, be particularly incentivized to or passionate about improving program efficacy, who have sufficient seniority and authority to propose or authorize (sometimes risky) experiments, and who are willing to act based on data and evidence rather than organizational or political expediency. These stakeholders need to tangibly and practically see and realize the benefits of an adaptive management approach and the role of better, faster data within it.

This is not always easy to accomplish. It is rare that only one person or office acting alone will have sufficient authority. Especially for complex problems, several different actors with differing forms of authority may have to be engaged.

Andrews et al (2017) propose a series of steps to build an authorizing environment for adaptive management initiatives more broadly. These steps are relevant to data-enabled adaptive management.

- **Identify whose authority is needed:** Be specific about what authority is needed for—not just general support for a project, but the specific types of decisions or uses of data that will need to be approved during the project.
- **Identify where to find this authority, given how authority is structured in a particular context:** Identify the full range of people who need to be brought into a process. Often there is a tendency to focus on one person or office (e.g., a high-level minister) but given the nature of many complex reforms, change will often require the buy-in of multiple different actors over time. This means on one particular project, buy-in might need to come from junior software engineers working on a six-month contract to develop the data collection

platform, the donor program officer and procurement officers who design and revise contracts to respond to programmatic pivots identified through the analysis of new data, and a technical manager from the government agency who will eventually inherit the data platform and integrate it into the agency's process/es for delivering public services. In contexts with a high degree of informality, moreover, key decision makers may not be in the most obvious places. This requires in-depth knowledge of who really has influence over a given a problem area (and may range from traditional chiefs, to informal advisers, to private sector lobbyists).

- **Identify how to secure that authority and how to expand it over time:** Identify how best to convince decision maker(s) of the need for experimental, iterative approaches that use faster data by recognizing their own interests and incentives. Build a strategy to increase this support over time—including showing some early “quick wins” rather than assuming total support needs to be secured upfront.

Putting this into action will require a much broader set of considerations than real-time data initiatives typically implement. Stakeholders need to think about what sort of procurement and contracting methods are being chosen and how much they will allow a program to change course. The roles and responsibilities of the full set of actors influencing decision making, and tools like Standard Operating Procedures, need to be thought through to formally empower actors who might not be normally allowed to change behavior. Budgets also need to include the resources that would allow an actor to adapt. Analyzing the incentives that already exist in a system can highlight opportunities to frame the tools and decisions they suggest within the already existing ecosystem.

The process suggested here is really about building a “data-enabled decision-making coalition.” Rather than identifying one key influencer, it means considering the wider ecosystem—so that over time, it is not individual decision makers championing such approaches, but networks of actors who are able to articulate and realize the value of these approaches and encourage their organizations to adopt them.



Lesson 10: Work to strengthen data culture and data leadership

Realizing the potential of better, faster data for ongoing adjustments to decision making goes far beyond dashboards and reports. It involves the culture of the teams, organizations, and networks that can use data to improve program design and decision making.

Perhaps the most important enabler of bridging real-time data and adaptive management is the culture, space, endorsement, and prioritization of data responsiveness—as both a leadership and behavioral imperative. Without such space and endorsement within implementing organizations, it will be difficult for such initiatives to get off the ground and for resources to be mobilized, partners to be engaged, middle management to provide support, and frontline staff to be actively and constructively engaged collecting and using real-time data.

Support must go beyond specific development organizations and extend to the constellation of national and local actors who are engaged in particular efforts to bridge real-time data and adaptive management. This may include those who are strategic and operational partners in specific implementation efforts, or those who create an authorizing environment in which initiatives are given time, attention, and credibility.

Political support, and the nature of that support, from internal and external champions matters. For example, support for efforts to bridge real-time data and adaptive management that do not distinguish the efforts from wider sectoral or organizational efforts to strengthen top-down accountability can easily lead to these being perceived, and used, as another upward reporting mechanism. Real-time data systems are often used for reporting purposes and often allow for managers to see the actions of employees in the systems they digitize—making this issue especially problematic. Such initiatives are likely to create a fear of reprisal for non-compliance or errors, rather than a hunger for learning and the space for flexibility.

Put another way, if the wider culture emphasizes adherence to plans and accomplishing extant goals and pre-defined processes and outcomes, then efforts to bridge real-time data and adaptive management will run counter to both the culture and logic of the institutions concerned. An enabling culture is one that places high value on the potential uses of real-time data, on its collecting, sharing, analysis, and application and promotes a climate of creativity, free flow of ideas, and questioning assumptions. Underlying all of this is the notion of trust: it will be almost impossible for such an initiative to work effectively without trust, even with the best technology and resources. Importantly, this trust cannot be only one way (superiors trust frontline staff) but needs to be mutual—addressing any concerns about hidden motivations and intentions that may underpin a real-time data system. Issues which real-time data systems can uncover around following protocols and managerial accountability are real and often can weaken intervention approaches. Designing an initiative that is both empowering rather than not punitive, and supportive rather than burdensome, should be the goal of those seeking to harness real-time data systems for program adaptation.

Conclusions

There are no silver bullets in development. Real-time data is by no means a panacea, especially if management culture, processes, and systems are not aligned to make use of the data. But theory, program evidence, and our experience suggest that development outcomes could be enhanced by more dynamic collection, sharing, and interpretation of quality data fused with more adaptive management decision-making processes. This policy and design lessons paper has been an attempt to illuminate this area by focusing on a set of comprehensive lessons that should be considered when using real-time data systems to benefit more adaptive and flexible development programs. We believe that real-time data systems can be genuinely synergistic with adaptive management. At the moment, development organizations too often fail to capitalize on this.

Our findings suggest that development organizations can and should work to integrate these areas, and in doing so can realize development gains. Such integration, if achieved in timely and efficient ways, has considerable potential to inspire and underpin a new generation of development interventions and ultimately benefit poor and vulnerable groups. Many have called for new business models for development work that is more appropriate to the complex challenges of the 21st century. Our research suggests that a fusion of the latest technological and managerial advances could well provide an important element for such models.

This will require harnessing the momentum around the development of real-time data systems and responding to growing calls for and efforts in adaptive management. Real-time data systems, in their design and delivery, need to focus as much on ensuring adaptive responses to the data coming through the system as they focus on gathering and sharing data. Adaptive management decision makers need to create an enabling culture that places high value on the potential uses of data and evidence for enabling adaptive management and promotes iteration and adaptation.

There is no simple or one-size-fits-all approach for collecting the right data with the right frequency and using it the right way for the right decisions. The process of gathering, assembling, and analyzing data requires judgment, discussion, and iteration. The process of adapting programs based on what data suggest also requires judgment and will vary from context to context. The good news, even though we are at an early stage of employing right-time data for adaptive management, is that our research and experience provide some solid guidance for policy makers and practitioners as they develop new, more responsive approaches that use knowledge, information, and data to deliver not just more effective use of resources, but also more creative and imaginative approaches to achieving development impact.



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